

**1. RECEIPT AND OPENING OF BIDS**

The Lowndes County Board of Commissioners (hereinafter called the "Owner"), invites bids on the Bid Form attached hereto, all blanks of which must be appropriately filled in. Bids will be received by the Owner in the \_\_\_\_\_ until \_\_\_\_\_ P.M. on \_\_\_\_\_, 20\_\_ at which time said bids will be publicly opened and read aloud. The envelopes containing your bid and Bid Bond only must be sealed, addressed to \_\_\_\_\_ and designated as Bid for \_\_\_\_\_.

The Owner may consider informal any bid not prepared and submitted in accordance with the provisions hereof and may waive any informalities 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 Any bid may be withdrawn prior to the above scheduled time for the opening of bids or authorized postponement thereof.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 \_\_\_\_\_ days after the actual date of the opening thereof.

**2. PREPARATION OF BID**

Each bid must be submitted on the Bid Form. All blank spaces for bid prices must be filled in, in ink or typewritten and a Bid Bond must be submitted with the bid.

Bids which are incomplete, unbalanced, conditional or obscure, or which contain additions not called for, erasures, alterations, or irregularities of any kind, or which do not comply with the Information for Bidders, may be rejected at the option of the Owner.

The correct total amount bid for the completed work is defined as the correct sum total of the amounts bid for the individual items in the Proposal. The correct amount bid for each unit price item is defined as the correct product of the quantity listed for the item by the unit price bid.

Each bid must be submitted in a sealed envelope bearing on the outside the name of the bidder, bidder's address, Contractor's License Number, 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 as specified above.

**3. SUBCONTRACTS**

The bidder is specifically advised that any person, firm or other party to whom it is proposed to award a subcontract under this contract must be acceptable to the Owner.

## INFORMATION FOR BIDDERS

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00100-2

### 4. TELEGRAPHIC MODIFICATION

Any bidder may modify its bid by telegraphic or facsimile communication at any time prior to the scheduled time for receipt of bids, provided such telegraphic or facsimile communication is received by the Owner prior to closing time, and provided further the Owner is satisfied that a written confirmation of the telegraphic or facsimile modification over the signature of the bidder was mailed prior to the closing time. The telegraphic or facsimile communication should not reveal the bid price, but should provide the addition or subtraction or other modification so that the final prices or terms will not be known by the Owner until the sealed bid is opened. If written confirmation is not received within two days from the closing time, no consideration will be given to the telegraphic or facsimile modification.

### 5. METHOD OF BIDDING

The Owner invites the following bid(s):

***SELECT AN ALTERNATE***

**ALTERNATE 1:**

- a. Lump sum.

**ALTERNATE 2:**

- a. Unit Price.

**ALTERNATE 3:**

- a. Unit price for line work and lump sum for treatment plant (pump station) work.

### 6. QUALIFICATION OF BIDDER

The Owner may make such investigations as is deemed 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 contract and to complete the work contemplated therein. Conditional bids will not be acceptable.

### 7. BID SECURITY

Each bid must be accompanied by cash, certified check of the bidder, or a Bid Bond prepared on the form of bid bond attached hereto, duly executed by the bidder as

principal and having as surety thereon a surety company approved by the Owner, in the amount of five percent (5%) of the bid. Cash or checks will be returned to all except the three lowest bidders within three days after the opening of bids, and the remaining cash or checks will be returned promptly after the Owner and the accepted bidder have executed the contract, or, if no award has been made within \_\_\_\_\_ days after the date of the opening of the bids, upon demand of the bidder at any time thereafter so long as bidder has not been notified of the acceptance of its bid.

**8. LIQUIDATED DAMAGES FOR FAILURE TO ENTER INTO CONTRACT**

The successful bidder, upon failure or refusal to execute and deliver the contract and bonds required within ten (10) days after they have received notice of the acceptance of their bid, shall forfeit to the Owner, as liquidated damages for such failure or refusal, the security deposited with the bid.

**9. TIME OF COMPLETION AND LIQUIDATED DAMAGES**

Bidder must agree to commence work on or before a date to be specified in a written "Notice to Proceed" of the Owner and to fully complete the project within the number of consecutive calendar days thereafter as indicated on the Bid Form. Bidder must agree also to pay as liquidated damages the sum indicated on the Bid Form for each consecutive calendar day thereafter as hereinafter provided in General Conditions.

**10. CONDITIONS OF WORK**

Each bidder must inform himself fully of the conditions relating to the construction of the project and the employment of labor thereon. Failure to do so will not relieve a successful bidder of the obligation to furnish all material and labor necessary to carry out the provisions of the contract. Insofar as possible, the Contractor in carrying out the work must employ such methods or means as will not cause any interruption of or interference with the work of any other contractor.

**11. ADDENDA AND INTERPRETATIONS**

No interpretation of the meaning of the plans, specifications or other pre-bid documents will be made to any bidder orally. Each request for such interpretation should be in writing, addressed to ENGINEER. To be given consideration, the request must be received at least five days prior to the date fixed for the opening of bids. Any and all such interpretations and any supplemental instructions will be in the form of written addenda to the specifications which, if issued, will be mailed to all prospective bidders (at the respective addresses furnished for such purposes), no later than three days prior to the date fixed for the opening of bids. Failure of any bidder to receive any such addendum or interpretation shall not relieve such bidder

## INFORMATION FOR BIDDERS

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00100-4

from any obligation under its bid as submitted. All addenda so issued shall become part of the contract documents.

### **12. SECURITY FOR FAITHFUL PERFORMANCE**

Simultaneously with bidders delivery of the executed contract, the Contractor shall furnish a surety bond or bonds as security for faithful performance of this contract and for the payment of all persons performing labor on the project under this contract, as specified in General Conditions included herein. The surety on such bond or bonds shall be a duly authorized surety company, bond shall be countersigned by an agent residing in South Carolina, and the said surety shall be satisfactory to the Owner.

### **13. POWER OF ATTORNEY**

Attorneys-in-fact who sign bonds or contract bonds must file with each bond a certified and effectively dated copy of their power of attorney.

### **14. NOTICE OF SPECIAL CONDITIONS**

Attention is particularly called to those parts of the contract documents and specifications that deal with the following:

- (a)
- (b)
- (c)
- (d)
- (e)

### **15. LAWS AND REGULATIONS**

The Bidder's attention is directed to the fact that all applicable State laws, municipal ordinances, and the rules and regulations of all authorities having jurisdiction over construction of the project shall apply to the contract throughout, and they will be deemed to be included in the contract the same as though herein written out in full.

### **16. METHOD OF AWARD - LOWEST QUALIFIED BIDDER**

If at the time this contract is to be awarded, the lowest base bid submitted by a responsible bidder does not exceed the amount of funds then estimated by the Owner as available to finance the contract, the contract will be awarded on the base bid only. If such bid exceeds such amount, the Owner may reject all bids or may award the contract on the base bid combined with such deductible alternates applied in numerical order in which they are listed in the Form of Bid, as produces a net amount which is within the

available funds. The Owner will decide which is the lowest qualified bidder, and in determining such bidder, the following elements will be considered for each bidder:

- (a) Maintains a permanent place of business.
- (b) Has adequate plant equipment and personnel to perform the work properly and expeditiously.
- (c) Has suitable financial status to meet obligations incident to the work.
- (d) Has appropriate technical experience.

**17. OBLIGATION OF BIDDER**

At the time of the opening of bids, each bidder will be presumed to have inspected the site and to have read and be thoroughly familiar with the plans and contract documents, including all addenda. The failure or omission of any bidder to examine any form, instrument or document shall in no way relieve any bidder from any obligation in respect to its bid.

**END OF SECTION**

**KNOW ALL MEN BY THESE PRESENTS:** That we, the undersigned \_\_\_\_\_  
\_\_\_\_\_ as Principal, and \_\_\_\_\_ as Surety, are  
hereby held and firmly bound unto the Lowndes County Board of Commissioners as Owner, in  
the penal sum of \_\_\_\_\_  
Dollars \_\_\_\_\_ Cents (\$ \_\_\_\_\_), for the payment of  
which, well and truly to be made, we hereby jointly and severally bind ourselves, successors and  
assigns.

Signed this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_.

The condition of the above obligation is such that: Whereas, the Principal has submitted to \_\_\_\_\_  
\_\_\_\_\_ a certain Bid, attached hereto and by reference made a part  
hereof, to enter into a contract in writing for the \_\_\_\_\_.

**NOW, THEREFORE,**

- (a) If said BID shall be rejected, or
- (b) If said BID shall be accepted and the Principal shall execute and deliver a contract in the Form of Contract attachment hereto (properly completed in accordance with said BID) and shall furnish a BOND for faithful performance of said contract, and for the payment of all persons performing labor furnishing materials in connection therewith, and shall in all other respects perform the agreement created by the acceptance of said BID, then this obligation shall be void; otherwise the same shall remain in force and effect - it being expressly understood and agreed that the liability of the Surety for any and all claims hereunder shall, in no event, exceed the penal amount of this obligation as herein stated.

The Surety, for value received, hereby stipulates and agrees that the obligations of said Surety and its BOND shall be in no way impaired or affected by any extension of the time within which the OWNER may accept such BID, and said Surety does hereby waive notice of any such extension.

**BID BOND**

**00350-2**

**IN WITNESS WHEREOF**, the Principal and Surety have hereunto set their hands and seals, and such of them as are corporations have caused their corporate seals to be hereto affixed and these presents to be signed by their proper officers, the day and year first set forth above.

\_\_\_\_\_  
Principal (Corporate Seal)

BY: \_\_\_\_\_(L.S.)

\_\_\_\_\_  
Surety (Corporate Seal)

BY: \_\_\_\_\_(L.S.)

**IMPORTANT:** Surety companies executing BONDS must appear on the Treasury Department's most current list (Circular 570 as amended) and be authorized to transact business in the state where the project is located.

**NOTE:** Bond must be countersigned by a Georgia resident agent.

**END OF SECTION**

**THIS AGREEMENT** made this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_, by and between \_\_\_\_\_, acting herein through its \_\_\_\_\_, hereinafter called "Owner", and \_\_\_\_\_, doing business as a partnership / a corporation /an individual (Strike out inapplicable terms), with its principal office in the City of \_\_\_\_\_, County of \_\_\_\_\_, State of \_\_\_\_\_, hereinafter called "Contractor".

**WITNESSETH:** That for and in consideration of the payments and agreements hereinafter mentioned, to be made and performed by the Owner, the Contractor hereby agrees with the Owner to commence and complete the construction described as follows: \_\_\_\_\_, hereinafter called the "Project", for the sum of \_\_\_\_\_ Dollars \_\_\_\_\_ Cents (\$\_\_\_\_\_). Contractor further agrees to commence and complete any and all extra work in connection therewith, under the terms as stated in the General and Special Conditions of the Contract; and at his (its or their) own proper cost and expense to furnish all the materials, supplies, machinery, equipment, tools, superintendents, labor, insurance and other accessories and services necessary to complete the said project in accordance with the conditions and prices stated in the Proposal and the General Conditions, Supplemental General Conditions and Special Conditions of the Contract, the plans, including all maps, plats, blueprints, and other drawings and printed or written explanatory matters thereof, the specifications and contract documents therefore as prepared by BP Barber, herein entitled the "Engineer", and as enumerated in Paragraph 1 of the Supplemental General Conditions, all of which are made a part hereof and collectively evidence and constitute the Contract.

The Contractor hereby agrees to commence work under the Contract on or before a date to be specified in written Notice to Proceed from the Owner and to fully complete the project within \_ consecutive calendar days thereafter. The Contractor further agrees to pay as liquidated damages the amount of \$\_\_\_\_\_ for each consecutive calendar day thereafter that the Contractor fails to complete the project, as hereinafter provided in Paragraph 19 of the General Conditions.

The Owner agrees to pay the Contractor in current funds for the performance of the Contract, subject to additions and deductions, as provided in the General Conditions of the Contract, and to make payments on account thereof as provided in Paragraph 25, "Payments to Contractor", of the General Conditions.

**CONTRACT**

**00500-2**

**IN WITNESS WHEREOF**, the parties hereto have executed this contract in six counterparts, each copy of which shall be deemed an original, in the year and day first above mentioned.

(Seal)

\_\_\_\_\_  
**OWNER**

By: \_\_\_\_\_

Title: \_\_\_\_\_

ATTEST:

\_\_\_\_\_  
**Witness**

\_\_\_\_\_  
Witness

(Corporate Seal)

\_\_\_\_\_  
**CONTRACTOR**

By: \_\_\_\_\_

Title: \_\_\_\_\_

ATTEST:

\_\_\_\_\_  
Its Secretary

\_\_\_\_\_  
Witness

**CONTRACTOR'S ADDRESS:**

\_\_\_\_\_  
\_\_\_\_\_

**END OF SECTION**

**KNOW ALL MEN BY THESE PRESENTS THAT**

\_\_\_\_\_  
(Name of Contractor)

\_\_\_\_\_  
(Address of Contractor)

a (Corporation, Partnership or Individual), hereinafter called Principal, and

\_\_\_\_\_  
(Name of Surety)

\_\_\_\_\_  
(Address of Surety)

hereinafter called Surety, are held and firmly bound unto

\_\_\_\_\_  
Lowndes County Board of Commissioners  
(Name of Owner)

\_\_\_\_\_  
300 Patterson Street, Valdosta, Georgia, 31601  
(Address of Owner)

hereinafter called Owner, in the penal sum of \_\_\_\_\_

\_\_\_\_\_ Dollars \_\_\_\_\_ Cents

(\$ \_\_\_\_\_) in lawful money of the United States, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators and successors, jointly and severally, firmly by these presents.

**THE CONDITION OF THIS OBLIGATION** is such that whereas the Principal entered into a certain Contract with the Owner dated the \_\_ day of \_\_\_\_\_, 20\_\_, a copy of which is hereto attached and made a part hereof for the construction of:

**NOW, THEREFORE**, if the Principal shall well, truly and faithfully perform its duties, all the undertakings, covenants, terms, conditions and agreements of said Contract during the original term thereof, and any extensions thereof which may be granted by the Owner, with or without notice to the Surety, and if he shall satisfy all claims and demands incurred under such contract and fully indemnify and save harmless the Owner from all costs and damages which it may suffer by reason failure to do so, and shall reimburse and repay the Owner all outlay and expense which the Owner may incur in making good any default, then this obligation shall be void; otherwise to remain in full force and effect.

**PROVIDED FURTHER**, that the said Surety, for value received hereby stipulates and agrees that no change, extensions of time, alteration or addition to the terms of the Contract or to the work to be performed there under or the specifications accompanying the same shall in any way

**PERFORMANCE BOND**

**00600-2**

affect its obligation on this bond, and it does hereby waive notice of any such change, extension of time, alteration or addition to the terms of the Contract or to the work or to the specifications.

**PROVIDED FURTHER**, that no final settlement between the Owner and the Contractor shall abridge the right of any beneficiary hereunder, whose claim may be unsatisfied.

**IN WITNESS WHEREOF**, this instrument is executed in six (6) counterparts, each one of which shall be deemed an original, this the \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_.

Signed, sealed and delivered in the presence of:

\_\_\_\_\_  
By: \_\_\_\_\_  
Principal – Contractor

\_\_\_\_\_  
Title

*As to Principal*

\_\_\_\_\_  
By: \_\_\_\_\_  
Surety

\_\_\_\_\_  
By: \_\_\_\_\_  
Attorney-In-Fact  
(Power of Attorney to be Attached)

\_\_\_\_\_  
By: \_\_\_\_\_  
Resident Agent

\_\_\_\_\_  
Resident Agent Company Name

*As to Surety*

\_\_\_\_\_

\_\_\_\_\_  
Resident Agent Company Address

\_\_\_\_\_

**NOTES:**

1. Date of Bond must not be prior to date of Contract.
2. If Contractor is a Partnership, all partners should execute bond.
3. Surety companies executing bonds must appear on the Treasury Department's most current list (Circular 570 as amended) and be authorized to transact business in the state where the project is located.

**END OF SECTION**

**KNOW ALL MEN BY THESE PRESENTS THAT**

\_\_\_\_\_  
(Name of Contractor)

\_\_\_\_\_  
(Address of Contractor)

a (Corporation, Partnership or Individual) , hereinafter called Principal, and

\_\_\_\_\_  
(Name of Surety)

\_\_\_\_\_  
(Address of Surety)

hereinafter called Surety, are held and firmly bound unto

Lowndes County Board of Commissioners

\_\_\_\_\_  
(Name of Owner)

300 Patterson Street / Valdosta, Georgia 31601

\_\_\_\_\_  
(Address of Owner)

hereinafter called Owner, in the penal sum of \_\_\_\_\_

\_\_\_\_\_ Dollars \_\_\_\_\_ Cents  
(\$ \_\_\_\_\_) in lawful money of the United States, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators and successors, jointly and severally, firmly by these presents.

**THE CONDITION OF THIS OBLIGATION** is such that whereas the Principal entered into a certain Contract with the Owner dated the \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_, a copy of which is hereto attached and made a part hereof for the construction of:

**NOW, THEREFORE,** if the Principal shall promptly make payment to all persons, firms, subcontractors and corporations furnishing materials for or performing labor in the prosecution of the work provided for in such contract, and any authorized extension or modification thereof, including all amounts due for materials, lubricants, oil, gasoline, coal and coke, repairs on machinery, equipment and tools, consumed or used in connection with the construction of such work, and all insurance premiums on said work, and for all labor, performed in such work whether by subcontractor or otherwise, then this obligation shall be void; otherwise to remain in full force and effect.

**PROVIDED FURTHER,** that the said Surety, for value received hereby stipulates and agrees that no change, extensions of time, alteration or addition to the terms of the Contract or to the work to be performed thereunder or the specifications accompanying the same shall in any way affect its obligation on this bond, and it does hereby waive notice of any such change, extension of time, alteration or addition to the terms of the Contract or to the work or to the specifications.

**PROVIDED FURTHER,** that no final settlement between the Owner and the Contractor shall

**PAYMENT BOND**

**00601-2**

abridge the right of any beneficiary hereunder, whose claim may be unsatisfied.

**IN WITNESS WHEREOF**, this instrument is executed in six (6) counterparts, each one of which shall be deemed an original, this the \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_.

Signed, sealed and delivered in the presence of:

\_\_\_\_\_  
By: \_\_\_\_\_  
Principal – Contractor

\_\_\_\_\_  
Title

*As to Principal*

\_\_\_\_\_  
By: \_\_\_\_\_  
Surety  
Attorney-In-Fact  
(Power of Attorney to be Attached)

\_\_\_\_\_  
By: \_\_\_\_\_  
Resident Agent

*As to Surety*

\_\_\_\_\_  
Resident Agent Company Name

\_\_\_\_\_  
Resident Agent Company Address

\_\_\_\_\_  
Resident Agent Address

**NOTES:**

1. Date of Bond must not be prior to date of Contract.
2. If Contractor is a Partnership, all partners should execute bond.
3. Surety companies executing bonds must appear on the Treasury Department's most current list (Circular 570 as amended) and be authorized to transact business in the state where the project is located.

**END OF SECTION**

TO:

PROJECT DESCRIPTION: \_\_\_\_\_

The Owner has considered the bid dated \_\_\_\_\_, 20\_\_ submitted by you for the above described work in response to its Advertisement for Bids and its Information for Bidders.

You are hereby notified that your bid has been accepted for items in the amount of \$\_\_\_\_\_.

You are required by the Information for Bidders to execute the Agreement and furnish the required Contractor's performance bond, payment bond and certificates of insurance within ten (10) calendar days from the date of this notice to you. If you fail to execute said agreement and to furnish said bonds within ten (10) days from the date of this notice, said Owner will be entitled to consider all your rights arising out of the Owner's acceptance of your bid as abandoned and as a forfeiture of your bid bond. The Owner will be entitled to such other rights as may be granted by law.

You are required to return an acknowledged copy of this Notice of Award to the Owner.

Dated this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_.

Lowndes County Board of Commissioners  
Owner

\_\_\_\_\_  
(Signature)

By:

\_\_\_\_\_  
(Print Name)

Title

:

***Acceptance of Notice***

Receipt of the above Notice of Award is hereby acknowledged by \_\_\_\_\_  
\_\_\_\_\_, this the \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_.

By: \_\_\_\_\_

Title: \_\_\_\_\_

**END OF SECTION**

**CONTRACT CHANGE ORDER**

**00603-1**

Date: \_\_\_\_\_ Project: \_\_\_\_\_  
Change Order No.: \_\_\_\_\_  
Contract No.: \_\_\_\_\_

Description of and Reason for Change: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Itemization of Proposed Change and Basis for Payment

Original Contract Price	\$
Previous Change Orders	\$
This Change, (An Addition) (A Deduction) of	\$
Proposed Revised Contract Price	\$

Additional funds are to be provided in the following manner: \_\_\_\_\_  
\_\_\_\_\_

Extension of Contract Time Required: \_\_\_\_\_ Days.

Revised Contract Completion Date: \_\_\_\_\_.

This Change is Acceptable: \_\_\_\_\_, Contractor

By \_\_\_\_\_

Recommended: \_\_\_\_\_, Engineer

By \_\_\_\_\_

Approval of Change is Requested: Lowndes County Board of Commissioners, Owner

By \_\_\_\_\_

**END OF SECTION**

**NOTICE TO PROCEED**

00606-1

TO: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

DATE: \_\_\_\_\_

PROJECT DESCRIPTION: \_\_\_\_\_

OWNER: Lowndes County Board of Commissioners

ENGINEER PROJECT NO: \_\_\_\_\_

You are hereby notified to commence WORK in accordance with the Agreement dated \_\_\_\_\_, 20\_\_, on or before \_\_\_\_\_, 20\_\_, and you are to complete the WORK within \_\_\_ consecutive calendar days thereafter.

The date of completion of all work is therefore: \_\_\_\_\_, 20\_\_.

\_\_\_\_\_  
(Engineer)

By: \_\_\_\_\_

Title \_\_\_\_\_  
:

Acceptance of Notice

Receipt of the above NOTICE TO PROCEED is hereby acknowledged by \_\_\_\_\_  
\_\_\_\_\_ this the \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_.

By: \_\_\_\_\_  
Title \_\_\_\_\_  
:

**END OF SECTION**

APPLICATION FOR PAYMENT

00607-1

Contractor may submit other Pay Request form for Engineer approval in lieu of the following:

Owner: Contractor: Contract No. Pay Estimate No. Period of Estimate: From to

CONTRACT CHANGE ORDER SUMMARY

ESTIMATE

Table with columns: No., Approval Date, Additions, Deductions. Rows include: 1. Original Contract, 2. Change Orders, 3. Revised Contract (1+2), 4. Work Completed\*, 5. Stored Materials\*, 6. Subtotal (4+5), 7. Retainage, 8. Previous Payments, 9. Amount Due (6-7-8). Totals and Net Change rows.

\* Detailed breakdown attached

CONTRACT TIME

Original (days): Revised: Remaining: Contractor's Certification: On Schedule: Yes No Starting Date: Projected Completion: Engineer's Certification:

The undersigned certifies that to the best of their knowledge, information and belief the work covered by this payment estimate has been completed in accordance with the contract documents, that all amounts due subcontractors and suppliers have been paid by the Contractor for work for which previous payment estimates were issued and payments received from the Owner, and that the current payment shown herein is now due.

The undersigned certifies that to the best of their knowledge and belief, the quantities shown in this estimate are correct and the work has been performed in accordance with the contract documents. Based on periodic but less than full time field representation, to the best of our information the quantities, items and schedule of values, work completed and material and equipment delivered are accurate as indicated on this request for payment. Some defects or problems with construction items may not be determined until final testing and operation of the system is performed. The Engineer cannot be held liable for approval for partial payments for the installation of these items from which the evidence of defects or problems were not determined until after the request for payment was approved.

BP Barber (Signature):

(Signature):

By:

By:

Date:

Date:

Approved by Owner:

(Signature):

By:

By:

Date:

Date:

**APPLICATION FOR PAYMENT**

**00607-2**



**CONTRACTOR'S AFFIDAVIT**

00690-1

The State of \_\_\_\_\_ Date: \_\_\_\_\_

The County of \_\_\_\_\_

The City/Town of \_\_\_\_\_

\_\_\_\_\_ of \_\_\_\_\_  
(Officer's Name) (Officer's Title)

being duly sworn, deposes and says that \_\_\_\_\_  
(Contractor's Name)

has furnished all labor and material entering into the \_\_\_\_\_

\_\_\_\_\_ at \_\_\_\_\_  
(Kind of Work) (Name and Location of Plant or Work)

called for in the Contract Documents dated \_\_\_\_\_ with \_\_\_\_\_

Lowndes County Board of Commissioners.  
(Owner's Name)

\_\_\_\_\_ states further that this officer has full knowledge  
(Contractor's Name)

of all obligations for such labor and materials which have entered into and become part of that certain project known and designated above, and that this officer further deposes and says that all debts and other obligations for such labor and materials have been fully and completely paid for in good and lawful money of the United States of America and that there are no suits for damages against them proceeding, prospective and/or that there are no suits for damages against them proceeding, prospective, or otherwise, in consequence of their operations on the above said project.

The said \_\_\_\_\_ will hold the Owners,  
(Contractor's Name)

Lowndes County Board of Commissioners blameless of any and all mechanic's liens that  
(Owner's Name)

may be hereafter entered or filed for record, so as to constitute charge against said premises for work or labor done or materials furnished by them.

**IN WITNESS HEREOF**, this officer has heretofore put his hand and seal:

\_\_\_\_\_  
(Officer's Name) (Seal)

I, \_\_\_\_\_, Notary Public in and for the above named County and

State do hereby certify that \_\_\_\_\_ personally known to me to be the  
affiant

(Officer's Name)

in the foregoing Affidavit, personally appeared before me this day and, having been duly sworn, deposes and says that the facts set forth in the above Affidavit are true and correct.

WITNESS my hand and seal this \_\_\_\_ day of \_\_\_\_\_, 20\_\_\_. (Seal)

Notary Public for the State of \_\_\_\_\_

**SAFETY IN WASTEWATER WORKS**

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**01569-2**

My Commission Expires: \_\_\_\_\_

**DRAWINGS INDEX**

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00851-1

TITLE

SHEET NO.

**END OF SECTION**

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**PART 1 GENERAL**

**1.01 SCOPE**

- A. The Contractor shall be responsible for conducting all Work in a safe manner and shall take reasonable precautions to ensure the safety and protection of workers, property and the general public.
- B. All construction shall be conducted in accordance with the latest applicable requirements for Part 1926 of the Occupational Safety and Health Act, Safety and Health Regulations for Construction, Section 107 of the Contract Work Hours and Safety Standards Act, as well as any other local, state or federal safety codes and regulations.
- C. The Contractor shall designate a trained and qualified employee who is to be responsible for ensuring that the Work is performed safely and in conformance with all applicable regulations.
- D. The Contractor shall determine the safety hazards involved in prosecuting the Work and the precautions necessary to conduct the Work safely.
- E. The Contractor shall bear all risks associated with performing the Work and shall fully indemnify and hold harmless the County.

**1.02 SPECIAL REQUIREMENTS**

- A. The Contractor's attention is directed to the fact that construction activities involving sanitary sewer systems will occasionally involve work in potentially hazardous environments in which oxygen deficient, toxic or explosive conditions may exist. Additional hazards arise from the presence of pathogens in the wastewater and from the slime and scum layer that coat walking, working and other surfaces. In dealing with these hazards, the Contractor shall take special precautions to ensure worker safety. Such precautions shall include, but are not limited to, the following, as applicable:
  - 1. Installing temporary forced air ventilation equipment and ducts for fresh air in enclosed areas.
  - 2. Using pneumatic tools and equipment instead of electric-driven equipment in hazardous areas.
  - 3. Avoiding the use of cutting torches, field welding and grinders in hazardous areas.
  - 4. Cleaning and disinfecting working surfaces with hot water, high pressure washers prior to commencing work.

5. Installing sealed wooden baffles or bulkheads to isolate working areas from hazardous atmospheres.
  6. Providing portable oxygen meters, combustible gas detectors and hydrogen sulfide detectors to continuously monitor the atmosphere in enclosed working areas.
  7. Providing safety harnesses, safety lines and recovery crews for workers in hazardous areas.
  8. Providing self-contained breathing apparatus with spare air cylinders for workers in hazardous areas.
  9. Providing dry chemical fire extinguishers and connected fire hoses in areas where a danger of fire or explosion exists.
  10. Providing adequate, oxygen-equipped, first aid facilities.
  11. Providing suitable wash-up areas and facilities for workers.
  12. Installing temporary lighting using explosion-proof fixtures in hazardous environments.
  13. Installing approved warning and hazard signs and posting safety procedures.
  14. Instructing all workers as to the hazards present, the procedures to be followed and the proper function and use of all safety and emergency equipment furnished.
- B. Prior to commencing Work on existing facilities and equipment, the Contractor shall notify the Lowndes County maintenance superintendent and shall ensure that the source of electrical energy to all affected equipment is shut off and locked out at the appropriate motor control center. Local switches and pushbutton stations, where provided, shall be locked in the "off" position.
- C. Prior to entering or commencing work in a hazardous area, the Contractor shall ensure that all safety and emergency equipment is in place and in satisfactory operating condition.

**END OF SECTION**

**PART 1 GENERAL**

**1.01 PROJECT MAINTENANCE AND WARRANTY**

- A. Maintain and keep in good repair the Work covered by these Drawings and Specifications until acceptance by the Owner.
- B. The Contractor shall warrant for a period of one year from the date of Owner's written acceptance of certain segments of the Work and/or Owner's written final acceptance of the Project, as defined in the Contract Documents, that the completed Work is free from all defects due to faulty products or workmanship and the Contractor shall promptly make such corrections as may be necessary by reason of 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, may do so and charge the Contractor the cost thereby incurred. The Performance Bond shall remain in full force and effect throughout the warranty period.
- C. The Contractor shall not be obligated to make replacements which become necessary because of ordinary wear and tear, or as a result of improper operation or maintenance, or as a result of improper work or damage by another Contractor or the Owner, or to perform any work which is normally performed by a maintenance crew during operation.
- D. In the event of multiple failures of major consequences prior to the expiration of the One-year warranty described above, the affected unit shall be disassembled, inspected and modified or replaced as necessary to prevent further occurrences. All related components which may have been damaged or rendered non-serviceable as a consequence of the failure shall be replaced. A new 12-month warranty against defective or deficient design, workmanship, and materials shall commence on the day that the item is reassembled and placed back into operation. As used herein, multiple failure shall be interpreted to mean two or more successive failures of the same kind in the same item or failures of the same kind in two or more items. Major failures may include, but are not limited to, cracked or broken housings, piping, or vessels, excessive deflections, bent or broken shafts, broken or chipped gear teeth, premature bearing failure, excessive wear or excessive leakage around seals. Failures which are directly and clearly traceable to operator abuse, such as operations in conflict with published operating procedures or improper maintenance, such as substitution of unauthorized replacement parts, use of incorrect lubricants or chemicals, flagrant over-or under-lubrication and using maintenance procedures not conforming with published maintenance instructions, shall be exempted from the scope of the one-

year warranty. Should multiple failures occur in a given item, all products of the same size and type shall be disassembled, inspected, modified or replaced as necessary and guarantee for one year.

- E. The Contractor shall, at Contractor's own expense, furnish all labor, materials, tools and equipment required and shall make such repairs and removals and shall perform such work or reconstruction as may be made necessary by any structural or functional defect or failure resulting from neglect, faulty workmanship or faulty materials, in any part of the Work performed by the Contractor. Such repair shall also include refilling of trenches, excavations or embankments which show settlement or erosion after backfilling or placement.
- F. Except as noted on the Drawings or as specified, all structures such as embankments and fences shall be returned to their original condition prior to the completion of the Contract. Any and all damage to any facility (not designated for removal) resulting from the Contractor's operations, shall be promptly repaired by the Contractor at no cost to the Owner.
- G. The Contractor shall be responsible for all road and entrance reconstruction and repairs and maintenance of same for a period of one year from the date of final acceptance. In the event the repairs and maintenance are not made immediately and it becomes necessary for the owner of the road to make such repairs, the Contractor shall reimburse the owner of the road for the cost of such repairs.
- H. In the event the Contractor fails to proceed to remedy the defects upon notification within 15 days of the date of such notice, the Owner reserves the right to cause the required materials to be procured and the work to be done, as described in the Drawings and Specifications, and to hold the Contractor and the sureties on Contractor's bond liable for the cost and expense thereof.
- I. Notice to Contractor for repairs and reconstruction will be made in the form of a registered letter addressed to the Contractor at Contractor's home office.
- J. Neither the foregoing paragraphs nor any provision in the Contract Documents, nor any special guarantee time limit implies any limitation of the Contractor's liability within the law of the place of construction.

**END OF SECTION**

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**PART 1 GENERAL**

**1.01 SCOPE**

- A. Clearing and grubbing includes, but is not limited to, removing from the Project site, trees, stumps, roots, brush, structures, abandoned utilities, trash, debris and all other materials found on or near the surface of the ground in the construction area and understood by generally accepted engineering practice not to be suitable for construction of the type contemplated. Precautionary measures that prevent damage to existing features to remain is part of the Work.
- B. Clearing and grubbing operations shall be coordinated with temporary and permanent erosion and sedimentation control procedures.

**1.02 QUALITY ASSURANCE**

- A. The Contractor shall comply with applicable codes, ordinances, rules, regulations and laws of local, municipal, state or federal authorities having jurisdiction over the Project. All required permits of a temporary nature shall be obtained for construction operations by the Contractor.
- B. Open burning, if allowed, shall first be permitted by the local authority having jurisdiction. The Contractor shall notify the local fire department and abide by fire department restrictions.

**1.03 JOB CONDITIONS**

Location of the Work: The area to be cleared and grubbed is shown schematically on the Drawings or specified below. It includes all areas designated for construction.

**PART 2 PRODUCTS**

**2.01 EQUIPMENT**

The Contractor shall furnish equipment of the type normally used in clearing and grubbing operations including, but not limited to, tractors, trucks and loaders.

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**PART 3 EXECUTION**

**3.01 SCHEDULING OF CLEARING**

- A. The Contractor shall clear at each construction site only that length of the right-of-way, permanent or construction easement which would be the equivalent of one month's pipe laying. This length shall be determined from the Contractor's Progress Schedule.
- B. The County may permit clearing for additional lengths of the pipe line provided that temporary erosion and sedimentation controls are in place and a satisfactory stand of temporary grass is established. Should a satisfactory stand of grass not be possible, no additional clearing shall be permitted beyond that specified above.
- C. A satisfactory stand of grass shall have no bare spots larger than one square yard. Bare spots shall be scattered and the bare area shall not comprise more than one percent of any given area.

**3.02 CLEARING AND GRUBBING**

- A. Clear and grub as required on each side of the pipeline before excavating. Remove all trees, growth, debris, stumps and other objectionable matter. Clear the construction easement or road right-of-way only if necessary.
- B. Grubbing shall consist of completely removing roots, stumps, trash and other debris from all graded areas so that topsoil is free of roots and debris. Topsoil is to be left sufficiently clean so that further picking and raking will not be required.
- C. All stumps, roots, foundations and planking embedded in the ground shall be removed and disposed of. Piling and butts of utility poles shall be removed to a minimum depth of two feet below the limits of excavation for structures, trenches and roadways or two feet below finish grade, whichever is lower.
- D. Landscaping features shall include, but are not necessarily limited to, fences, cultivated trees, cultivated shrubbery, property corners, man-made improvements, subdivision and other signs within the right-of-way and easement. The Contractor shall take extreme care in moving landscape features and promptly re-establishing these features.
- E. Surface rocks and boulders shall be grubbed from the soil and removed from the site if not suitable as rip rap.
- F. Where the tree limbs interfere with utility wires, or where the trees to be felled are in

close proximity to utility wires, the tree shall be taken down in sections to eliminate the possibility of damage to the utility.

- G. Any work pertaining to utility poles shall comply with the requirements of the appropriate utility.
- H. All fences adjoining any excavation or embankment that, in the Contractor's opinion, may be damaged or buried, shall be carefully removed, stored and replaced. Any fencing that, in the County's opinion, is significantly damaged shall be replaced with new fence material.
- I. The Contractor shall exercise special precautions for the protection and preservation of trees, cultivated shrubs, sod, fences, etc. situated within the limits of the construction area but not directly within excavation and/or fill limits. The Contractor shall be held liable for any damage the Contractor's operations have inflicted on such property.
- J. The Contractor shall be responsible for all damages to existing improvements resulting from Contractor's operations.

### **3.03 DISPOSAL OF DEBRIS**

- A. The debris resulting from the clearing and grubbing operation shall be hauled to a disposal site secured by the Contractor and shall be disposed of in accordance with all requirements of federal, state, county and municipal regulations. No debris of any kind shall be deposited in any stream or body of water, or in any street or alley. No debris shall be deposited upon any private property except with written consent of the property owner. A copy of written consent shall be provided to the County for permanent records. In no case shall any material or debris be left on the Project, shoved onto abutting private properties or buried on the Project.
- B. When approved in writing by the County and when authorized by the proper authorities, the Contractor may dispose of such debris by burning on the Project site provided all requirements set forth by the governing authorities are met. The authorization to burn shall not relieve the Contractor in any way from damages which may result from Contractor's operations. On easements through private property, the Contractor shall not burn on the site unless written permission is also secured from the property owner, in addition to authorization from the proper authorities.

**END OF SECTION**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. The work specified in this Section consists of providing, maintaining and removing temporary erosion, sedimentation and pollution controls.
- B. Temporary erosion controls, include, but are not limited to, grassing, mulching, watering and reseeded on-site surfaces and spoil and borrow area surfaces, and providing interceptor ditches at ends of berms and at those locations which will ensure that erosion during construction will be either eliminated or maintained within acceptable limits as established by the Georgia Erosion and Sedimentation Act of 1975, as amended, Section 402 of the Federal Clean Water Act, and applicable codes, ordinances, rules, regulations and laws of local and municipal authorities having jurisdiction.
- C. Temporary sedimentation controls include, but are not limited to, silt dams, traps, barriers, filter stone and appurtenances at the foot of sloped surfaces which will ensure that sedimentation pollution will be either eliminated or maintained within acceptable limits as established by the Federal Clean Water Act of 1987, as amended.
- D. Land disturbance activity shall not commence until the Land Disturbance Permit and, if required, Georgia's National Pollutant Discharge Elimination System Permit (NPDES), General Permit No.: GAR100000 has been issued.
- E. Basic Principles
  - 1. Conduct the earthwork and excavation activities in such a manner to fit the topography, soil type and condition.
  - 2. Minimize the disturbed area and the duration of exposure to erosion elements.
  - 3. Stabilize disturbed areas immediately.
  - 4. Safely convey run-off from the site to an outlet such that erosion will not be increased off site.
  - 5. Retain sediment on site that was generated on site.
  - 6. Minimize encroachment upon watercourses.
- F. Temporary Erosion and Sedimentation Control: In general, temporary erosion and sedimentation control procedures shall be directed toward:

1. Preventing soil erosion at the source.
  2. Preventing silt and sediment from entering any waterway if soil erosion cannot be prevented.
  3. Preventing silt and sediment from migrating downstream in the event it cannot be prevented from entering the waterway.
- G. Permanent Erosion Control: Permanent erosion control measures shall be implemented to prevent sedimentation of the waterways and to prevent erosion of the Project site.

## **1.02 QUALITY ASSURANCE**

- A. General: Perform all work under this Section in accordance with all pertinent rules and regulations including, but not necessarily limited to, those stated above and these Specifications.
- B. Conflicts: Where provisions of pertinent rules and regulations conflict with these Specifications, the more stringent provisions shall govern.

## **PART 2 PRODUCTS**

### **2.01 SEDIMENT BARRIER**

- A. Silt Fence: Silt fence shall be as shown on the Standard Detail Drawings.
- B. Stone Check Dams: Stone shall conform to the requirements of Section 805.01 of the Georgia Department of Transportation Standard Specification, latest edition, for Stone Dumped Rip Rap except the stone shall be have a graded size of 2" to 10" at the greatest dimension.
- C. Hay Bales: Hay bales shall be clean, seed-free cereal hay. Hay bales can be used in conjunction with silt fence but not as a substitute for silt fence.
- D. Concrete Blocks: Concrete blocks shall be hollow, non-load-bearing type.
- E. Plywood shall be 3/4-inch thick exterior type.

### **2.02 CONSTRUCTION EXIT STONE**

Use sound, tough, durable stone resistant to the action of air and water. Slabby or

shaley pieces will not be acceptable. Aggregate size shall be in accordance with the National Stone Association Size R-2 (1.5 to 3.5-inch stone) or Type 3 rip rap stone conforming to Section 805.01 of the Georgia Department of Transportation Standard Specifications.

**2.03 CONCRETE**

Concrete shall have a compressive strength of not less than 3,000 psi, with not less than 5.5 bags of cement per cubic yard and a slump between 3 and 5-inches. Ready-mixed concrete shall be mixed and transported in accordance with ASTM C 94. Reinforcing steel shall conform to the requirements of ASTM A 615, Grade 60.

**2.04 RIP RAP**

- A. Stone Rip Rap: Use sound, tough, durable stones resistant to the action of air and water. Slabby or shaley pieces will not be acceptable. Unless shown or specified otherwise, stone rip rap shall be Type 1.
  - 1. Type 1 Rip Rap: Rip rap size shall conform to Section 805.01 of the Georgia Department of Transportation Standard Specification for Type 1 Stone Dumped Rip Rap except the stone size shall have a graded size of 4" to 10" at the greatest dimension.
  - 2. Type 3 Rip Rap: Rip rap size shall conform to Section 805.01 of the Georgia Department of Transportation Standard Specifications for Type 3 Stone Dumped Rip Rap except the stone size shall have a graded size of 4" to 10" at the greatest dimension.
  - 3. 200 Pound Rip Rap: Minimum weight of individual stones shall be 200 pounds.

**2.05 FILTER FABRIC**

- A. The filter fabric for use under rip rap shall be a monofilament, polypropylene woven fabric meeting the specifications as established by Task Force 25 for the Federal Highway Administration. The filter fabric shall have an equivalent opening size (EOS) of 70.
- B. Filter fabric under rip rap shall be Mirafi, Amoco or Exxon.

**2.06 GRASSING**

- A. Grassing materials shall meet the requirements of the following sections of the Georgia Department of Transportation Standard Specifications, latest edition:

<b>Material</b>	<b>Section</b>
Topsoil	893.01
Seed and Sod	890
Fertilizer	891.01
Agricultural Lime	882.02
Mulch	893.02
Inoculants	893.04

- B. Seed species shall be provided as shown on the approved Erosion Control Plan.
- C. Mulch Binder: Mulch on slopes exceeding 3 (horizontal) to 1 (vertical) shall be held in place by the use of a mulch binder, as approved by the County. The mulch binder shall be non-toxic to plant and animal life and shall be approved by the County.
- D. Water: Water shall be free of excess and harmful chemicals, organisms and substances, which may be harmful to plant growth or obnoxious to traffic. Salt or brackish water shall not be used. Water shall be furnished and paid for by the Contractor. It shall be the Contractors responsibility to obtain a meter and backflow prevention device from the County if obtaining water from the County’s public water system.

**2.07 POLYACRYLAMIDE (PAM)**

Polyacrylamide (PAM) is a anionic chemical element, when land applied, acts as a temporary soil binding agent to reduce soil erosion. PAM shall meet the requirements for mixture as outlined in the “Manual for Erosion and Sediment Control in Georgia”, latest Edition.

**2.08 STREAMBANK STABILIZATION**

Streambank Stabilization, using permanent vegetation, is the use of readily available native plant materials to maintain and enhance streambanks, or to prevent, or restore

and repair small streambank erosion problems. All streambank stabilization measures shall meet the minimum requirements as set forth in the "Manual for Erosion and Sediment Control in Georgia", latest edition.

**PART 3 EXECUTION**

**3.01 GENERAL**

- A. Standards: Provide all materials and promptly take all actions necessary to achieve effective erosion and sedimentation control in accordance with the Federal Clean Water Act of 1987, as amended, local enforcing agency guidelines and these Specifications.
- B. Implementation: The Contractor shall have the responsibility to actively take all steps necessary to control soil erosion and sedimentation.

**3.02 TEMPORARY EROSION AND SEDIMENTATION CONTROL**

- A. Temporary erosion and sedimentation control procedures should be initially directed toward preventing silt and sediment from entering the waterways. The preferred method is to provide an undisturbed natural buffer, extending a minimum of twenty five feet from the water, to filter the run-off. Should this buffer prove infeasible due to construction activities being too close to the water, or if the amount of sediment overwhelms the buffer, the Contractor shall place silt fences to filter the run-off and, if necessary, place permanent rip rap to stabilize the bank.
- B. Silt dams, silt fences, traps, barriers, check dams, appurtenances and other temporary measures and devices shall be installed as indicated on the approved plans and working drawings, shall be maintained until no longer needed, and shall then be removed. Deteriorated hay bales and dislodged filter stone shall be replaced with new materials.
- C. Where permanent grassing is not appropriate, and where the Contractor's temporary erosion and sedimentation control practices are inadequate, the County may direct the Contractor to provide temporary vegetative cover with fast growing seedings.
- D. All erosion and sedimentation control devices, including check dams, shall be inspected by the Contractor at least weekly and after each rainfall occurrence and cleaned out and repaired by the Contractor as necessary.
- E. Temporary erosion and sedimentation control devices shall be installed and maintained from the initial land disturbance activity until the satisfactory completion and establishment of permanent erosion control measures. At that time, temporary devices

shall be removed.

- F. Temporary vegetative measures, such as Disturbed Area Stabilization are defined as Mulching Only, (Ds1), Temporary Seeding (Ds2), Permanent Vegetation (Ds3) and Sodding (Ds4) shall be installed as per the approved erosion, sedimentation and pollution control plan and meeting the requirements of the "Manual for Erosion and Sediment Control in Georgia", latest edition with the exception that Ds1 measures be installed at the end of each day, while Ds2 measures be installed every seven days.
- G. Polyacrylamide (PAM) shall be installed and applied as per the manufacturers specifications and meeting the minimum requirements set forth in the "Manual for Erosion and Sediment Control in Georgia", latest edition. Frequency of installing shall be as required to maintain erosion and sediment control throughout duration of the project or as directed by the County.

### **3.03 PERMANENT EROSION CONTROL**

- A. Permanent erosion control shall include:
  - 1. Restoring the work site to its original contours, unless shown otherwise on the Drawings or directed by the County.
  - 2. Permanent vegetative cover shall be performed in accordance with "Grassing" of this Section.
- B. Permanent erosion control measures shall be implemented as soon as practical after the completion of pipe installation or land disturbance for each segment of the Project. In no event shall implementation be postponed when no further activities related to pipe installation will impact that portion or segment of the Project. Partial payment requests may be withheld for those portions of the Project not complying with this requirement.

### **3.04 GRASSING**

- A. General
  - 1. Grassing shall be performed as shown on the approved Erosion Control Plan.
  - 2. All references to grassing, unless noted otherwise, shall relate to establishing permanent vegetative cover as specified herein for seeding, fertilizing, mulching, etc.
  - 3. When final grade has been established, all bare soil, unless otherwise required by

the Contract Documents, shall be seeded, fertilized and mulched in an effort to restore to a protected condition. Critical areas shall be sodded as approved or directed by the County.

4. Specified permanent grassing shall be performed at the first appropriate season listed below following establishment of final grading in each section of the site.

**B. Materials**

1. Topsoil: Natural, fertile, agricultural soil typical of the locality, capable of sustaining vigorous plant growth, from a well drained site free of flooding, not in frozen or muddy condition, not less than six percent organic matter, and pH value of 5.9 to 7.0. Free from subsoil, slag, clay, stones, lumps, live plants, roots, sticks, crabgrass, couch grass, noxious weeds, and foreign matter.
2. Peatmoss: Horticultural grade Class A decomposed plant material, elastic and homogeneous. Free of decomposed colloidal residue, wood, sulphur, and iron. Peatmoss shall have a pH value of 5.9 to 7.0, 60 percent organic matter by weight, moisture content not exceeding 15 percent and water absorption capacity of not less than 300 percent by weight on oven dry basis.
3. Sand: Hard, granular, natural, beach sand, washed, free of impurities, chemical, or organic matter.
4. Fertilizer: 6-12-12 grade Commercial type with six percent nitrogen, 12 percent P<sub>2</sub>O<sub>5</sub>, and 12 percent K<sub>2</sub>O.
5. Lime: Standard agricultural type containing at least 85 percent total carbonates applied at a rate of 4,000 pounds per acre (92 pounds per 1,000 square feet), or as required by the test results and recommendations as specified above. Before seeding, apply lime and fertilizer and incorporate them into the soil at least 3-inches deep by discing and harrowing, at the rates recommended above or required by the above test results.
6. Seed: Seed shall be uniform mixtures of the kinds and applied at the rates shown in the approved Erosion Control Plan.

- C. Replant grass removed or damaged in residential areas using the same variety of grass and at the first appropriate season. Where sod is removed or damaged, replant such areas using sod of the same species of grass at the first appropriate season. Outside of residential or landscaped areas, grass the entire area disturbed by the work on completion of work in any area. In all areas, promptly establish successful stands of grass.**

**3.05 RIP RAP**

- A. Unless shown otherwise on the Drawings and/or approved Erosion Control Plan, rip rap shall be placed where ordered by the County. Carefully compact backfill and place rip rap to prevent subsequent settlement and erosion.
- B. Preparation of Foundations: The ground surface upon which the rip rap is to be placed shall be brought in reasonably close conformity to the correct lines and grades before placement is commenced. Where filling of depressions is required, the new material shall be compacted with hand or mechanical tampers.
- C. Placement of Filter Fabric: The surface to receive fabric shall be prepared to a relatively smooth condition free from obstructions, depressions and debris. The fabric shall be placed with the long dimension running up the slope and shall be placed to provide a minimum number of overlaps. The strips shall be placed to provide a minimum width of one foot of overlap for each joint. The filter fabric shall be anchored in place with securing pins of the type recommended by the fabric manufacturer. Pins shall be placed on or within 3-inches of the centerline of the overlap. The fabric shall be placed so that the upstream strip overlaps the downstream strip. The fabric shall be placed loosely so as to give and therefore avoid stretching and tearing during placement of the stones. The stones shall be dropped no more than three feet during construction. The fabric shall be protected at all times during construction from clogging due to clay, silts, chemicals or other contaminants. Any contaminated fabric or any fabric damaged during its installation or during placement of rip rap shall be removed and replaced with uncontaminated and undamaged fabric at no expense to the County.
- D. Placement of Rip Rap: The rip rap shall be placed on a 6-inch layer of soil, crushed stone or sand overlaying the filter fabric. This 6-inch layer shall be placed to maximize the contact between the soil beneath the filter fabric and the filter fabric. Rip rap shall be placed with its top elevation conforming with the natural slope of the stream bank and stream bottom. Stone rip rap shall be dumped into place to form a uniform surface and to the thickness specified on the Drawings. The thickness tolerance for the course shall be -6-inches and +12-inches. If the Drawings or Bid do not specify a thickness, the course shall be placed to a thickness of not less than 18-inches.

**3.06 STREAMBANK STABILIZATION**

Streambank stabilization with permanent vegetative materials shall be installed as per the erosion control plan, or otherwise directed by the County, as outlined in the “Manual for Erosion and Sediment Control in Georgia”, Latest Edition.

**END OF SECTION**

**PART 1 GENERAL****1.01 SCOPE**

The work to be performed under this Section shall consist of furnishing all labor, equipment, appliances and materials, and performing all operations in connection with the basic pipeline construction methods and procedures.

**1.02 RELATED SECTIONS**

1. Section 02665 – Water Mains and Accessories
2. Section 02730 – Sewer and Accessories
3. Section 02731 – Force Mains

**PART 3 EXECUTION****3.01 EXISTING UTILITIES AND OBSTRUCTIONS**

- A. The Drawings indicate utilities or obstructions that are known to exist according to the best information available to the County. The Contractor shall call the Utilities Protection Center (UPC) (325-5000 or 1-800-282-7411) as required by Georgia law (O.C.G.A. §25-9-1 through §25-9-13) and all utilities, agencies or departments that own and/or operate utilities in the vicinity of the construction work site, at least 72 hours (three business days) prior to construction, to verify the location of the existing utilities.
- B. Existing Utility Location: The following steps shall be exercised to avoid interruption of existing utility service.
  1. Provide the required notice to the utility owners and allow them to locate their facilities according to Georgia law. Field utility locations are valid for only 10 days after original notice. The Contractor shall ensure, at the time of any excavation, that a valid utility location exists at the point of excavation.
  2. Expose the facility, for a distance of at least 200 feet in advance of pipeline construction, to verify its true location and grade. Repair, or have repaired, any damage to utilities resulting from locating or exposing their true location.
  3. Avoid utility damage and interruption by protection with means or methods recommended by the utility owner.
  4. Maintain a log identifying when phone calls were made, who was called, area for which utility relocation was requested and work order number issued, if any. The

Contractor shall provide the County an updated copy of the log bi-weekly, or more frequently if required.

C. Conflict with Existing Utilities

1. Horizontal Conflict: Horizontal conflict shall be defined as when the actual horizontal separation between a utility, main, or service and the proposed pipeline does not permit safe installation of the pipeline by the use of sheeting, shoring, tying-back, supporting, or temporarily suspending service of the parallel or crossing facility. The Contractor may change the proposed alignment of the pipeline to avoid horizontal conflicts if the new alignment remains within the available right-of-way or easement, complies with regulatory agency requirements and after a written request to and subsequent approval by the County. If, in the opinion of the County, the pipeline's proposed location cannot be adjusted, thus requiring the relocation of an existing utility, the County will direct the Contractor to relocate the utility as part of the Contract with the costs of such relocation being paid for as part of a change order.
2. Vertical Conflict: Vertical conflict shall be defined as when the actual vertical separation between a utility, main, or service and the proposed pipeline does not permit the crossing without immediate or potential future damage to the utility, main, service, or the pipeline. The Contractor may change the proposed grade of the pipeline to avoid vertical conflicts if the changed grade maintains adequate cover and complies with regulatory agencies requirements after written request to and subsequent approval by the County. If, in the opinion of the County, the pipeline's proposed location cannot be adjusted, thus requiring the relocation of an existing utility, the County will direct the Contractor to relocate the utility as part of the Contract with the costs of such relocation being paid for as part of a change order.

D. Electronic Locator: Have available at all times an electronic pipe locator and a magnetic locator, in good working order, to aid in locating existing pipe lines or other obstructions.

E. Water and Sewer Separation

1. Water mains should maintain a minimum 10 foot edge-to-edge separation from sewer lines, whether gravity or pressure. If the main cannot be installed in the prescribed easement or right-of-way and provide the 10 foot separation, the separation may be reduced, provided the bottom of the water main is a minimum of 18-inches above the top of the sewer. Should neither of these two separation criteria be possible, the water main shall be installed below the sewer with a minimum vertical separation of 18-inches. Where possible, a full joint of sewer

pipe shall be centered over the water main. Any deviation shall be requested in writing to the County.

2. The water main, when installed below the sewer, shall be encased in concrete with a minimum 6-inch concrete depth to the first joint in each direction. Where water mains cross the sewer, the pipe joint adjacent to the pipe crossing the sewer shall be cut to provide maximum separation of the pipe joints from the sewer.
3. No water main shall pass through, or come in contact with, any part of a sanitary sewer manhole.

F. **Miscellaneous Obstructions:** The Contractor shall coordinate its work with the individual property owners during the installation of the proposed pipeline. Property owners may have invisible fences, underground sprinkler systems, storm drainage, and other miscellaneous obstructions which must be worked around. The Contractor shall take all necessary measures to minimize disruption or damage to such systems. The Contractor shall restore any damage to personal property as soon as possible.

**3.02 CONSTRUCTION ALONG HIGHWAYS, STREETS AND ROADWAYS**

A. Install pipe lines and appurtenances along highways, streets and roadways in accordance with the applicable regulations of, and permits issued by, the Georgia Department of Transportation, Lowndes County and the City of Valdosta with reference to construction operations, safety, traffic control, road maintenance and repair.

B. **Traffic Control**

1. The Contractor shall provide, erect and maintain all necessary barricades, suitable and sufficient lights and other traffic control devices; provide qualified flagmen where necessary to direct traffic; take all necessary precautions for the protection of the work and the safety of the public.
2. Construction traffic control devices and their installation shall be in accordance with the current Manual On Uniform Traffic Control Devices for Streets and Highways.
3. Placement and removal of construction traffic control devices shall be coordinated with the Georgia Department of Transportation, the City of Valdosta and Lowndes County a minimum of 48 hours in advance of the activity.
4. Placement of construction traffic control devices shall be scheduled ahead of associated construction activities. Construction time in street right-of-way shall be conducted to minimize the length of time traffic is disrupted. Construction

traffic control devices shall be removed immediately following their useful purpose. Traffic control devices used intermittently, such as "Flagmen Ahead", shall be removed and replaced when needed.

5. Existing traffic control devices within the construction work zone shall be protected from damage. Traffic control devices requiring temporary relocation shall be located as near as possible to their original vertical and horizontal locations. Original locations shall be measured from reference points and recorded in a log prior to relocation. Temporary locations shall provide the same visibility to affected traffic as the original location. Relocated traffic control devices shall be reinstalled in their original locations as soon as practical following construction.
6. Construction traffic control devices shall be maintained in good repair and shall be clean and visible to affected traffic for daytime and nighttime operation. Traffic control devices affected by the construction work zone shall be inspected daily.
7. Construction warning signs shall be black legend on an orange background. Regulatory signs shall be black legend on a white background. Construction sign panels shall meet the minimum reflective requirements of the Georgia Department of Transportation the City of Valdosta and Lowndes County. Sign panels shall be of durable materials capable of maintaining their color, reflective character and legibility during the period of construction.
8. Channelization devices shall be positioned preceding an obstruction at a taper length as required by the current Manual On Uniform Traffic Control Devices for Streets and Highways, as appropriate for the speed limit at that location. Channelization devices shall be patrolled to insure that they are maintained in the proper position throughout their period of use.

#### C. Construction Operations

1. Perform all work along highways, streets and roadways to minimize interference with traffic.
2. Stripping: Where the pipe line is laid along road right-of-way, strip and stockpile all sod, topsoil and other material suitable for right-of-way restoration.
3. Trenching, Laying and Backfilling: Do not open the trench any further ahead of pipe laying operations than is necessary. Backfill and remove excess material immediately behind laying operations. Complete excavation and backfill for any portion of the trench in the same day.

4. Shaping: Reshape damaged slopes, side ditches, and ditch lines immediately after completing backfilling operations. Replace topsoil, sod and any other materials removed from shoulders.
  5. Construction operations shall be limited to 400 feet along areas, including clean-up and utility exploration unless otherwise approved by the County.
- D. Excavated Materials: Do not place excavated material along highways, streets and roadways in a manner which obstructs traffic. Sweep all scattered excavated material off of the pavement in a timely manner.
- E. Drainage Structures: Keep all side ditches, culverts, cross drains, and other drainage structures clear of excavated material. Care shall be taken to provide positive drainage to avoid ponding or concentration of runoff.
- F. Landscaping Features: Landscaping features shall include, but are not necessarily limited to: fences; property corners; cultivated trees and shrubbery; manmade improvements; subdivision and other signs within the right-of-way and easement. The Contractor shall take extreme care in moving landscape features and promptly re-establishing these features.
- G. Maintaining Highways, Streets, Roadways and Driveways
1. Maintain streets, highways, roadways and driveways in suitable condition for movement of traffic until completion and final acceptance of the Work.
  2. During the time period between pavement removal and completing permanent pavement replacement, maintain highways, streets and roadways by the use of steel running plates. Running plate edges shall have asphalt placed around their periphery to minimize vehicular impact. The backfill above the pipe shall be compacted as specified elsewhere up to the existing pavement surface to provide support for the steel running plates.
  3. Furnish a road grader or front-end loader for maintaining highways, streets, and roadways. The grader or front-end loader shall be available at all times.
  4. Immediately repair all driveways that are cut or damaged. Maintain them in a suitable condition for use until completion and final acceptance of the Work.
  5. The pressure mains shall be punched under all paved surfaces. After several unsuccessful attempts to punch the pipe, the County may direct the Contractor to

trench across the pavement.

### **3.03 PIPE DISTRIBUTION**

- A. Pipe shall be distributed and placed in such a manner that will not interfere with traffic.
- B. No pipe shall be strung further along the route than 1,000 feet beyond the area in which the Contractor is actually working without written permission from the County. The County reserves the right to reduce this distance to a maximum distance of 200 feet in residential and commercial areas based on the effects of the distribution to the adjacent property owners.
- C. No street or roadway may be closed for unloading of pipe without first obtaining permission from the proper authorities. The Contractor shall furnish and maintain proper warning signs and obstruction lights for the protection of traffic along highways, streets and roadways upon which pipe is distributed.
- D. No distributed pipe shall be placed inside drainage ditches.
- E. Distributed pipe shall be placed as far as possible from the roadway pavement, but no closer than five feet from the roadway pavement, as measured edge-to-edge.

### **3.04 PROTECTION AND RESTORATION OF WORK AREA**

- A. General: Return all items and all areas disturbed, directly or indirectly by work under these Specifications, to their original condition or better, as quickly as possible after work is started.
  - 1. The Contractor shall plan, coordinate, and prosecute the work such that disruption to personal property and business is held to a practical minimum.
  - 2. All construction areas abutting lawns and yards of residential or commercial property shall be restored promptly. Backfilling of underground facilities, ditches, and disturbed areas shall be accomplished on a daily basis as work is completed. Finishing, dressing, and grassing shall be accomplished immediately thereafter, as a continuous operation within each area being constructed and with emphasis placed on completing each individual yard or business frontage. Care shall be taken to provide positive drainage to avoid ponding or concentration of runoff.
  - 3. Handwork, including raking and smoothing, shall be required to ensure that the removal of roots, sticks, rocks, and other debris is removed in order to provide a neat and pleasing appearance.

4. The Department of Transportation's engineer shall be authorized to stop all work by the Contractor when restoration and cleanup are unsatisfactory and to require appropriate remedial measures.
- B. Man-Made Improvements: Protect, or remove and replace with the County's approval, all fences, walkways, mail boxes, pipe lines, drain culverts, power and telephone lines and cables, property pins and other improvements that may be encountered in the Work.
  - C. Cultivated Growth: Do not disturb cultivated trees or shrubbery unless approved by the County. Any such trees or shrubbery which must be removed shall be heeled in and replanted under the direction of an experienced nurseryman.
  - D. Cutting of Trees: Do not cut trees for the performance of the work except as absolutely necessary. Protect trees that remain in the vicinity of the work from damage from equipment. Do not store spoil from excavation against the trunks. Remove excavated material stored over the root system of trees within 30 days to allow proper natural watering of the root system. Repair any damaged tree over 3-inches in diameter, not to be removed, under the direction of an experienced nurseryman. All trees and brush that require removal shall be promptly and completely removed from the work area and disposed of by the Contractor. No stumps, wood piles, or trash piles will be permitted on the work site.
  - E. Disposal of Rubbish: Dispose of all materials cleared and grubbed during the construction of the Project in accordance with the applicable codes and rules of the appropriate county, state and federal regulatory agencies.
  - F. Swamps and Other Wetlands
    1. The Contractor shall not construct permanent roadbeds, berms, drainage structures or any other structures which alter the original topographic features within the easement.
    2. All temporary construction or alterations to the original topography will incorporate measures to prevent erosion into the surrounding swamp or wetland. All areas within the easement shall be returned to their original topographic condition as soon as possible after work is completed in the area. All materials of construction and other non-native materials shall be disposed by the Contractor.
    3. The Contractor shall provide temporary culverts or other drainage structures, as necessary, to permit the free migration of water between portions of a swamp, wetland or stream which may be temporarily divided by construction.
    4. The Contractor shall not spread, discharge or dump any fuel oil, gasoline,

pesticide, or any other pollutant to adjacent swamps or wetlands.

**END OF SECTION**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. The work under this Section consists of furnishing all labor, equipment and materials and performing all operations in connection with the trench excavation and backfill required to install the pipelines shown on the Drawings and as specified.
- B. Excavation shall include the removal of any trees, stumps, brush, debris or other obstacles which remain after the clearing and grubbing operations, which may obstruct the work, and the excavation and removal of all earth, rock or other materials to the extent necessary to install the pipe and appurtenances in conformance with the lines and grades shown on the Drawings and as specified.
- C. Backfill shall include the refilling and compaction of the fill in the trenches and excavations up to the surrounding ground surface or road grade at crossing.
- D. The trench is divided into five specific areas:
  - 1. Foundation: The area beneath the bedding, sometimes also referenced to as trench stabilization.
  - 2. Bedding: The area above the trench bottom (or foundation) and below the bottom of the barrel of the pipe.
  - 3. Haunching: The area above the bottom of the barrel of the pipe up to a specified height above the bottom of the barrel of the pipe.
  - 4. Initial Backfill: The area above the haunching material and below a plane 18 inches above the top of the barrel of the pipe or the top of duct bank.
  - 5. Final Backfill: The area above a plane 18 inches above the top of the barrel of the pipe.
- E. The choice of method, means, techniques and equipment rests with the Contractor. The Contractor shall select the method and equipment for trench excavation and backfill depending upon the type of material to be excavated and backfilled, the depth of excavation, the amount of space available for operation of equipment, storage of excavated material proximity of man-made improvements to be protected, available easement or right-of-way and prevailing practice in the area.

## 1.02 QUALITY ASSURANCE

- A. Density: All references to "maximum dry density" shall mean the maximum dry density defined by the "Maximum Density-Optimum Moisture Test", ASTM D 698, except that for non-cohesive materials "maximum dry density" shall mean the maximum index density as determined by the "Maximum Index Density of Soils Using a Vibratory Table", ASTM D 4253. Determination of the density of foundation, bedding, haunching, or backfill materials in place shall meet with the requirements of ASTM D 1556, "Density of Soil In Place by the Sand Cone Method", ASTM D 2937, "Density of Soil In Place by the Drive-Cylinder Method" or ASTM D 2922, "Density of Soil and Soil-Aggregate In Place by Nuclear Methods (Shallow Depth)".
- B. Sources and Evaluation Testing: Testing of materials to certify conformance with the Specifications shall be performed by an independent testing laboratory. All imported fill materials shall meet the requirements of on-site fill materials.
- C. All costs associated with compaction testing ordered by the County shall be paid for by the Contractor. The extent of testing required shall be reasonable, but shall also be dependent upon soil conditions, Contractor's means and methods of operation, and regulatory requirements. As a minimum, compaction tests shall be performed in two foot lifts at a single location per each public right-of-way.

## 1.03 SAFETY

Perform all trench excavation and backfilling activities in accordance with the Occupational Safety and Health Act of 1970 (PL 91-596), as amended. The Contractor shall pay particular attention to the Safety and Health Regulations Part 1926, Subpart P "Excavation, Trenching & Shoring" as described in OSHA publication 2226. Particular attention is drawn to the requirement that the Contractor must have on site and individual with current competent person training certification.

## PART 2 PRODUCTS

### 2.01 TRENCH FOUNDATION MATERIALS

Crushed stone shall be utilized for trench foundation (trench stabilization) and shall meet the requirements of the Georgia Department of Transportation Specification 800.01, Group I (limestone, marble or dolomite) or Group II (quartzite, granite or gneiss). Stone sizes shall be between No. 57 and No. 4, inclusive.

**2.02 BEDDING AND HAUNCHING MATERIALS**

- A. Unless shown on the Drawings or specified otherwise, bedding and haunching materials shall be as follows:
  - 1. Gravity Sewers: Class IA, IB or II embedment material as specified below.
  - 2. Gravity Sewer Services: Earth materials as specified below.
  - 3. Force Mains: Earth materials as specified below.
  - 4. Water Mains: Earth materials as specified below.
- B. Bedding and haunching material under all pavement areas or where the trench is within three feet of the pavement edge shall be Class IA, IB or II embedment material.
- C. Earth materials utilized for bedding and haunching shall be suitable materials selected from materials excavated from the trench. Suitable materials shall be clean and free of rock larger than 2 inches at its largest dimension, organics, cinders, stumps, limbs, frozen earth or mud, man-made wastes and other unsuitable materials. Should the material excavated from the trench be saturated, the saturated material may be used as earth material, provided it is allowed to dry properly and it is capable of meeting the specified compaction requirements. When necessary, earth bedding and haunching materials shall be moistened to facilitate compaction by tamping. If materials excavated from the trench are not suitable for use as bedding or haunching material, as determined by the County, provide select material conforming to the requirements of this Section at no additional cost to the County.
- D. Class IA, IB and II Embedment Materials
  - 1. Class IA, IB and II embedment materials shall meet the requirements of ASTM D 2321.
  - 2. Class IA embedment material is generally a manufactured aggregate, open-graded and clean; has a particle size distribution such that, when it is compacted, the voids between the aggregate particles, expressed as a percentage of the total space occupied by the material, is small. This material shall include angular, crushed stone or rock, crushed gravel, broken coral, crushed slag, cinders or shells.
  - 3. Class IB embedment material is generally manufactured or processed aggregate, dense-graded and clean; such as slag, that is a product or byproduct of a manufacturing process, or natural aggregates that are reduced to their final form

by a manufacturing process such as crushing. This material includes Class IA materials and stone/sand mixtures with gradations selected to minimize migration of adjacent soils into this material.

4. Class II embedment material is generally coarse-grained soils which are clean. This material includes well-graded and poorly graded gravels and gravel-sand mixtures with little to no fines; well graded and poorly graded sands and gravelly sands, with little or no fines.

### **2.03 INITIAL BACKFILL**

- A. Unless shown on the Drawings or specified otherwise, initial backfill material shall be crushed stone, Class IA, IB or II embedment material, or earth materials as specified for bedding and haunching materials.
- B. Earth materials utilized for initial backfill shall be suitable materials selected from materials excavated from the trench. Suitable materials shall be clean and free of rock larger than 2 inches at its largest dimension, organics, cinders, stumps, limbs, frozen earth or mud, man-made wastes and other unsuitable materials. Should the material excavated from the trench be saturated, the saturated material may be used as earth material, provided it is allowed to dry properly and it is capable of meeting the specified compaction requirements. When necessary, initial backfill materials shall be moistened to facilitate compaction by tamping. If materials excavated from the trench are not suitable for use as initial backfill material, as determined by the County, provide select material conforming to the requirements of this Section.

### **2.04 FINAL BACKFILL**

Unless shown on the Drawings or specified otherwise, final backfill material shall be general excavated earth materials, shall not contain more than one-third broken rock, of which no stone or boulder shall weigh more than 50 pounds, cinders, stumps, limbs, man-made wastes and other unsuitable materials. If materials excavated from the trench are not suitable for use as final backfill material, as determined by the County, provide select material conforming to the requirements of this Section.

### **2.05 SELECT BACKFILL**

Select backfill shall be materials which meet the requirements as specified for bedding, haunching, initial backfill or final backfill materials, including compaction requirements.

**2.06 CONCRETE**

Concrete for bedding, haunching, initial backfill or encasement shall have a compressive strength of not less than 3,000 psi, with not less than 5.5 bags of cement per cubic yard and a slump between 3 and 5 inches. Ready-mixed concrete shall be mixed and transported in accordance with ASTM C 94. Reinforcing steel shall conform to the requirements of ASTM A 615, Grade 60.

**PART 3 EXECUTION**

**3.01 TRENCH EXCAVATION**

- A. Topsoil and grass shall be stripped a minimum of 6 inches over the trench excavation site and stockpiled separately for replacement over the non-paved, finished grading areas.
- B. Trenches shall be excavated to the lines and grades shown on the Drawings with the centerlines of the trenches on the centerlines of the pipes and to the dimensions which provide the proper support and protection of the pipe and other structures and accessories.
- C. Trench Width for Pipelines
  - 1. The sides of all trenches shall be as vertical as is practical to a minimum of one foot above the top of the pipe. Unless otherwise indicated on the Drawings, the maximum trench width shall be equal to the sum of the outside diameter of the pipe plus two feet. The minimum trench width shall be that which allows the proper consolidation of the haunching and initial backfill material.
  - 2. Excavate the top portion of the trench to any width within the construction easement or right-of-way which will not cause unnecessary damage to adjoining structures, roadways, pavement, utilities, trees or private property. Where necessary to accomplish this, provide sheeting and shoring.
  - 3. Where rock is encountered in trenches, excavate to remove boulders and stones to provide a minimum of 6 inches clearance between the rock and any part of the pipe or appurtenance.
  - 4. Wherever the prescribed maximum trench width is exceeded, the Contractor shall use the next higher Class or Type of bedding and haunching as shown on the

Drawings for the full trench width as actually cut. The excessive trench width may be due to unstable trench walls, inadequate or improperly placed bracing and sheeting which caused sloughing, accidental over-excavation, intentional over-excavation necessitated by the size of the Contractor's tamping and compaction equipment, intentional over-excavation due to the size of the Contractor's excavation equipment, or other reasons beyond the control of the County.

**D. Depth**

1. The trenches shall be excavated to the required depth or elevation which allow for the placement of the pipe and bedding to the dimensions shown on the Drawings or specified.
2. Force Mains
  - a. Excavate trenches to provide a minimum cover of 36 inches. Within the right-of-way of highways, streets or roadways, also excavate to place the top of the pipe a minimum of 36 inches below the nearest pavement edge or drainage ditch.
  - b. Increase the depth of cover where specifically shown on the Drawings and where necessary to avoid interference with underground utilities and obstructions.
3. Water Mains
  - a. Excavate trenches to provide a minimum cover of 36 inches. Within the right-of-way of highways, streets or roadways, also excavate to place the top of the pipe a minimum of 36 inches below the nearest pavement edge or drainage ditch.
  - b. Increase the depth of cover where specifically shown on the Drawings and where necessary to avoid interference with underground utilities and obstructions.
4. Increase the depth of cover where specifically shown on the Drawings and where necessary to avoid interference with underground utilities and obstructions.
5. Where rock is encountered in trenches for pipelines, excavate to the minimum depth which will provide clearance below the pipe barrel of 8 inches for pipe 21 inches in diameter and smaller and 12 inches for larger pipe, valves and manholes.

Remove boulders and stones to provide a minimum of 6-inches clearance between the rock and any part of the pipe, manhole or accessory.

**E. Excavated Materials**

1. Excavated materials shall be placed adjacent to the work to be used for backfilling as required. Top soil shall be carefully separated and lastly placed in its original location.
2. Excavated material shall be placed sufficiently back from the edge of the excavation to prevent caving of the trench wall, to permit safe access along the trench and not cause any drainage problems. Excavated material shall be placed so as not to damage existing landscape features or man-made improvements.

**3.02 SHEETING, BRACING AND SHORING**

**A. Sheeting, bracing and shoring shall be performed in the following instances:**

1. Where sloping of the trench walls does not adequately protect persons within the trench from slides or cave-ins.
2. In caving ground.
3. In wet, saturated, flowing or otherwise unstable materials. The sides of all trenches and excavations shall be adequately sheeted, braced and shored.
4. Where necessary to prevent damage to adjoining buildings, structures, roadways, pavement, utilities, trees or private properties which are required to remain.
5. Where necessary to maintain the top of the trench within the available construction easement or right-of-way.

**B. In all cases, excavation protection shall strictly conform to the requirements of the Occupational Safety and Health Act of 1970, as amended.**

**C. Timber:** Timber for shoring, sheeting, or bracing shall be sound and free of large or loose knots and in good, serviceable condition. Size and spacing shall be in accordance with OSHA regulations.

**D. Steel Sheeting and Sheet Piling:** Steel sheet piling shall be the continuous interlock type. The weight, depth and section modulus of the sheet piling shall be sufficient to restrain the loads of earth pressure and surcharge from existing foundations and live

loads. Procedure for installation and bracing shall be so scheduled and coordinated with the removal of the earth that the ground under existing structures shall be protected against lateral movement at all times. The Contractor shall provide closure and sealing between sheet piling and existing facilities.

- E. Trench Shield: A trench shield or box may be used to support the trench walls. The use of a trench shield does not necessarily preclude the additional use of bracing and sheeting. When trench shields are used, care must be taken to avoid disturbing the alignment and grade of the pipe or disrupting the haunching of the pipe as the shield is moved. When the bottom of the trench shield extends below the top of the pipe, the trench shield will be raised in 6-inch increments with specified backfilling occurring simultaneously. At no time shall the trench shield be "dragged" with the bottom of the shield extending below the top of the pipe or utility.
- F. Remove bracing and sheeting in units when backfill reaches the point necessary to protect the pipe and adjacent property. Leave sheeting in place when in the opinion of the County it cannot be safely removed or is within three feet of an existing structure, utility, or pipeline. Cut off any sheeting left in place at least two feet below the surface.
- G. Sheet piling within three feet of an existing structure or pipeline shall remain in place, unless otherwise directed by the County.

### **3.03 ROCK EXCAVATION**

- A. Definition of Rock: Any material which cannot be excavated with conventional excavating equipment, and is removed by drilling and blasting, or mechanically fracturing by means other than a trench excavator, and occupies an original volume of at least one-half cubic yard.
- B. Blasting: Provide licensed, experienced workmen to perform blasting. Conduct blasting operations in accordance with all existing ordinances and regulations. Protect all buildings and structures from the effects of the blast. Repair any resulting damage. If the Contractor repeatedly uses excessive blasting charges or blasts in an unsafe or improper manner, the County may direct the Contractor to employ an independent blasting consultant to supervise the preparation for each blast and approve the quantity of each charge.
- C. Removal of Rock: Dispose of rock off site that is surplus or not suitable for use as rip rap or backfill.
- D. The Contractor shall notify the County prior to any blasting. Additionally, the Contractor shall notify the County and local fire department before any charge is set.

- E. The Contractor shall conduct pre-blast and post-blast inspections of structures, including photographs or videos, and maintain a detailed written log.

### **3.04 DEWATERING EXCAVATIONS**

- A. Dewater excavation continuously to maintain a water level two feet below the bottom of the trench.
- B. Control drainage in the vicinity of excavation so the ground surface is properly pitched to prevent water running into the excavation.
- C. There shall be sufficient pumping equipment, in good working order, available at all times, to remove any water that accumulates in excavations. Where the utility crosses natural drainage channels, the work shall be conducted in such a manner that unnecessary damage or delays in the prosecution of the work will be prevented. Provision shall be made for the satisfactory disposal of surface water to prevent damage to public or private property.
- D. In all cases, accumulated water in the trench shall be removed before placing bedding or haunching, laying pipe, placing concrete or backfilling.
- E. Where dewatering is performed by pumping the water from a sump, crushed stone shall be used as the medium for conducting the water to the sump. Sump depth shall be at least two feet below the bottom of the trench, Pumping equipment shall be of sufficient quantity and/or capacity to maintain the water level in the sump two feet below the bottom of the trench. Pumps shall be a type such that intermittent flows can be discharged. A standby pump shall be required in the event the operating pump or pumps clog or otherwise stop operation.
- F. Dewater by use of a well point system when pumping from sumps does not lower the water level two feet below the trench bottom. Where soil conditions dictate, the Contractor shall construct well points cased in sand wicks. The casing, 6 to 10-inches in diameter, shall be jetted into the ground, followed by the installation of the well point, filling casing with sand and withdrawing the casing.

### **3.05 TRENCH FOUNDATION AND STABILIZATION**

- A. The bottom of the trench shall provide a foundation to support the pipe and its specified bedding. The trench bottom shall be graded to support the pipe and bedding uniformly throughout its length and width.

- B. If, after dewatering as specified above, the trench bottom is spongy, or if the trench bottom does not provide firm, stable footing and the material at the bottom of the trench will still not adequately support the pipe, the trench will be determined to be unsuitable and the County shall then authorize payment for trench stabilization.
- C. Should the undisturbed material encountered at the trench bottom constitute, in the opinion of the County, an unstable foundation for the pipe, the Contractor shall be required to remove such unstable material and fill the trench to the proper subgrade with crushed stone or surge stone as directed by the County.
- D. Where trench stabilization is provided, the trench stabilization material shall be compacted to at least 90 percent of the maximum dry density, unless shown or specified otherwise.

### **3.06 BEDDING AND HAUNCHING**

- A. Prior to placement of bedding material, the trench bottom shall be free of any water, loose rocks, boulders or large dirt clods.
- B. Bedding material shall be placed to provide uniform support along the bottom of the pipe and to place and maintain the pipe at the proper elevation. The initial layer of bedding placed to receive the pipe shall be brought to the grade and dimensions indicated on the Drawings. All bedding shall extend the full width of the trench bottom. The pipe shall be placed and brought to grade by tamping the bedding material or by removal of the excess amount of the bedding material under the pipe. Adjustment to grade line shall be made by scraping away or filling with bedding material. Wedging or blocking up of pipe shall not be permitted. Applying pressure to the top of the pipe, such as with a backhoe bucket, to lower the pipe to the proper elevation or grade shall not be permitted. Each pipe section shall have a uniform bearing on the bedding for the length of the pipe, except immediately at the joint.
- C. At each joint, excavate bell holes of ample depth and width to permit the joint to be assembled properly and to relieve the pipe bell of any load.
- D. After the pipe section is properly placed, add the haunching material to the specified depth. The haunching material shall be shovel sliced, tamped, vigorously chinked or otherwise consolidated to provide uniform support for the pipe barrel and to fill completely the voids under the pipe, including the bell hole. Prior to placement of the haunching material, the bedding shall be clean and free of any water, loose rocks, boulders or dirt clods.
- E. Gravity Sewers and Accessories: Lay PVC pipe with minimum Class "B" bedding.

Lay all other pipe with Class "C" bedding, unless shown or specified otherwise.

1. Class "A" (Bedding Factor - 2.8): Excavate the bottom of the trench flat at a minimum depth as shown on the Drawings, below the bottom of the pipe barrel. Lay pipe to line and grade on concrete block. Place concrete to the full width of the trench and to a height of one-fourth of the outside diameter of the pipe above the invert.
  2. Class "B" (Bedding Factor - 1.9): Excavate the bottom of the trench flat at a minimum depth as shown on the Drawings, below the bottom of the pipe barrel. Place and compact bedding material to the proper grade. Haunching material shall then be carefully placed by hand and compacted to provide full support under and up to the centerline of the pipe.
  3. Class "C" (Bedding Factor - 1.5): Excavate the bottom of the trench flat at a minimum depth as shown on the Drawings, below the bottom of the pipe barrel. Place and compact bedding material to the proper grade. Haunching material shall then be carefully placed by hand and compacted to provide full support under and up to a height of one-fourth the outside diameter of the pipe above the bottom of the pipe barrel.
  4. Type 5: Excavate the bottom of the trench flat at a minimum depth as shown on the Drawings, below the bottom of the pipe barrel. Place and compact bedding material to the proper grade before installing pipe. After the pipe has been brought to the proper grade, haunching material shall be carefully placed by hand and compacted to the top of the pipe.
- F. Manholes: Excavate to a minimum of 12 inches below the planned elevation of the base of the manhole. Place and compact crushed stone bedding or Class IA, IB or II embedment material to the required grade before constructing the manhole.
- G. Force Mains
1. Ductile Iron Pipe
    - a. Unless otherwise shown on the Drawings or specified, utilize earth materials for bedding and haunching.
    - b. Unless specified or shown otherwise, bedding shall meet the requirements for Type 2 Pipe Bedding. Unless specified or shown otherwise for restrained joint pipe and fittings, bedding shall meet the requirements for Type 3 Pipe Bedding.
    - c. Where the depth of cover over the piping exceeds 15 feet, the pipe bedding

shall meet the requirements of Type 4 Pipe Bedding. Where the depth of cover over the piping exceeds 28 feet, the pipe bedding shall meet the requirements of Type 5 Pipe Bedding.

- d. Type 4 or Type 5 Pipe Bedding called for on the Drawings, specified or ordered by the County, shall meet requirements for Type 4 or Type 5 Pipe Bedding, utilizing sand, gravel or crushed stone as bedding and haunching material.

2. Polyvinyl Chloride Pipe

- a. Unless shown otherwise on the Drawings, utilize earth materials for bedding and haunching.
- b. Unless shown otherwise on the Drawings, bedding and haunching shall meet the requirements for Type 2 Pipe Bedding, as detailed on the Drawings.
- c. Where the depth of cover over the piping exceeds 15 feet, the pipe bedding shall meet the requirements of Type 4 Pipe Bedding. Where the depth of cover over the piping exceeds 28 feet, the pipe bedding shall meet the requirements of Type 5 Pipe Bedding.
- d. Type 4 or Type 5 Pipe Bedding called for on the Drawings, specified or ordered by the County, shall meet requirements for Type 4 or Type 5 Pipe Bedding, utilizing sand, gravel or crushed stone as bedding and haunching material.

3. High Density Polyethylene Pipe: Per manufactures Specifications.

H. Water Mains

1. Ductile Iron Pipe

- a. Unless otherwise shown on the Drawings or specified, utilize earth materials for bedding and haunching. Type 2, 3, 4 and 5 bedding shall be as detailed on the Drawings.
- b. Unless specified or shown otherwise, bedding shall meet the requirements for Type 2 Pipe Bedding. Unless specified or shown otherwise for restrained joint pipe and fittings, bedding shall meet the requirements for Type 3 Pipe Bedding.
- c. Where the depth of cover over the piping exceeds 15 feet, the pipe bedding shall meet the requirements of Type 4 Pipe Bedding. Where the depth of cover over the piping exceeds 28 feet, the pipe bedding shall meet the

requirements of Type 5 Pipe Bedding.

- d. Type 4 or Type 5 Pipe Bedding called for on the Drawings, specified or ordered by the County, shall meet requirements for Type 4 or Type 5 Pipe Bedding, utilizing sand, gravel, or crushed stone bedding and haunching material.

2. Polyvinyl Chloride Pipe

- a. Unless shown otherwise on the Drawings, utilize earth materials for bedding and haunching.
- b. Unless shown otherwise on the Drawings, bedding and haunching shall meet the requirements for Type 2 Pipe Bedding, as detailed on the Drawings.

3. High Density Polyethylene Pipe: Per manufactures Specifications.

I. Excessive Width and Depth

1. Gravity Sewers: If the trench is excavated to excess width, provide the bedding class with the next higher bedding factor. Crushed stone haunching and initial backfill may be used in lieu of Class "A" bedding, where Class "A" bedding is necessitated by excessive trench width.
2. Pressure Mains: If the trench is excavated to excess width, provide the next higher type or class of pipe bedding, but a minimum of Type 4, as detailed on the Drawings.
3. If the trench is excavated to excessive depth, provide crushed stone or Class IA, IB or II embedment material to place the bedding at the proper elevation or grade for wastewater items only. For water mains, provide sand, gravel, or crushed stone to place the bedding at the proper elevation or grade.

- J. Compaction: Bedding and haunching materials under pipe, manholes and accessories shall be compacted to a minimum of 90 percent of the maximum dry density, unless shown or specified otherwise.

**3.07 INITIAL BACKFILL**

- A. Initial backfill shall be placed to anchor the pipe, protect the pipe from damage by subsequent backfill and ensure the uniform distribution of the loads over the top of the

pipe.

- B. Place initial backfill material carefully around the pipe in uniform layers to a depth of at least 18 inches above the pipe barrel. Layer depths shall be a maximum of 6 inches.
- C. Backfill on both sides of the pipe simultaneously to prevent side pressures.
- D. Compact each layer thoroughly with suitable hand tools or tamping equipment.
- E. Initial backfill shall be compacted to a minimum 90 percent of the maximum dry density, unless shown or specified otherwise.
- F. If materials excavated from the trench are not suitable for use as backfill materials, provide select backfill material conforming to the requirements of this Section.

### **3.08 CONCRETE ENCASEMENT FOR PIPELINES**

Where concrete encasement is shown on the Drawings for pipelines, excavate the trench to provide a minimum of 6-inches clearance from the bell of the pipe. Lay the pipe to line and grade on concrete blocks. In lieu of bedding, haunching and initial backfill, place concrete to the full width of the trench and to a height of not less than 6 inches above the pipe bell. Do not backfill the trench for a period of at least 24 hours after concrete is placed.

### **3.09 FINAL BACKFILL**

- A. Backfill carefully to restore the ground surface to its original condition.
- B. Except under paved areas, the top 6 inches shall be topsoil obtained as specified in "Trench Excavation" of this Section.
- C. Excavated material which is unsuitable for backfilling, and excess material, shall be disposed of, at no additional cost to the County, in a manner approved by the County. Surplus soil may be neatly distributed and spread over the site, if approved by the County. If such spreading is allowed, the site shall be left in a clean and slightly condition and shall not affect pre-construction drainage patterns. Surplus rock from the trenching operations shall be removed from the site.
- D. If materials excavated from the trench are not suitable for use as backfill materials, provide select backfill material conforming to the requirements of this Section.
- E. After initial backfill material has been placed and compacted, backfill with final backfill

material. Place backfill material in uniform layers, compacting each layer thoroughly as follows:

1. In 6 inch layers, if using light power tamping equipment, such as a "jumping jack"
  2. In 12 inch layers, if using heavy tamping equipment, such as hammer with tamping feet
  3. In 24 inch layers, if using a hydra-hammer
- F. Settlement: If trench settles, re-fill and grade the surface to conform to the adjacent surfaces.
- G. Final backfill shall be compacted to a minimum 90 percent of the maximum dry density, unless specified otherwise.

### **3.10 ADDITIONAL MATERIAL**

Where final grades above the pre-construction grades are required to maintain minimum cover, additional fill material will be as shown on the Drawings. Utilize excess material excavated from the trench, if the material is suitable. If excess excavated materials are not suitable, or if the quantity available is not sufficient, provide additional suitable fill material.

### **3.11 BACKFILL UNDER ROADS**

Compact backfill underlying pavement and sidewalks, and backfill under dirt and gravel roads to a minimum 98 percent of the maximum dry density. The top 12 inches shall be compacted to a minimum of 98 percent of the maximum dry density.

### **3.12 BACKFILL WITHIN GEORGIA DOT RIGHT-OF-WAY**

Backfill within the Georgia DOT right-of-way shall meet the requirements stipulated in the "Utility Accommodation Policy and Standards", published by the Georgia Department of Transportation.

### **3.13 BACKFILL ALONG RESTRAINED JOINT PIPE**

Backfill along restrained joint pipe shall be compacted to a minimum 90 percent of the maximum dry density.

**3.14 TESTING AND INSPECTION**

- A. The soils testing laboratory is responsible for the following:
  - 1. Compaction tests in accordance with Article 1.02 of this Section.
  - 2. Field density tests as ordered by the County.
  - 3. Inspecting and testing stripped site, subgrades and proposed fill materials.
- B. The Contractor's duties relative to testing include:
  - 1. Notifying laboratory of conditions requiring testing.
  - 2. Coordinating with laboratory for field testing.
  - 3. Paying costs for all testing performed at the request of the County beyond the scope of that required and for re-testing where initial tests reveal non-conformance with specified requirements.
  - 4. Providing excavation as necessary for laboratory personnel to conduct tests.
- C. Inspection
  - 1. Earthwork operations, acceptability of excavated materials for bedding or backfill, and placing and compaction of bedding and backfill is subject to inspection by the County.
  - 2. Where required by the County, foundations and shallow spread footing foundations are required to be inspected by a geotechnical engineer, who shall verify suitable bearing and construction.
- D. Comply with applicable codes, ordinances, rules, regulations and laws of local, municipal, state or federal authorities having jurisdiction.
- E. County shall have the right to select the location of compaction tests, no more than one per 1,000 feet of pipeline, and shall be notified by Contractor 24-hours in advance for the County to be present.

**END OF SECTION**

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**PART 1 GENERAL**

**1.01 SCOPE**

- A. The work covered by this Section includes furnishing all labor, materials and equipment required to bore and jack casings and to properly complete pipeline construction as described herein and/or shown on the Drawings.
- B. General: Supply all materials and perform all work in accordance with applicable American Society for Testing and Materials (ASTM), American Water Works Association (AWWA), American National Standards Institute (ANSI) or other recognized standards. Latest revisions of all standards are applicable. If requested by the County, submit evidence that manufacturer has consistently produced products of satisfactory quality and performance over a period of at least two years.

**1.02 SUBMITTALS**

- A. Submit shop drawings, product data and experience.
- B. Material Submittals: The Contractor shall provide shop drawings and other pertinent specifications and product data as follows:
  - 1. Shop drawings for casing pipe showing sizes and connection details.
  - 2. Casing Spacers.
- C. Experience Submittals: Boring and jacking casings is deemed to be specialty contractor work. If the Contractor elects to perform the work, the Contractor shall provide evidence as required by the General Conditions. A minimum of five continuous years of experience in steel casing construction is required of the casing installer. Evidence of this experience must be provided with the shop drawings for review by the County.

**1.03 STORAGE AND PROTECTION**

All materials shall be stored and protected in accordance with the manufacturer's recommendations and as approved by the County.

**PART 2 PRODUCTS**

**2.01 MATERIALS AND CONSTRUCTION**

A. Casing for Pipe Greater than 3 Inches in Diameter

1. The casing shall be new and unused pipe. The casing shall be made from steel plate having a minimum yield strength of 35,000 psi. The steel plate shall also meet the chemical requirements of ASTM A 36.
2. The thicknesses of casing shown in paragraph B. below are minimum thicknesses. Actual thicknesses shall be determined by the casing installer, based on an evaluation of the required forces to be exerted on the casing when jacking. Any buckling of the casing due to jacking forces shall be repaired at no additional cost to the County.
3. The diameters of casing shown in paragraph B. below and shown on the Drawings are minimum. Larger casings, with the County's approval, may be provided at no additional cost to the County, for whatever reasons the Contractor may decide, whether casing size availability, line and grade tolerances, soil conditions, etc.
4. Casing Sizes

<b>UNDER RAILROADS</b>			
<b>Pipe Diameter, inches</b>	<b>Casing Diameter, inches</b>	<b>Wall Thickness, inches</b>	
		<b>Coated</b>	<b>Uncoated</b>
6	14	0.250	0.282
8	18	0.250	0.313
10	20	0.281	0.344
12	22	0.312	0.375

<b>UNDER HIGHWAYS</b>		
<b>Pipe Diameter, inches</b>	<b>Casing Diameter, inches</b>	<b>Wall Thickness, inches</b>
6	12	0.250
8	16	0.250
10	16	0.250
12	18	0.250

- B. Casing for Pipe Less than or Equal to 3 Inches in Diameter: Casing shall be polyvinyl chloride pipe which has a minimum wall thickness equal to Schedule 80.
- C. Casing Spacers: Casing spacers shall meet one of the following requirements:
1. Casing spacers shall be flanged, bolt-on style with a two-section stainless steel shell lined with a PVC liner, minimum 0.09-inch thick also having a hardness of 85-90 durometer. Runners shall be attached to stainless steel risers which shall be properly welded to the shell. The height of the runners and risers shall be manufactured such that the pipe does not float within the casing. Casing spacers shall be Cascade Waterworks Manufacturing Company or Advanced Products & Systems, Inc.
  2. Casing spacers shall be a two-section, flanged, bolt on style constructed of heat fused PVC coated steel, minimum 14 gauge band and 10 gauge risers, with 2-inch wide glass reinforced polyester insulating skids, heavy duty PVC inner liner, minimum 0.09-inch thick having a hardness of 85-90 durometer, and all stainless steel or cadmium plated hardware shall be Pipeline Seal and Insulator, Inc.
- D. Carrier Pipe: Carrier pipes shall meet requirements as specified in these Specifications.

## **2.02 EQUIPMENT**

- A. A cutting head shall be attached to a continuous auger mounted inside the casing pipe.
- B. On casing pipe for gravity sewer over 60 feet in length, the installation equipment shall include a steering head and a grade indicator.

- C. The steering head shall be controlled manually from the bore pit. The grade indicator shall consist of a water level attached to the casing which would indicate the elevation of the front end of the casing or some other means for grade indication approved by the County.

## **PART 3 EXECUTION**

### **3.01 GENERAL**

- A. Interpretation of soil investigation reports and data, investigating the site and determination of the site soil conditions prior to bidding is the sole responsibility of the Contractor. Any subsurface investigation by the Bidder or Contractor must be approved by the appropriate authority having jurisdiction over the site.
- B. Casing construction shall be performed so as not to interfere with, interrupt or endanger roadway surface and activity thereon, and minimize subsidence of the surface, structures, and utilities above and in the vicinity of the casing. Support the ground continuously in a manner that will prevent loss of ground and keep the perimeters and face of the casing, passages and shafts stable. The Contractor shall be responsible for all settlement resulting from casing operations and shall repair and restore damaged property to its original or better condition at no cost to the County.
- C. Face Protection: The face of the excavation shall be protected from the collapse of the soil into the casing.
- D. Casing Design: Design of the bore pit and required bearing to resist jacking forces are the responsibility of the Contractor. The excavation method selected shall be compatible with expected ground conditions. The lengths of the casing shown on the Drawings are the minimum lengths required. The length of the casing may be extended for the convenience of the Contractor, at no additional cost to the County. Due to restrictive right-of-way and construction easements, boring and jacking casing lengths less than the nominal 20 foot length may be necessary.
- E. Highway Crossings
  - 1. The Contractor shall be held responsible and accountable for the coordinating and scheduling of all construction work within the highway right-of-way.
  - 2. Work along or across the highway department rights-of-way shall be subject to inspection by such highway department.

3. All installations shall be performed to leave free flows in drainage ditches, pipes, culverts or other surface drainage facilities of the highway, street or its connections.
4. No excavated material or equipment shall be placed on the pavement or shoulders of the roadway without the express approval of the highway department.
5. In no instance will the Contractor be permitted to leave equipment (trucks, backhoes, etc.) on the pavement or shoulder overnight. Construction materials to be installed, which are placed on the right-of-way in advance of construction, shall be placed in such a manner as not to interfere with the safe operation of the roadway.
6. The Contractor shall be responsible for providing the County sufficient information to obtain a blasting permit in a timely manner.

F. Railroad Crossings

1. The Contractor shall secure permission from the Railroad to schedule work so as not to interfere with the operation of the Railroad.
2. Additional insurance is required for each railroad crossing. The Contractor shall furnish the Railroad with such additional insurance as may be needed, cost of the same shall be borne by the Contractor.
3. All work on the Railroad right-of-way, including necessary support of tracks, safety of operations and other standard and incidental operation procedures may be under the supervision of the appropriate authorized representative of the Railroad affected and any decisions of this representative pertaining to construction and/or operations shall be final and construction must be governed by such decisions.
4. If, in the opinion of the Railroad, it becomes necessary to provide flagging protection, watchmen or the performance of any other work in order to keep the tracks safe for traffic, the Contractor shall coordinate such work and shall reimburse the Railroad, in cash, for such services, in accordance with accounting procedures agreed on by the Contractor and affected Railroad before construction is started.
5. No blasting shall be permitted within the Railroad right-of-way.

**3.02 GROUNDWATER CONTROL**

- A. The Contractor shall control the groundwater throughout the construction of the casing.
- B. Methods of dewatering shall be at the option and responsibility of the Contractor. Maintain close observation to detect settlement or displacement of surface facilities due to dewatering. Should settlement or displacement be detected, notify the County immediately and take such action as necessary to maintain safe conditions and prevent damage.
- C. When water is encountered, provide and maintain a dewatering system of sufficient capacity to remove water on a 24 hour basis keeping excavations free of water until the backfill operation is in progress. Dewatering shall be performed in such a manner that removal of soil particles is held to a minimum. Dewater into a sediment trap and comply with requirements specified in Section 02125 of these Specifications.

**3.03 SAFETY**

- A. Provide all necessary bracing, bulkheads and shields to ensure complete safety to all traffic, persons and property at all times during the work. Perform the work in such a manner as to not permanently damage the roadbed or interfere with normal traffic over it.
- B. Observe all applicable requirements of the regulations of the authorities having jurisdiction over this site. Conduct the operations in such a manner that all work will be performed below the level of the roadbed.
- C. Perform all activities in accordance with the Occupational Safety and Health Act of 1970 (PL-596), as amended, applicable regulations of the Federal Government, OSHA 29CFR 1926 and applicable criteria of ANSI A10.16-81, "Safety Requirements for Construction of Tunnel Shafts and Caissons".

**3.04 BORING AND JACKING**

- A. Shaft
  - 1. Conduct boring and jacking operations from a shaft excavated at one end of the section to be bored. Where conditions and accessibility are suitable, place the shaft on the downstream end of the bore.
  - 2. The shaft shall be rectangular and excavated to a width and length required for

ample working space. If necessary, sheet and shore shaft properly on all sides. Shaft sheeting shall be timber or steel piling of ample strength to safely withstand all structural loadings of whatever nature due to site and soil conditions. Keep preparations dry during all operations. Perform pumping operations as necessary.

3. The bottom of the shaft shall be firm and unyielding to form an adequate foundation upon which to work. In the event the shaft bottom is not stable, excavate to such additional depth as required and place a gravel sub-base or a concrete sub-base if directed by the County due to soil conditions.

**B. Jacking Rails and Frame**

1. Set jacking rails to proper line and grade within the shaft. Secure rails in place to prevent settlement or movement during operations. The jacking rails shall cradle and hold the casing pipe on true line and grade during the progress of installing the casing.
2. Place backing between the heels of jacking rails and the rear of the shaft. The backing shall be adequate to withstand all jacking forces and loads.
3. The jacking frame shall be of adequate design for the magnitude of the job. Apply thrust to the end of the pipe in such a manner to impart a uniformly balanced load to the pipe barrel without damaging the joint ends of the pipe.

**C.** Boring and jacking of casing pipes shall be accomplished by the dry auger boring method without jetting, sluicing or wetboring.

**D.** Auger the hole and jack the casing through the soil simultaneously.

**E.** Bored installations shall have a bored-hole diameter essentially the same as the outside diameter of the casing pipe to be installed.

**F.** Execute boring ahead of the casing pipe with extreme care, commensurate with the rate of casing pipe penetration. Boring may proceed slightly in advance of the penetrating pipe and shall be made in such a manner to prevent any voids in the earth around the outside perimeter of the pipe. Make all investigations and determine if the soil conditions are such as to require the use of a shield.

**G.** As the casing is installed, check the horizontal and vertical alignment frequently. Make corrections prior to continuing operation. For casing pipe installations over 100 feet in length, the auger shall be removed and the alignment and grade checked at minimum intervals of 60 feet.

- H. Any casing pipe damaged in jacking operations shall be repaired, if approved by the County, or removed and replaced at Contractor's own expense.
- I. Lengths of casing pipe, as long as practical, shall be used except as restricted otherwise. Joints between casing pipe sections shall be butt joints with complete joint penetration, single groove welds, for the entire joint circumference, in accordance with AWS recommended procedures. Prior to welding the joints, the Contractor shall ensure that both ends of the casing sections being welded are square.
- J. The Contractor shall prepare a contingency plan which will allow the use of a casing lubricant, such as bentonite, in the event excessive frictional forces jeopardize the successful completion of the casing installation.
- K. Once the jacking procedure has begun, it should be continued without stopping until completed, subject to weather and conditions beyond the control of the Contractor.
- L. Care shall be taken to ensure that casing pipe installed by boring and jacking method will be at the proper alignment and grade.
- M. The Contractor shall maintain and operate pumps and other necessary drainage system equipment to keep work dewatered at all times.
- N. Adequate sheeting, shoring and bracing for embankments, operating pits and other appurtenances shall be placed and maintained to ensure that work proceeds safely and expeditiously. Upon completion of the required work, the sheeting, shoring and bracing shall be left in place, cut off or removed, as designated by the County.
- O. Trench excavation, all classes and type of excavation, the removal of rock, muck, debris, the excavation of all working pits and backfill requirements of Section 02225 are included under this Section.
- P. All surplus material shall be removed from the right-of-way and the excavation finished flush with the surrounding ground.
- Q. Grout backfill shall be used for unused holes or abandoned pipes.

### **3.05 FREE BORING**

- A. Where the Drawings indicate a pipeline is to be installed by boring without casing, the Contractor shall construct the crossing by the free bore method. The free bore method shall be accomplished by the dry auger boring method without jetting, sluicing, wet

boring, or by "punching".

- B. The diameter of the free bore shall not exceed the pipe bell outside diameter or the pipe barrel outside diameter plus 1-inch, whichever is greater.
- C. Free boring, where indicated on the Drawings, is to be performed at the Contractor's option. The Contractor may choose to construct the crossing by the conventional bore and jack casing methodology.
- D. The Contractor shall be responsible for any settlement of the roadway caused by the free bore construction activities.
- E. If the Contractor elects to free bore, and an acceptable installation does not result for any reason, the Contractor shall install a casing pipe by the bore and jack method.

### **3.06 VENTILATION AND AIR QUALITY**

Provide, operate and maintain for the duration of casing project a ventilation system to meet safety and OSHA requirements.

### **3.07 ROCK EXCAVATION**

- A. In the event that rock is encountered during the installation of the casing pipe which, in the opinion of the County, cannot be removed through the casing, the County may authorize the Contractor to complete the crossing by a method established in a change order.
- B. At the Contractor's option, the Contractor may continue to install the casing and remove the rock through the casing at no additional cost to the County.

### **3.08 INSTALLATION OF PIPE**

- A. After construction of the casing is complete, and has been accepted by the County, install the pipeline in accordance with the Drawings and Specifications.
- B. Check the alignment and grade of the casing and prepare a plan to set the pipe at proper alignment, grade and elevation, without any sags or high spots.
- C. The carrier pipe shall be held in the casing pipe by the use of casing spacers sized to limit radial movement to a maximum of 1-inch. Provide a minimum of one casing spacer per nominal length of pipe. Casing spacers shall be attached to the pipe at maximum 18 to 20 foot intervals.

- D. Close the ends of the casing with 4-inch brick walls or seal ends with one-piece synthetic rubber especially formulated for sealing casing/carrier pipe.

**3.09 SHEETING REMOVAL**

Remove sheeting used for shoring from the shaft and off the job site. The removal of sheeting, shoring and bracing shall be done in such a manner as not to endanger or damage either new or existing structures, private or public properties and also to avoid cave-ins or sliding in the banks.

**END OF SECTION**

**PART 1 GENERAL**

**1.01 SCOPE**

The work to be performed under this Section shall consist of removing and replacing existing pavement, sidewalks and curbs in paved areas where such have been removed for construction of water mains, fire hydrants and all other water, sewer and utility appurtenances and structures.

**1.02 SUBMITTALS**

Provide certificates stating that materials supplied comply with Specifications. Certificates shall be signed by the asphalt producer and the Contractor.

**1.03 CONDITIONS**

A. Weather Limitations

1. Do not conduct paving operations when surface is wet or contains excess of moisture which would prevent uniform distribution and required penetration.
2. Construct prime and tack coats, and asphaltic courses only when atmospheric temperature in the shade is above 50 degrees F, when the underlying base is dry and when weather is not rainy.
3. Place base course when air temperature is above 35 degrees F and rising.

B. Grade Control: Establish and maintain the required lines and grades for each course during construction operations.

**PART 2 PRODUCTS**

**2.01 MATERIALS AND CONSTRUCTION**

- A. Graded Aggregate Base Course: Graded aggregate base course shall be of uniform quality throughout and shall meet the requirements of Section 815.01 of the Georgia Department of Transportation Standard Specifications.
- B. Surface Course: The surface course for all pavement, including prime or tack coat when required by the County, shall conform to the requirements of Section 400, Type "E" of the Georgia Department of Transportation Standard Specifications.

- C. Concrete: Provide concrete and reinforcing for concrete pavement or base courses in accordance with the requirements of the Georgia Department of Transportation Standard Specifications, Section 430. Concrete shall be of the strength classifications shown on the Drawings.
- D. Special Surfaces: Where driveways or roadways are disturbed or damaged which are constructed of specialty type surfaces, e.g., brick or stone, these driveways and roadways shall be restored utilizing similar, if not original, materials. Where the nature of these surfaces dictate, a specialty contractor shall be used to restore the surfaces to their previous or better condition. Special surfaces shall be removed and replaced to the limits to which they were disturbed.

## 2.02 TYPES OF PAVEMENTS

- A. General: All existing pavement removed, destroyed or damaged by construction shall be replaced with the same type and thickness of pavement as that existing prior to construction, unless otherwise directed by the County. Materials, equipment and construction methods used for paving work shall conform to the Georgia Department of Transportation specifications applicable to the particular type required for replacement, repair or new pavements.
- B. Aggregate Base: Aggregate base shall be constructed in accordance with the requirements of Section 310 of the Georgia Department of Transportation Standard Specifications. The maximum thickness to be laid in a single course shall be 6-inches compacted. If the design thickness of the base is more than 6-inches, it shall be constructed in two or more courses of approximate equal thickness. After the material placed has been shaped to line, grade and cross-section, it shall be rolled until the course has been uniformly compacted to at least 100 percent of the maximum dry density when Group 2 aggregate is used, or to at least 98 percent of maximum dry density when Group 1 aggregate is used.
- C. Concrete Pavement: Concrete pavement or base courses shall be replaced with concrete. The surface finish of the replaced concrete pavement shall conform to that of the existing pavement. The surface of the replaced concrete base course shall be left rough. The slab depth shall be equivalent to the existing concrete pavement or base course, but in no case less than 6-inches thick. Transverse and longitudinal joints removed from concrete pavement shall be replaced at the same locations and to the same types and dimensions as those removed. Concrete pavements or concrete base courses shall be reinforced.
- D. Asphaltic Concrete Surface Course: Asphaltic concrete surface course construction

shall conform to Georgia Department of Transportation Standard Specifications, Section 400. The pavement mixture shall not be spread until the designated surface has been previously cleaned and prepared, is intact, firm, properly cured, dry and the tack coat has been applied. Apply and compact the base in maximum layer thickness by asphalt spreader equipment of design and operation approved by the County. Apply and compact the surface course in a manner approved by the County. Immediately correct any high, low or defective areas by cutting out the course, replacing with fresh hot mix, and immediately compacting to conform and thoroughly bond to the surrounding area.

- E. Surface Treatment Pavement: Bituminous penetration surface treatment pavement shall be replaced with a minimum thickness of 1-inch conforming to Section 424, Georgia Department of Transportation Standard Specifications.
- F. Gravel Surfaces: Existing gravel road, drive and parking area replacement shall meet the requirements of graded aggregate base course. This surfacing may be authorized by the County as a temporary surface for paved streets until replacement of hard surfaced pavement is authorized.
- G. Temporary Measures: During the time period between pavement removal and complete replacement of permanent pavement, maintain highways, streets and roadways by the use of steel running plates anchored to prevent movement. The backfill above the pipe shall be compacted, as specified in Section 02225 of these Specifications, up to the existing pavement surface to provide support for the steel running plates. All pavement shall be replaced within seven calendar days of its removal.

### **PART 3 EXECUTION**

#### **3.01 REMOVING PAVEMENT**

- A. General: Remove existing pavement as necessary for installing the pipe line and appurtenances.
- B. Marking: Before removing any pavement, mark the pavement neatly paralleling pipe lines and existing street lines. Space the marks the width of the trench.
- C. Breaking: Break asphalt pavement along the marks using pavement shearing equipment, jack hammers or other suitable tools. Break concrete pavement along the marks by scoring with a rotary saw and breaking below the score by the use of jack hammers or other suitable tools.
- D. Machine Pulling: Do not pull pavement with machines until the pavement is completely

- broken and separated from pavement to remain.
- E. Damage to Adjacent Pavement: Do not disturb or damage the adjacent pavement. If the adjacent pavement is disturbed or damaged, remove and replace the damaged pavement.
  - F. Damage to Traffic Signal Loops: Any pavement removal which will include removal of traffic signal loops embedded in the pavement shall be coordinated with the Traffic Engineering Department having jurisdiction over the traffic signal five days prior to pavement removal.
  - G. Sidewalk: Remove and replace any sidewalks disturbed by construction for their full width and to the nearest undisturbed joint.
  - H. Curbs: Tunnel under or remove and replace any curb disturbed by construction to the nearest undisturbed joint.

### 3.02 REPLACING PAVEMENT

- A. Pavement shall be replaced no later than seven days after the original surface was cut.
- B. Preparation of Subgrade: During backfilling and compaction of the backfill, arrange to have the compaction tested by an independent testing laboratory. After compaction testing has been satisfactorily completed, replace all pavements, sidewalks and curbs removed.
  - 1. The existing street pavement or surface shall be removed along the lines of the work for the allowable width specified for the trench or structure. After the installation of the sewerage or water works facilities and after the backfill has been compacted suitably, the additional width of pavement to be removed, as shown on the Standard Detail Drawings, shall be done immediately prior to replacing the pavement.
  - 2. Trench backfill shall be compacted for the full depth of the trench as specified in Section 02225 of these Specifications.
  - 3. Temporary trench backfill along streets and driveways shall include 6-inches of crushed stone or cherty clay as a temporary surfacing of the trenches or asphalt as directed by the County. This temporary surface shall be maintained carefully at grade and dust-free by the Contractor until the backfill of the trench has thoroughly compacted in the opinion of the County and permission is granted to replace the street pavement.
  - 4. When temporary crushed stone or chert surface is considered by the County to be

sufficient surface for gravel pavement, the surface shall be graded smooth and to an elevation that will make the final permanent surfacing level with the adjacent surfacing that was undisturbed.

C. Pavement Replacement

1. Prior to replacing pavement, make a final cut in concrete pavement 12-inches back from the edge of the damaged pavement with a concrete saw. Remove asphalt pavement 12-inches back from the edge of the damaged pavement using pavement shearing equipment, jack hammers or other suitable tools.
2. Replace all street and roadway pavement as shown on the Drawings. Replace driveways, sidewalks and curbs with the same material, to nearest existing undisturbed construction joint and to the same dimensions as those existing.
3. If the temporary crushed stone or chert surface is to be replaced, the top 6-inches shall be removed and the crushed stone surfacing for unpaved streets or the base for the bituminous surface shall be placed.
4. Following this preparation, the chert or crushed stone base shall be primed with a suitable bituminous material and surfaced with the proper type of bituminous surface treatment.
5. Where the paved surface is to be replaced with asphaltic concrete pavement, concrete pavement or with a concrete base and a surface course, the temporary chert or crushed stone surface and any necessary backfill material, additional existing paving and new excavation shall be removed to the depth and width shown on the Standard Detail Drawings. All edges of the existing pavement shall be cut to a straight, vertical edge. Care shall be used to get a smooth joint between the old and new pavement and to produce an even surface on the completed street. Concrete base slabs and crushed stone bases, if required, shall be placed and allowed to cure for three days before bituminous concrete surface courses are applied. Expansion joints, where applicable, shall be replaced in a manner equal to the original joint.
6. Where driveways or roadways, constructed of specialty type surfaces, e.g. brick or stone are disturbed or damaged, these driveways and roadways shall be restored utilizing similar materials. Where the nature of these surfaces dictate, a specialty contractor shall be used to restore the surfaces to their previous or better condition. Special surfaces shall be removed and replaced to the limits to which they were disturbed.

D. Pavement Resurfacing

1. Certain areas to be resurfaced may be specified or noted on the Drawings. Where pavement to be resurfaced has been damaged with potholes, the Contractor shall remove all existing loose pavement material and fill the hole with Bituminous Plant Mix Base, as specified, to the level of the existing pavement. After all pipe line installations are complete and existing pavement has been removed and replaced along the trench route, apply tack coat and surface course as specified.
2. Resurfacing limits shall be perpendicular to the road centerline. The limits of resurfacing shall be 10 feet beyond the edge of the pavement replacement on the main road being resurfaced, and to the point of tangency of the pavement on the side streets.

E. Pavement Striping: Pavement striping removed or paved over shall be replaced with the same type, dimension and material as original unless directed otherwise by the County.

F. Traffic Signal Loops: The replacement or repair of all traffic signal loops removed or damaged during the removal and replacement of pavement shall be coordinated by the Contractor with the Traffic Engineering Department having jurisdiction over each traffic signal. The Contractor shall be responsible for payment of all fees associated with replacement or repair of traffic signal loops.

**3.03 SIDEWALK AND CURB REPLACEMENT**

A. Construction

1. All concrete sidewalks and curbs shall be replaced with concrete.
2. Preformed joints shall be 1/2-inch thick, conforming to the latest edition of AASHTO M 59 for sidewalks and AASHTO M 123 for curbs.
3. Forms for sidewalks shall be of wood or metal, shall be straight and free from warp, and shall be of sufficient strength, when in place, to hold the concrete true to line and grade without springing or distorting.
4. Forms for curbs shall be metal and of an approved section. They shall be straight and free from distortions, showing no vertical variation greater than 1/8-inch in 10 feet and no lateral variation greater than 1/4-inch in 10 feet from the true plain surface on the vertical face of the form. Forms shall be of the full depth of the

- structure and constructed such to permit the inside forms to be securely fastened to the outside forms.
5. Securely hold forms in place true to the lines and grades to match existing.
  6. Wood forms may be used on sharp turns and for special sections, as approved by the County. Where wooden forms are used, they shall be free from warp and shall be the nominal depth of the structure.
  7. All mortar and dirt shall be removed from forms and all forms shall be thoroughly oiled or wetted before any concrete is deposited.
- B. When a section is removed, the existing sidewalk or curb shall be cut to a neat line, perpendicular to both the centerline and the surface of the concrete slab. Existing concrete shall be cut along the nearest existing construction joints; if such joints do not exist, the cut shall be made at minimum distances to match existing.
- C. Existing concrete sidewalks and curbs that have been cut and removed for construction purposes shall be replaced with the same width and surface as the portion removed. Sidewalks shall have a minimum uniform thickness of 4-inches. The new work shall be neatly jointed to the existing concrete so that the surface of the new work shall form an even, unbroken plane with the existing surfaces.
- D. The subgrade shall be formed by excavating to a depth equal to the thickness of the concrete, plus 2-inches. Subgrade shall be of such width as to permit the proper installation and bracing of the forms. Subgrades shall be compacted by hand tamping or rolling. Soft, yielding or unstable material shall be removed and backfilled with satisfactory material. Place 2-inches of porous crushed stone under all sidewalks and curbs and compact thoroughly, then finish to a smooth, unyielding surface at proper line, grade and cross section.
- E. Joint for Curbs
1. Joints shall be constructed to match existing and as specified. Construct joints true to line with their faces perpendicular to the surface of the structure and within 1/4-inch of their designated position.
  2. Thoroughly spade and compact the concrete at the faces of all joints filling all voids.
  3. Install expansion joint materials at the point of curve at all street returns. Install expansion joint material behind the curb at abutment to sidewalks and adjacent structures.

4. Place contraction joints every 10 feet along the length of the curbs and gutters. Form contraction joints using steel templates or division plates which conform to the cross section of the structure. Leave the templates in place until the concrete has set sufficiently to hold its shape, but remove them while the forms are still in place. Contraction joint templates or plates shall not extend below the top of the steel reinforcement or they shall be notched to permit the reinforcement to be continuous through the joint. Contraction joints shall be a minimum of 1-1/2-inches deep.
- F. Expansion joints shall be required to replace any removed expansion joints. Expansion joints shall be true and even, shall present a satisfactory appearance, and shall extend to within 1/2-inch of the top of finished concrete surface.
- G. Finishing
1. Strike off the surface with a template and finish the surface with a wood float using heavy pressure, after which, contraction joints shall be made and the surface finished with a wood float or steel trowel.
  2. Finish the face of the curbs at the top and bottom with an approved finishing tool of the radius to match existing.
  3. Finish edges with an approved finishing tool having a 1/4-inch radius.
  4. Provide a final broom finish by lightly combing with a stiff broom after troweling is complete.
  5. The finished surface shall not vary more than 1/8-inch in 10 feet from the established grade.
- H. Driveway and Sidewalk Ramp Openings
1. Provide driveway openings of the widths and at the locations to match existing and as directed by the County.
  2. Provide sidewalk ramp openings to match existing, in conformance with the applicable regulations and as directed by the County.
- I. Concrete shall be suitably protected from freezing and excessive heat. It shall be kept covered with burlap or other suitable material and kept wet until cured. Provide necessary barricades to protect the work. All damage caused by people, vehicles,

animals, rain, the Contractor's operations and the like shall be repaired by the Contractor, at no additional expense to the County.

**3.04 MAINTENANCE**

The Contractor shall maintain the surfaces of roadways built and pavements replaced until the acceptance of the Project. Maintenance shall include replacement, scraping, reshaping, wetting and rerolling as necessary to prevent raveling of the road material, the preservation of reasonably smooth surfaces and the repair of damaged or unsatisfactory surfaces, to the satisfaction of the County. Maintenance shall include sprinkling as may be necessary to abate dust from the gravel surfaces.

**3.05 SUPERVISION AND APPROVAL**

- A. Pavement restoration shall meet the requirements of the regulatory agency responsible for the pavement. Obtain agency approval of pavement restorations before requesting final payment.
- B. Obtain the County's approval of restoration of pavement, such as private roads and drives, that are not the responsibility of a regulatory agency.
- C. Complete pavement restoration as soon as possible after backfilling.
- D. Failure of Pavement: Should any pavement restoration or repairs fail or settle during the life of the Contract, including the bonded period, promptly restore or repair defects.

**3.06 CLEANING**

The Contractor shall remove all surplus excavation materials and debris from the street surfaces and rights-of-way and shall restore street, roadway or sidewalk surfacing to its original condition.

**END OF SECTION**

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**PART 1 GENERAL**

**1.01 SCOPE**

- A. This Section describes products to be incorporated into the water mains and requirements for the installation and use of these items. Furnish all products and perform all labor necessary to fulfill the requirements of these Specifications.
- B. General: Supply all products and perform all work in accordance with applicable American Society for Testing and Material (ASTM), American Water Works Association (AWWA), American National Standards Institute (ANSI), or other recognized standards. Latest revisions of all standards are applicable.

**1.02 QUALIFICATIONS**

If requested by the County, submit evidence that manufacturers have consistently produced products of satisfactory quality and performance for a period of at least two years.

**1.03 SUBMITTALS**

Complete shop drawings, product data and engineering data for all products shall be submitted to the County.

**1.04 TRANSPORTATION AND HANDLING**

- A. Unloading: Furnish equipment and facilities for unloading, handling, distributing and storing pipe, fittings, valves and accessories. Make equipment available at all times for use in unloading. Do not drop or dump materials. Any materials dropped or dumped will be subject to rejection without additional justification. Pipe handled on skids shall not be rolled or skidded against the pipe on the ground.
- B. Handling: Handle pipe, fittings, valves and accessories carefully to prevent shock or damage. Handle pipe by rolling on skids, forklift, or front end loader. Do not use material damaged in handling. Slings, hooks or pipe tongs shall be padded and used in such a manner as to prevent damage to the exterior coatings or internal lining of the pipe.

**1.05 STORAGE AND PROTECTION**

- A. Store all pipe which cannot be distributed along the route. Make arrangements for the use of suitable storage areas.

## **WATER MAINS AND ACCESSORIES**

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- B. Stored materials shall be kept safe from damage. The interior of all pipe, fittings and other appurtenances shall be kept free from dirt or foreign matter at all times. Valves and hydrants shall be drained and stored in a manner that will protect them from damage by freezing.
- C. Pipe shall not be stacked higher than the limits recommended by the manufacturer. The bottom tier shall be kept off the ground on timbers, rails or concrete. Pipe in tiers shall be alternated: bell, plain end; bell, plain end. At least two rows of timbers shall be placed between tiers and chocks, affixed to each other in order to prevent movement. The timbers shall be large enough to prevent contact between the pipe in adjacent tiers.
- D. Stored mechanical and push-on joint gaskets shall be placed in a cool location out of direct sunlight. Gaskets shall not come in contact with petroleum products. Gaskets shall be used on a first-in, first-out basis.
- E. Mechanical-joint bolts shall be handled and stored in such a manner that will ensure proper use with respect to types and sizes.

### **1.06 QUALITY ASSURANCE**

The manufacturer shall provide written certification to the County that all products furnished comply with all applicable requirements of these Specifications.

### **1.07 RELATED SECTIONS**

- 1. Section 02200-Basic Pipeline Construction

## **PART 2 PRODUCTS**

### **2.01 PIPING MATERIALS AND ACCESSORIES**

- A. Ductile Iron Pipe (DIP)
  - 1. Ductile iron pipe shall be manufactured in accordance with AWWA C151. All pipe, except specials, shall be furnished in nominal lengths of 18 to 20 feet. Sizes will be as shown on the Drawings. All pipe shall be Pressure Class 350 and have corresponding minimum wall thickness, unless otherwise specified or shown on the Drawings.
  - 2. Pipe and fittings shall be cement lined in accordance with AWWA C104. Pipe

and fittings shall be furnished with a bituminous outside coating.

3. Fittings shall be ductile iron and shall conform to AWWA C110 or AWWA C153 with a minimum rated working pressure of 250 psi.
4. Joints: Unless shown or specified otherwise, joints shall be push-on or restrained joint type for pipe and standard mechanical, push-on or restrained joints for fittings. Push-on and mechanical joints shall conform to AWWA C111. Restrained joints shall be American "FLEX-RING" or "FAST-GRIP", or U.S. Pipe "TR FLEX" or "FIELD LOK". No field welding of restrained joint pipe will be permitted.
5. Provide the appropriate gaskets for mechanical and flange joints. Gaskets for flange joints shall be made of 1/8-inch thick, cloth reinforced rubber; gaskets may be ring type or full face type.
6. Bolts and Nuts
  - a. Provide the necessary bolts for connections. All bolts and nuts shall be threaded in accordance with ANSI B1.1, Coarse Thread Series, Class 2A external and 2B internal fit. All bolts and nuts shall be made in the U.S.A.
  - b. Bolts and nuts for mechanical joints shall be Tee Head Bolts and nuts of high strength low-alloy steel in accordance with ASTM A 242 to the dimensions shown in AWWA C111/ANSI A21.11.
  - c. Bolts for exposed service shall be zinc plated, cold pressed, steel machine bolts conforming to ASTM A 307, Grade B. Nuts for exposed service shall be zinc plated, heavy hex conforming to ASTM A 563. Zinc plating shall conform to ASTM B 633, Type II.
7. Mechanical joint glands shall be ductile iron.
8. Thrust collars shall be welded-on ductile iron body type designed to withstand thrust due to 250 psi internal pressure on a dead end.
9. Ductile iron pipe shall be encased in polyethylene film where shown on the Drawings. Polyethylene film shall have a minimum thickness of 8 mils and shall meet the requirements of AWWA C105.
10. Acceptance will be on the basis of the County's inspection and the manufacturer's written certification that the pipe was manufactured and tested in accordance with the applicable standards.

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### B. Polyvinyl Chloride (PVC) Pipe and Fittings

1. Pipe
  - a. All PVC pipe shall have integral belled ends for push-on type jointing and shall conform to ASTM D 2241.
  - b. Unless shown otherwise on the Drawings, pipe shall have a Standard Dimension Ratio (SDR) of 26 and shall be capable of withstanding a working pressure of 160 psi, unless indicated otherwise on the Drawings.
  - c. PVC pipe in Georgia DOT right-of-way, the pipe shall have a Standard Dimension Ratio (SDR) of 21 and shall be capable of withstanding a working pressure of 200 psi.
  - d. Pipe shall be supplied in minimum lengths of 20 feet.
2. All fittings shall be of ductile iron meeting the requirements of AWWA C110 or AWWA C153 with a minimum rated working pressure of 250 psi. Fittings shall be cement lined in accordance with AWWA C104. Fittings shall be furnished with a bituminous outside coating. Special adapters shall be provided as recommended by the manufacturer to adapt the PVC pipe to mechanical jointing with cast or ductile iron pipe, fittings, or valves.
3. Acceptance will be on the basis of the County's inspection and the manufacturer's written certification that the pipe was manufactured and tested in accordance with the applicable standards, including the National Sanitation Foundation. Additionally, each piece of pipe shall be stamped "NSF Approved".

### C. High Density Polyethylene Pipe (HDPE)

1. Polyethylene Piping Material
  - a. The pipe and fittings shall be made of High Density, Extra High Molecular Weight (EHMW) polyethylene with a standard thermoplastic material designation code of PE3408 and having a cell classification of 345444E per ASTM D3350. The molecular weight category shall be extra high (250,000 to 1,500,000) as per the Gel Permeation Chromatography determination procedure with a typical value of 300,000 to 330,000. The pipe shall be manufactured in accordance with ASTM F714 and/or ASTM D3035. The pipe shall meet the Utility Location and Coordination Council, "*Uniform Color Code*", for water mains, per APWA/ULCC Standards Committee.
  - b. The polyethylene pipe manufacturer shall provide certification that the stress regression testing has been performed on the specific product. The said certification shall include a stress life curve per ASTM D2837. The stress

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regression testing shall have been performed in accordance with ASTM D2837, and the manufacturer shall provide a product supplying a minimum Hydrostatic Design Basis (HDB) of 1,600 psi as determined by ASTM D2837.

- c. The material shall be listed by the Plastics Pipe Institute (PPI), a division of the Society of the Plastics Industry in PPI TR-4. The pipe material shall have a Hydrostatic Design Basis of 1,600 psi at 73°F and 800 psi at 140°F. The PPI listing shall be in the name of the pipe manufacturer and testing and validation of samples of the pipe manufacturer's production pipe shall be based upon ASTM D2837 and PPI TR-3.
- d. The manufacturer's certification shall state that the pipe was manufacturer from one specific resin in compliance with these specifications. The certificate shall state the specific resin used and its source.
- e. Manufacturer shall further provide a sample piece of the product approximately 12" long in an outside diameter of choice to show the approximate color the manufacturer will provide.
- f. The materials used for the manufacture of polyethylene pipe and fittings shall meet the following nominal physical property requirements:

<u>Property</u>	<u>Specification</u>	<u>Units</u>	<u>Nominal Value</u>
Material Designation	PPI/ASTM	----	PE3408
Material Classification	ASTM D3350	----	III/C/5/P34
Cell Classification	ASTM D3350	----	345444E
Density	ASTM D1505	gm/cm <sup>3</sup>	0.950
Flow Rate	ASTM D1238(190/21.6)	gm/10 min.	8.5
Flexural Modulus	ASTM D790	psi	136,000
Tensile Strength @ Yield	ASTM D638	psi	3,500
ESCR	ASTM D1693	hours	F <sub>0</sub> >5,000
ESCR, Compressed ring	F1248	hours	F <sub>0</sub> >10,000
Hydrostatic Design Basis at 73°F	ASTM D2837	psi	1,600
Hardness	ASTM D2240	Shore "D"	66
Molecular Weight Category			Extra High
Tensile Strength @ Ultimate	ASTM D638	psi	5,000
Elongation	ASTM D638	percent	750 min.
Modulus of Elasticity	ASTM D638	psi	130,000
Linear Thermal Expansion Coefficient	ASTM D696	in/in-°F	1.1 X 10 <sup>-4</sup>
Thermal Conductivity	ASTM C177	Btu-in/ft-hr-°F	2.7
Brittleness Temperature	ASTM D746	°F	<-180

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Heat Fusion Cond. Psi @ °F 40 psi @ 500°F

U.V. stabilizer per manufacturer's recommendation shall be sufficient to provide for two years storage life.

Using the methods as specified in ASTM D2837 "*Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials*", the pipe compound has been hydrostatically tested for a minimum of 10,000 hours at 73°F. This stress rupture data resulted in a stress time regression curve that yields a Hydrostatic Design Basis of 1,600 psi when extrapolated out to the 100,000 hours intercept.

- g. HDPE pipe manufactured from materials meeting the specifications of this section shall have an Environmental Stress Crack Resistance of no failures in 10,000 hrs. (ESCR:  $F_0 > 10,000$ ) when tested in accordance with ASTM F1248.
- h. Unless shown otherwise on the Drawings, HDPE pipe shall have a Dimension Ratio (DR) of 11.0 and shall be capable of withstanding a working pressure of 160 psi. HDPE pipe in Georgia DOT right-of-way, the pipe shall have a Dimension Ratio (DR) of 9.0 and shall be capable of withstanding a working pressure of 200 psi.

### 2. Pipe and Fittings

- a. Pipe and fittings shall be manufactured from material meeting the requirements of Section 2.01 C.1 listed above.
- b. Pipe and fittings shall be pressure rated using the certified HDB data from Section 2.01 C.1b. HDB, data from 2.01 C.1c shall not be allowed for this purpose. If HDB data in accordance with 2.01 C.1b is not available, pipe and fittings will not be acceptable. Pipe shall have a pressure rating in accordance with the following formula:

$$P = (2S/DR-1) \times DF \quad \text{and}$$

P	=	internal pressure, psi
S	=	long term hydrostatic strength, psi (1600)
DR	=	Dimension Ratio = D/t
D	=	outside diameter, actual, inches
t	=	wall, minimum wall thickness, inches
DF	=	design factor (0.5 for water @ 73.4°F)

- c. Pipe supplied under this specification shall have a nominal IPS (Iron pipe Size) outside diameter unless otherwise specified. The Dimension Ratio

(DR) and pressure rating of the pipe at 73° shall match the following unless noted otherwise on the drawings:

DR 7.3 – 250 psi	DR 13.5 – 130 psi	DR 21 – 80 psi
DR 9 – 200 psi	DR 15.5 – 110 psi	DR 26 – 65 psi
DR 11 – 160 psi	DR 17 – 100 psi	DR 32.5 – 50 psi

- d. The pipe and fittings shall have product traceability. The manufacturer shall include a print line on the pipe. This shall notate the manufacturer's name, date of manufacture, the lot and supplier of raw material, plant location, and production shift. The ASTM standard shall also appear as ASTM F714 with the material designation as PE3408. Colors of printline shall meet the Utility Location and Coordination Council, "Uniform Color Code", set for water lines, per APWA/ULCC Standards Committee.
  - e. Both pipe and fittings shall carry the same pressure rating. All fittings shall be pressure rated to match the system piping to which they are joined. At the point of fusion, the outside diameter and minimum wall thickness specifications of ASTM F714 for the same size pipe. Fittings shall be manufactured by the manufacturer of the pipe. Ells, tees, and wyes shall be manufactured by mitered fabrication. For force mains or pressure rated fittings, all fittings shall be derated according to the manufacturers written specifications, and clearly labeled on the fitting as such. For water mains, either direct bury or insertion lining fitting as such. For water mains, either direct bury or insertion-lining fittings will be fully pressure rated. All fittings will have a quality control label as approved by the manufacturer.
  - f. The manufacturer shall have a written specification for all standard mitered fittings, which establishes Quality Control criteria and tolerances. The manufacturer may be required to demonstrate its ability to produce product required by this specification.
3. Joining
- a. Heat fusion joining systems: Pipe and fittings shall be thermal butt fusion, saddle fusion, or socket fusion according to manufacturer recommended procedures.
  - b. The manufacturer shall provide fusion training. The Contractor (actual installers) and the onsite joint inspector shall be trained by the

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- manufacturer or manufacturer's authorized representative.
- c. It will not be permitted to join unlike DR's to one another. Transition from unlike SDR's shall be accomplished by mechanical couplings capable of identical pressure ratings or machined polyethylene nipples where a thicker wall polyethylene has been matched to the companion pipe wall.
  - d. Mechanical joining systems: Polyethylene pipe and fittings shall be connected by means of a polyethylene flange adapter and backup ring. The polyethylene flange adapter will be of the same specifications as the GreenView except will be made from black platestock. This method is also approved to join to another piping system or valves. Mechanical compression couplings or full circle encasement clamps may be used depending on the test specification.
  - e. Mechanical couplings shall be installed in accordance with the mechanical coupling manufacturer's recommended procedures.
  - f. Equipment: The fusion equipment and operator shall be required to demonstrate successful field experience. Regarding fusion over 36" capability, the fusion unit shall be field tested for a period of five years and the fusion operator shall have pipe size experience of the same size pipe on this project for five years or longer.
4. Installation
- a. Pressure mains shall follow installation procedures approved by the project engineer.
5. Warranty
- a. The manufacturer shall provide evidence that their standard Terms and Conditions of Sales for warranty and guarantee have been one year from date of manufacture for a period of at least five years. It will not be permitted for a manufacturer to waive the date for the period of warranty and guarantee for this project to meet this specification. The one-year date of manufacture shall be covered under the standard Terms and Conditions of Sale.

**2.02 GATE VALVES (GV)**

- A. Smaller than 3-Inches in Diameter: Gate valves shall be bronze, heavy duty, rising stem, wedge type with screwed or union bonnet. Valve ends shall be threaded type. Valves shall have a minimum 200 psi working pressure for water (125 psi working pressure for steam). Valves shall be made in the U.S.A. Gate valves shall be equal to Crane No. 428 (threaded).
- B. 3-Inches through 24-Inches in Diameter: Valves shall meet or exceed ANSI/AWWA Resilient Seated Gate Valve Standard C-509 (or latest revision) and meet the following provisions:
1. The wedge shall be of ductile iron, fully encapsulated with EPDM rubber, including the glide path.
  2. The gland flange shall be of ductile iron for maximum.
  3. Two upper stem seal O-rings, one above the thrust collar and one below as well as a lower stem seal O-ring will be provided to assure the upper stem seals can be replaced with the valve under full working pressure. All seals between valve parts, such as body and bonnet, bonnet and bonnet cover, shall be flat gaskets or O-rings.
  4. The stem material shall be AISI 420 / ASTM A276 stainless steel and contain no lead.
  5. A (2) inch cast iron operation nut will be marked with an arrow indicating the direction of opening, which is left or counter-clockwise. A cast iron hand wheel, when specified, shall be used and marked in a similar fashion.
  6. The waterway in the seat area shall be smooth, unobstructed, and free of cavities. Tapping valves shall accommodate a full size shell cutter.
  7. When specified tapping valves 4" through 12" shall have a ring cast with the body on its flanged end to ensure proper alignment with suitable tapping sleeves. All other end configurations shall be specified as mechanical joint (MJ) or Class 125 Flange (FL).
  8. All valves shall be tested by hydrostatic pressure to the requirements AWWA C-509 specifications prior to shipment from the manufacturer. The design shall be such that compression-set of the rubber shall not affect the ability of the valve to seal when pressure is applied to either side of the gate. The sealing mechanism

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shall provide zero leakage at the water working pressure when installed with the line flow in either direction.

9. Where applicable, all valve coating and materials shall meet all NSF requirements.
10. All valves shall be covered by a Manufacturer's 10 year Limited Warranty from date of purchase by the end user.
11. Valve body, bonnet and gland shall be electrostatically applied, fusion bonded epoxy coated internally and externally with a minimum of 8 mils. The epoxy shall be non-toxic, impart no taste to the water and shall meet or exceed the requirements of the AWWA C-550 (or latest revision).
12. All bolts and washers shall be stainless steel.
13. All gate valves 3 through 24-inches shall be manufactured by American AVK or approved equal.

### **2.03 FIRE HYDRANTS (FH)**

- A. Rated working pressure shall be 250 psi, test pressure shall be 500 psi in both open and closed positions.
- B. The hydrant's upper and lower stem, as well as its break coupling and internal pins and clips shall be manufactured of stainless steel. All external below ground bolting shall also be manufactured of stainless steel.
- C. The 5-1/4" hydrant main valve shall be of the true compression type, opening against and closing with the pressure. It shall use EPDM seating material only. All working parts shall be removable without excavation.
- D. All hydrants shall be of the traffic breakaway type and allow 360-degree rotation to position the pumper nozzle in the desired direction after installation. In the event of a traffic accident, the hydrant barrel shall break away from the standpipe at a point above ground and in a manner which will prevent damage to the barrel and stem, precluding opening the valve, and permit rapid and inexpensive restoration without digging or cutting off the water. Undercut or breakaway bolts will not be permitted.
- E. The seat ring shall be bronze and threaded into bronze drain rings. The drain ring assembly shall be replaceable without removing the MJ shoe connection. All working parts, including the seat ring shall be removable through the top without disturbing the

barrel of the hydrant.

- F. The operating nut shall match those on the existing hydrants. Lubrication reservoir shall be cast as part of the bonnet, creating a watertight cavity without the use of gaskets. A zurk fitting shall be provided for installation of lubricant without disassembly of the bonnet section. The combination of two O-rings in the reservoir shall seal the cavity from contact with water. The reservoir shall be filled with NSF/FDA approved food grade grease at the manufacturer's facility.
- G. Operating nut shall be made of bronze with two anti-friction washers, one above and one below the thrust collar.
- H. The weather shield shall be provided to prevent dirt and corrosion from affecting the operating mechanism. It will be marked with an arrow indicating the direction of opening, which is left or counter clockwise.
- I. Hydrant bonnet, nozzle, standpipe, shoe sections and flanges shall be made of ductile iron. Nozzle caps, pumper caps and weather shields may be cast or ductile iron. Hydrants shall have two positive stops to prevent over travel of the operating rod, one on the upper stem (stop nut) and one on the main valve (bottom stop). The main valve shall not bottom out onto the shoe section.
- J. Operating nut shall match those on existing hydrants and be made of bronze with two anti-friction washers, one above and one below the thrust collar.
- K. The draining system shall be a sliding drain seal type. The drain mechanism shall be completely closed after no more than four (4) turns in the opening direction. The drain channel shall be 360 degrees with a minimum of two drain port outlets, bronze brushed on the exterior of the hydrant, using a bronze plug if required. The drain, if unplugged, shall momentarily force flush when opening the hydrant.
- L. All hydrants shall be covered by a manufacture's 10 year limited warranty from date of purchase by the end user.
- M. Hydrants will consist of (1) 4.5" NST pumper nozzle and (2) 2.5" NST hose nozzles. Each nozzle will be a bronze ¼ turn bayonet lug style, secured with a stainless steel set screw each equipped with cap and non-kinking chain.
- N. Hydrants shall be furnished with a mechanical joint connection to the spigot of the 6-inch hydrant lead.
- O. All hydrant sections shall have electrostatically applied, fusion bonded epoxy coating

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internally and externally. The coating shall meet or exceed the requirements of AWWA C-550 (or latest revision). The standpipe shall be bitumen coated and lined with bury line present below the break flange to indicate proper installation depth. Minimum depth of bury shall be 3.5 feet. Provide extension section where necessary for proper vertical installation and in accordance with manufacturer's recommendations.

- P. All outside surfaces of the barrel above grade shall be painted white with enamel equal to KopCoat Glamortex 501.
- Q. Hydrants shall be listed by Underwriters Laboratory and approved by Factory Mutual for fire line service.
- R. All fire hydrants shall be Model 2780 as manufactured by American AVK or approved equal.

### **2.04 VALVE BOXES (VB) AND EXTENSION STEMS**

- A. All valves shall be equipped with valve boxes. The valve boxes shall be cast iron two-piece screw type with drop covers. Valve boxes shall have a 5.25-inch inside diameter. Valve box covers shall weigh a minimum of 13 pounds. The valve boxes shall be adjustable to 6-inches up or down from the nominal required cover over the pipe. Valve boxes shall be of sufficient length that bottom flange of the lower belled portion of the box is below the valve-operating nut. Ductile or cast iron extensions shall be provided as necessary. Covers shall have "WATER VALVE" or "WATER" cast into them. Valve boxes shall be manufactured in the United States and shall be equal to U.S. Foundry No. 7500-screw type.
- B. Extension stems shall be provided so as to set the top of the operating nut 30-inches below finished grade. Connection to the valve shall be with a wrench nut coupling and a setscrew to secure the coupling to the valve's operating nut. The coupling and square wrench nut shall be welded to the extension stem. Extension stems shall be equal to Mueller A-26441 or M & H Valve Style 3801.

### **2.05 TAPPING SLEEVES AND VALVES (TS&V)**

Tapping sleeves shall be cast or ductile iron of the split-sleeve, mechanical joint type. The Contractor shall be responsible for determining the outside diameter of the pipe to be connected to prior to ordering the sleeve. Valves shall be gate valves furnished in accordance with the specifications shown above, with flanged connection to the tapping sleeve and mechanical joint connection to the branch pipe. Tapping sleeves shall be equal to Ford FTS or approved equal.

**2.06 VALVE MARKERS**

The Contractor shall provide a concrete valve marker with brass plate as detailed on the Drawings for each valve installed. Valve markers shall be stamped "WATER". Contractor shall provide raised pavement markers that meet the specifications and requirements set forth in the most current edition of the State of Georgia Department of Transportation "Standard Specifications for the Construction of Roads and Bridges", Section 654. RPM shall be installed as specified in Part 3 of this Section.

**2.07 CORPORATION COCKS AND CURB STOPS**

Corporation cocks and curb stops shall be ground key type, shall be made of bronze conforming to ASTM B 61 or B 62, and shall be suitable for the working pressure of the system. Ends shall be suitable for grip type joint. Threaded ends for inlet and outlet of corporation cocks shall conform to AWWA C800; coupling nut for connection to flared copper tubing shall conform to ANSI B16.26. Corporation cocks and curb stops shall be manufactured by Mueller or Ford.

**2.08 BACKFLOW PREVENTION**

All backflow prevention devices shall be of a reduced pressure zone type and equipped with replaceable bronze seats and gate valves with levers and/or hand wheels. For 1-inch and smaller, backflow prevention devices shall be equal to a Ford Model 1024. For larger backflow prevention devices, provide a Watts Series 909 or approved equal. Additional options may be required by the County on a case by case basis.

**2.09 RETAINER GLANDS**

- A. Retainer glands for ductile iron pipe shall be Megalug Series 1100, as manufactured by EBAA Iron Sales, Inc.
- B. Retainer glands for polyvinyl chloride pipe shall be Megalug Series 2000 PV, as manufactured by EBAA Iron Sales, Inc.

**2.10 HYDRANT TEES**

Hydrant tees shall be equal to ACIPCO A10180 or U.S. Pipe U-592.

**2.11 ANCHOR COUPLINGS**

Lengths and sizes shall be as shown on the Drawings. Anchor couplings shall be equal

## **WATER MAINS AND ACCESSORIES**

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to ACIPCO A 10895 or U.S. Pipe U-591.

### **2.12 CONCRETE**

Concrete shall have a compressive strength of not less than 3000 psi, with not less than 5.5 bags of cement per cubic yard and a slump between 3 and 5-inches. For job mixed concrete, submit the concrete mix design for approval by the County. Ready-mixed concrete shall be mixed and transported in accordance with ASTM C 94. Reinforcing steel shall conform to the requirements of ASTM A 615, Grade 60.

### **2.13 DETECTION TAPE & WIRE**

Detection tape shall be composed of a solid aluminum foil encased in a protective plastic jacket. Tapes shall be color coded in accordance with APWA color codes with the following legends: Water Systems, Safety Precaution Blue, "Caution: Water Line Buried Below". Colors may be solid or striped. Tape shall be permanently printed with no surface printing allowed. Tape width shall be minimum 2-inches when buried less than 10-inches below the surface. Tape width shall be minimum 3-inches when buried greater than 10-inches and less than 20-inches. Detection tape shall be equal to Lineguard Type III Detectable or Allen Systems Detectatape Wire. In addition, prior to backfill of trench the Contractor shall furnish and install 14 gauge coated copy wire. The wire shall be installed along the pipe during the backfill operation. Wire shall be brought up at each valve.

## **PART 3 EXECUTION**

### **3.01 LOCATION AND GRADE**

- A. The Drawings show the alignment of the water main and the location of valves, hydrants and other appurtenances. Water mains shall be constructed at a depth as specified in Section 02225, Article 3.01, Paragraph D.
- B. After the Contractor locates and marks the water main centerline or baseline, the Contractor shall perform clearing and grubbing.
- C. Construction shall begin at a connection location and proceed without interruption. Multiple construction sites shall not be permitted without written authorization from the County for each site.

### **3.02 LAYING AND JOINTING PIPE AND ACCESSORIES**

- A. Lay all pipe and fittings to accurately conform to the lines and grades established by the

engineering plans.

**B. Pipe Installation**

1. Proper implements, tools and facilities shall be provided for the safe performance of the Work. All pipe, fittings, valves and hydrants shall be lowered carefully into the trench by means of slings, ropes or other suitable tools or equipment in such a manner as to prevent damage to water main materials and protective coatings and linings. Under no circumstances shall water main materials be dropped or dumped into the trench.
2. All pipe, fittings, valves, hydrants and other appurtenances shall be examined carefully for damage and other defects immediately before installation. Defective materials shall be marked and held for inspection by the County, who may prescribe corrective repairs or reject the materials.
3. All lumps, blisters and excess coating shall be removed from the socket and plain ends of each pipe, and the outside of the plain end and the inside of the bell shall be wiped clean and dry and free from dirt, sand, grit or any foreign materials before the pipe is laid. No pipe containing dirt shall be laid.
4. Foreign material shall be prevented from entering the pipe while it is being placed in the trench. No debris, tools, clothing or other materials shall be placed in the pipe at any time.
5. As each length of pipe is placed in the trench, the joint shall be assembled and the pipe brought to correct line and grade. The pipe shall be secured in place with approved backfill material.
6. It is not mandatory to lay pipe with the bells facing the direction in which work is progressing.
7. Applying pressure to the top of the pipe, such as with a backhoe bucket, to lower the pipe to the proper elevation or grade, shall not be permitted.

**C. Alignment and Gradient**

1. Lay pipe straight in alignment and gradient or follow true curves as nearly as practicable. Do not deflect any joint more than the maximum deflection recommended by the manufacturer.
2. Maintain a transit, level and accessories on the job to lay out angles and ensure that deflection allowances are not exceeded.

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- D. Expediting of Work: Excavate, lay the pipe, and backfill as closely together as possible. Do not leave unjointed pipe in the trench overnight. Backfill and compact the trench as soon as possible after laying and jointing is completed. Cover the exposed end of the installed pipe each day at the close of work and at all other times when work is not in progress. If necessary to backfill over the end of an uncompleted pipe or accessory, close the end with a suitable plug, either push-on, mechanical joint, restrained joint or as approved by the County.
- E. Joint Assembly
1. Push-on, mechanical, flange and restrained type joints shall be assembled in accordance with the manufacturer's recommendations.
  2. The Contractor shall inspect each pipe joint within 500 feet on either side of main line valves to insure 100 percent seating of the pipe spigot, except as noted otherwise.
  3. Each restrained joint shall be inspected by the Contractor to ensure that it has been "homed" 100 percent.
- F. Cutting Pipe: Cut ductile iron pipe using an abrasive wheel saw. Cut PVC pipe using a suitable saw; remove all burrs and smooth the end before jointing. The Contractor shall cut the pipe and bevel the end, as necessary, to provide the correct length of pipe necessary for installing the fittings, valves, accessories and closure pieces in the correct location. Only push-on or mechanical joint pipe shall be cut.
- G. Polyethylene Encasement: Installation shall be in accordance with AWWA C105 and the manufacturer's instructions. All ends shall be securely closed with tape and all damaged areas shall be completely repaired to the satisfaction of the County. Installation shall be at locations shown on the Drawings.
- H. Valve and Fitting Installation
1. Prior to installation, valves shall be inspected for direction of opening, number of turns to open, freedom of operation, tightness of pressure-containing bolting and test plugs, cleanliness of valve ports and especially seating surfaces, handling damage and cracks. Defective valves shall be corrected or held for inspection by the County. Valves shall be closed before being installed.
  2. Valves, fittings, plugs and caps shall be set and joined to the pipe in the manner specified in this Section for cleaning, laying and joining pipe, except that 12-inch

and larger valves shall be provided with special support, such as treated timbers, crushed stone, concrete pads or a sufficiently tamped trench bottom so that the pipe will not be required to support the weight of the valve. Valves shall be installed in the closed position.

3. A valve box shall be provided on each underground valve. They shall be carefully set, centered exactly over the operating nut and truly plumbed. The valve box shall not transmit shock or stress to the valve. The bottom flange of the lower belled portion of the box shall be placed below the valve operating nut. This flange shall be set on brick, so arranged that the weight of the valve box and superimposed loads will bear on the base and not on the valve or pipe. Extension stems shall be installed where depth of bury places the operating nut in excess of 60-inches beneath finished grade so as to set the top of the operating nut 30-inches below finished grade. The valve box cover shall be flush with the surface of the finished area or such other level as directed by the County.
4. In no case shall valves be used to bring misaligned pipe into alignment during installation. Pipe shall be supported in such a manner as to prevent stress on the valve.
5. A valve marker shall be provided for each underground valve. Unless otherwise detailed on the Drawings or directed by the County, valve markers shall be installed 6-inches inside the right-of-way or easement. Raised pavement markers (RPM's) shall be provided and installed along the appropriate roadway centerline for each in-line valve on County owned right-of-way. RPM's for in-line valves shall be Type I, two-way, and white in color.

#### I. Hydrant Installation

1. After staking the location of hydrants, Contractor shall contact County for final approval of hydrant location regardless of location shown on construction drawings.
2. Prior to installation, inspect all hydrants for direction of opening, nozzle threading, operating nut and cap nut dimensions, tightness of pressure-containing bolting, cleanliness of inlet elbow, handling damage and cracks. Defective hydrants shall be corrected or held for inspection by the County.
3. All hydrants shall stand plumb and shall have their nozzles parallel with or at right angles to the roadway, with pumper nozzle facing the roadway, except that hydrants having two-hose nozzles 90 degrees apart shall be set with each nozzle facing the roadway at an angle of 45 degrees.

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4. Hydrants shall be set to the established grade, with the centerline of the lowest nozzle at least 18-inches above the ground, no more than 30-inches above the ground or as directed by the County.
5. Each hydrant shall be connected to the main with a 6-inch branch controlled by an independent 6-inch valve. When a hydrant is set in soil that is pervious, drainage shall be provided at the base of the hydrant by placing coarse gravel or crushed stone mixed with coarse sand from the bottom of the trench to at least 6-inches above the drain port opening in the hydrant to a distance of 18-inches around the elbow.
6. When a hydrant is set in clay or other impervious soil, a drainage pit 2 x 2 x 2 feet shall be excavated below each hydrant and filled with coarse gravel or crushed stone mixed with coarse sand under and around the elbow of the hydrant and to a level of 6-inches above the drain port.
7. Hydrants shall be located as shown on the Drawings or as directed by the County. In the case of hydrants that are intended to fail at the ground-line joint upon vehicle impact, specific care must be taken to provide adequate soil resistance to avoid transmitting shock moment to the lower barrel and inlet connection. In loose or poor load bearing soil, this may be accomplished by pouring a concrete collar approximately 6-inches thick to a diameter of 24-inches at or near the ground line around the hydrant barrel.
8. Raised pavement markers (RPM's) shall be provided and installed along the appropriate roadway centerline for each fire hydrant on County owned right-of-way. RPM's for in-line valves shall be Type I, two-way, and blue in color.

### 3.03 CONNECTIONS TO WATER MAINS

- A. Make connections to existing pipe lines with tapping sleeves and valves, unless specifically shown otherwise on the Drawings.
- B. Location: Before laying pipe, locate the points of connection to existing water mains and uncover as necessary for the County to confirm the nature of the connection to be made.
- C. Interruption of Services: Make connections to existing water mains only when system operations permit. Operate existing valves only with the specific authorization and direct supervision of the County.

- D. Tapping Saddles and Tapping Sleeves
1. Holes in the new pipe shall be machine cut, either in the field or at the factory. No torch cutting of holes shall be permitted.
  2. Prior to attaching the saddle or sleeve, the pipe shall be thoroughly cleaned, utilizing a brush and rag, as required.
  3. Before performing field machine cut, the water tightness of the saddle or sleeve assembly shall be pressure tested. The interior of the assembly shall be filled with water. An air compressor shall be attached, which will induce a test pressure as specified in this Section. No leakage shall be permitted for a period of five minutes.
1. After attaching the saddle or sleeve to an existing main, but prior to making the tap, the interior of the assembly shall be disinfected. All surfaces to be exposed to potable water shall be swabbed or sprayed with a one percent hypochlorite solution.
- E. Connections and Repairs: Where connections or repairs are required, Contractor shall only use solid sleeves and provide all materials and labor necessary to make the connection or repair to the existing pipeline, excluding service lines 2" or smaller.

### **3.04 THRUST RESTRAINT**

- A. Provide restraint at all points where hydraulic thrust may develop.
- B. Retainer Glands: Provide retainer glands where shown on the Drawings and on fire hydrants and all associated fittings, valves and related piping. Retainer glands shall be installed in accordance with the manufacturer's recommendations, particularly, the required torque of the set screws. The Contractor shall furnish a torque wrench to verify the torque on all set screws which do not have inherent torque indicators.
- C. Harnessing
1. Provide harness rods only where specifically shown on the Drawings or directed by the County.
  2. Harness rods shall be manufactured in accordance with ASTM A 36 and shall have an allowable tensile stress of no less than 22,000 psi. Harness rods shall be hot dip galvanized or field coated with bitumastic before backfilling.
  3. Where possible, harness rods shall be installed through the mechanical joint bolt

## **WATER MAINS AND ACCESSORIES**

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holes. Where it is not possible, provide 90 degree bend eye bolts.

4. Eye bolts shall be of the same diameter as specified in AWWA C111 for that pipe size. The eye shall be welded closed. Where eye bolts are used in conjunction with harness rods, an appropriate size washer shall be utilized with a nut on each end of the harness rod. Eye bolts shall be of the same material and coating as the harness rods.
- D. Hydrants: Hydrants shall be attached to the water main as shown on the Standard Detail.
- E. Thrust Collars: Collars shall be constructed as shown on the Drawings. Concrete and reinforcing steel shall meet the requirements as specified in this Section. The welded-on collar shall be designed to meet the minimum allowable load shown on the Drawings. The welded-on collar shall be attached to the pipe by the pipe manufacturer.
- F. Concrete Blocking
1. Provide concrete blocking for all bends, tees, valves, and other points where thrust may develop, except where other exclusive means of thrust restraint are specifically shown on the Drawings.
  2. Concrete shall be as specified in this Section.
  3. Form and pour concrete blocking at fittings as shown on the Drawings and as directed by the County. Pour blocking against undisturbed earth. Increase dimensions when required by over excavation.

### **3.05 DETECTION TAPE & WIRE**

Provide detection tape and wire for all water mains.

### **3.06 INSPECTION AND TESTING - PRESSURE AND LEAKAGE TESTING**

- A. All sections of the water main subject to internal pressure shall be pressure tested in accordance with AWWA C600. A section of main will be considered ready for testing after completion of all thrust restraint and backfilling.
- B. Each segment of water main between main valves shall be tested individually.
- C. Test Preparation

## WATER MAINS AND ACCESSORIES

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1. Flush sections thoroughly at flow velocities, greater than 2.5 feet per second, adequate to remove debris from pipe and valve seats.
  2. Partially operate valves and hydrants to clean out seats.
  3. Provide temporary blocking, bulkheads, flanges and plugs as necessary, to assure all new pipe, valves and appurtenances will be pressure tested.
  4. Before applying test pressure, air shall be completely expelled from the pipeline and all appurtenances. Insert corporation cocks at highpoints to expel air as main is filled with water as necessary to supplement automatic air valves. Corporation stops shall be constructed as detailed on the Drawings with a meter box.
  5. Fill pipeline slowly with water. Provide a suitable pump with an accurate water meter to pump the line to the specified pressure.
  6. The differential pressure across a valve or hydrant shall equal the maximum possible, but not exceed the rated working pressure. Where necessary, provide temporary backpressure to meet the differential pressure restrictions.
  7. Valves shall not be operated in either the opening or closing direction at differential pressures above the rated pressure.
- D. Test Pressure: Test the pipeline at 150 psi or 1.5 times the operating pressure, whichever is greater, measured at the lowest point for at least two hours. Maintain the test pressure within 5 psi of the specified test pressure for the test duration. Should the pressure drop more than 5 psi at any time during the test period, the pressure shall be restored to the specified test pressure. Provide an accurate pressure gauge with graduation not greater than 5 psi.
- E. Leakage
1. Leakage shall be defined as the sum of the quantity of water that must be pumped into the test section, to maintain pressure within 5 psi of the specified test pressure for the test duration. Leakage shall be the total cumulative amount measured on a water meter.
  2. The County assumes no responsibility for leakage occurring through existing valves.
- F. Test Results: No test section shall be accepted if the leakage exceeds the limits

## WATER MAINS AND ACCESSORIES

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determined by the following formula:

$$L = \frac{SD(P)^{1/2}}{133,200}$$

Where: L = allowable leakage, in gallons per hour  
S = length of pipe tested, in feet  
D = nominal diameter of the pipe, in inches

P = average test pressure during the leakage test, in pounds per square inch (gauge)

As determined under Section 4 of AWWA C600.

If the water main section being tested contains lengths of various pipe diameters, the allowable leakage shall be the sum of the computed leakage for each diameter. The leakage test shall be repeated until the test section is accepted. All visible leaks shall be repaired regardless of leakage test results.

- G. Completion: After a pipeline section has been accepted, relieve test pressure. Record type, size and location of all outlets on record drawings.
- H. Re-Testing: Any alterations made to pipeline performed after initial testing shall be re-tested and passed again, regardless of initial test results.
- I. Notification: Lowndes County shall be notified 24-hours in advance prior to Contractor performing pressure and leakage testing.

### 3.07 DISINFECTING PIPELINE

- A. After successfully pressure testing each pipeline section, disinfect in accordance with AWWA C651 for the continuous-feed method and these Specifications.
- B. Specialty Contractor: Disinfection shall be performed by an approved specialty contractor. Before disinfection is performed, the Contractor shall submit a written procedure for approval before being permitted to proceed with the disinfection. This plan shall also include the steps to be taken for the neutralization of the chlorinated water.
- C. Chlorination
  - 1. Apply chlorine solution to achieve a concentration of at least 25 milligrams per

liter free chlorine in new line. Retain chlorinated water for 24 hours.

2. Chlorine concentration shall be recorded at every outlet along the line at the beginning and end of the 24 hour period.
  3. After 24 hours, all samples of water shall contain at least 10 milligrams per liter free chlorine. Re-chlorinate if required results are not obtained on all samples.
- D. Disposal of Chlorinated Water: Reduce chlorine residual of disinfection water to less than one milligram per liter if discharged directly to a body of water or to less than two milligrams per liter if discharged onto the ground prior to disposal. Treat water with sulfur dioxide or other reducing chemicals to neutralize chlorine residual. Flush all lines until residual is equal to existing system.
- E. Bacteriological Testing
1. After final flushing and before the water main is placed in service, the Contractor shall collect samples from the line and have tested for bacteriological quality in accordance with the rules of the Georgia Department of Natural Resources, Environmental Protection Division.
  2. The Contractor shall give the County 48-hour written notice of the planned bacteriological testing. A County representative must be present when samples are taken. The Contractor shall be responsible for delivering the samples to the laboratory for testing. The bacteriological samples shall be analyzed for both coliform and non-coliform growth. Testing shall be performed by a laboratory certified by the State of Georgia and approved by the County.
  3. All sampling and testing costs shall be paid for by the Contractor prior to final acceptance.
  4. Re-chlorinate lines until required results are obtained.

**END OF SECTION**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. The work covered by this Section includes furnishing all materials and equipment, providing all required labor and installing water service connections and all appurtenant work according to these Specifications and/or to the Water Connection Detail as shown schematically on the Drawings.
- B. Water meters are not to be furnished. However, the water meter connection must be compatible with the water meters currently used by the County.

**1.02 LOCATIONS**

Locations shall be directed by the County along the route of the water mains.

**1.03 SERVICE COMPATIBILITY**

It is the intent of these Specifications that the water service connections shall duplicate those presently being provided by the County in order to be compatible with their service maintenance procedures.

**1.04 QUALITY CONTROL**

All materials installed under this Section shall have the approval of the NSF for water services.

**PART 2 PRODUCTS**

**2.01 MATERIALS AND CONSTRUCTION**

- A. Pipe
  - 1. Services 1 ½ “ in diameter and larger:
    - a. PVC pipe with integral belled ends for push-on type jointing conforming to ASTM D 2241.
    - b. Unless shown otherwise on the Drawings, pipe shall have a Standard Dimension Ratio (SDR) of 26 and shall be capable of withstanding a working pressure of 160 psi, unless indicated otherwise on the Drawings.
    - c. Pipe shall be supplied in minimum lengths of 20 feet.

## WATER SERVICE CONNECTIONS

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2. Services 1" in diameter and smaller:
  - a. High molecular weight polyethylene tubing complying with ASTM D 2737, and AWWA C-901 for flexible pipe with SDR 9, CTS.
  - b. Provide black tubing with blue stripe.
3. Acceptance will be on the basis of the County's inspection and the manufacturer's written certification that the pipe was manufactured and tested in accordance with the applicable standards, including the National Sanitation Foundation. Additionally, each piece of pipe shall be stamped "NSF Approved".

### B. Meter Box

1. Meter boxes shall be plastic. Material shall meet or exceed the following:
  - a. Tensile Strength: 3,400 psi (ASTM D 638).
  - b. Flexural Modulus: 191,000 psi (ASTM D 790).
  - c. Impact Strength, Izod: 0.6-foot 16/inch (ASTM D 256).
  - d. Deflection Temperatures: 200 degrees F (ASTM D 648).
2. Plastic meter boxes shall be equal to Ametek, Plymouth Products Division or Brooks Products, Inc.
3. Meter box shall be fitted with cast iron cover.
4. Minimum dimensions shall be 10-3/4 x 16-inches top and 18-1/2 x 13-1/4-inches at bottom and 18-inches deep.

### C. Valves and Accessories

1. Valves: Gate valves shall be bronze, heavy duty, rising stem, wedge type with screwed or union bonnet. Valve ends shall be threaded or solder type as appropriate. Valves shall have a minimum 200 psi working pressure for water (125 psi working pressure for steam). Valves shall be made in the U.S.A. Gate valves shall be equal to Crane No. 428 (threaded) or Crane No. 1334 (solder end).
2. Corporation Cocks and Curb Stops
  - a. Corporation cocks and curb stops shall be ground key type, shall be made of bronze conforming to ASTM B 61 or B 62, and shall be suitable for the working pressure of the system. Ends shall be suitable for grip type joint. Threaded ends for inlet and outlet of corporation cocks shall conform to

AWWA C800; coupling nut for connection to flared copper tubing shall conform to ANSI B16.26.

- b. Corporation cocks and curb stops shall be manufactured by Mueller or Ford.

3. Service Clamps

- a. Clamp body shall be of epoxy coated ductile iron.
- b. The strap shall have a minimum width of 3-1/4-inches and shall be made of epoxy coated stainless steel.
- c. Service clamps shall be equal to Ford FC 202.

4. Backflow Preventers: County shall furnish and install a double check backflow preventer on single family residential service lines up to and including 1 inch (1"). Commercial, Industrial, Irrigation, and Residential customers requesting meters exceeding 1 inch (1") shall be furnished and installed by Contractor/Developer and be owned and maintained by Customer as required by the Uniform Plumbing Code (latest revision).

- a. Backflow preventers shall be rated for operation with inlet water pressures up to 175 psig and water temperatures up to 140-1/2 degrees F. Backflow preventers shall be tested and certified in accordance with ASSE 1013 and AWWA C506 and C511.
- b. Provide with bronze body construction, rubber check valve and relief valve assemblies, and Clecon check seats.
- c. Provide isolation valves on the inlet and outlet of each backflow preventer for maintenance. These valves shall be quarter turn, full port, resilient seated, bronze ball valves.
- d. Provide bronze ball body valve test cocks.
- e. Provide bronze body strainer on the inlet of each backflow preventer.
- f. Acceptable Manufacturers: Watts Series 909, or approved equal.

5. Meters: County shall furnish all meters 1-inch and greater shall be installed by Contractor/Developer.

D. Connections to Water Mains

## **WATER SERVICE CONNECTIONS**

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1. Connections to ductile iron pipe water mains shall be by the direct tap method or service clamp, as detailed on the Drawings in full accordance with AWWA requirements.
2. Connections to polyvinyl chloride pipe water mains shall be made using a full body service clamp.
3. Pressure ratings shall be as required for the installation.

### **E. Detection Tape & Tracer Wire**

Detection tape shall be composed of a solid aluminum foil encased in a protective plastic jacket. Tapes shall be color coded in accordance with APWA color codes with the following legends: Water Systems, Safety Precaution Blue, "Caution: Water Line Buried Below". Colors may be solid or striped. Tape shall be permanently printed with no surface printing allowed. Tape width shall be minimum 2-inches when buried less than 10-inches below the surface. Tape width shall be minimum 3-inches when buried greater than 10-inches and less than 20-inches. Detection tape shall be equal to Lineguard Type III Detectable or Allen Systems Detectatape. In addition, prior to backfill of trench the Contractor shall furnish and install 14 gauge coated copy wire. The wire shall be installed along the pipe during the backfill operation. Wire shall be brought up at each meter box.

## **PART 3 EXECUTION**

### **3.01 INSTALLATION**

#### **A. Water Service Connections**

1. Water service connections shall be installed to the properties adjacent to the water transmission mains both to the same side of the roadway (Short Side Service) and to the opposite side of the roadway (Long Side Service) as directed by the County.
2. Water service connections installed under roadway shall be pulled through a bored hole approximately equal in diameter to the external diameter of the service line. Casing will be required for pipes 2" and greater. Minimum cover under roadway shall be four feet. At other locations minimum cover shall be two feet.
3. Installation shall conform to the details for water service connections appearing schematically on the Drawings. Contractor shall provide any and all appurtenant work required to provide the intended water service connections.

**B. Permanent Water Services**

1. Each new service line shall be tapped into the main through a corporation stop, utilizing a service clamp, as detailed on the Drawings. A new service line shall be provided to the meter as shown on the Drawings.
2. A corporation cock shall be provided in the water main for each service line.
3. A curb stop shall be provided at each existing or future water meter location.
4. A service line, sized to match the existing line unless directed otherwise by the County, shall be provided between the corporation cock and curb stop.

**C. Transfer of Service:** Immediately before connecting to the relocated or existing meter, all service lines shall be flushed to remove any foreign matter. Any special fittings required to reconnect the existing meter to the new copper service line, or the existing private service line, shall be provided by the Contractor. To minimize out of service time, the Contractor shall determine the connections to be made and have all the required pipe and fittings on hand before shutting off the existing service. After completing the connection, the new corporation stop shall be opened and all visible leaks shall be repaired.

**D. Backflow preventers** shall be provided on all water services.

**E. Detection tape and wire** to be provided and installed on all water services.

**END OF SECTION**

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**PART 1 GENERAL**

**1.01 SCOPE**

- A. The work covered by this Section includes furnishing all materials and equipment, providing all required labor and installing water service to a wastewater pumping station and all appurtenant work according to these Specifications and/or to the Drawings.
- B. Water meters will be furnished. The water meter connection must be compatible with the water meters currently used by the County.

**1.02 LOCATIONS**

Locations shall be as shown on the Drawings.

**PART 2 PRODUCTS**

**2.01 MATERIALS AND CONSTRUCTION**

- A. Polyvinyl Chloride (PVC) Pipe and Fittings
  - 1. Pipe
    - a. All PVC pipe shall have integral belled ends for push-on type jointing and shall conform to ASTM D 2241.
    - b. Unless shown otherwise on the Drawings, pipe shall have a Standard Dimension Ratio (SDR) of 26 and shall be capable of withstanding a working pressure of 160 psi, unless indicated otherwise on the Drawings.
    - c. Pipe shall be supplied in minimum lengths of 20 feet.
  - 2. Acceptance will be on the basis of the County's inspection and the manufacturer's written certification that the pipe was manufactured and tested in accordance with the applicable standards, including the National Sanitation Foundation. Additionally, each piece of pipe shall be stamped "NSF Approved".
- B. Meter Box
  - 1. Meter boxes shall be plastic. Material shall meet or exceed the following:
    - a. Tensile Strength: 3,400 psi (ASTM D 638).
    - b. Flexural Modulus: 191,000 psi (ASTM D 790).

- c. Impact Strength, Izod: 0.6-feet 16/inch (ASTM D 256).
  - d. Deflection Temperatures: 200 degrees F (ASTM D 648).
2. Plastic meter boxes shall be equal to Ametek, Plymouth Products Division or Brooks Products, Inc.
  3. Meter box shall be fitted with cast iron cover.
  4. Minimum dimensions shall be 10-3/4 x 16-inches top and 18-1/2 x 13-1/4-inches at bottom and 18-inches deep.
- C. Valves: Gate valves shall be bronze, heavy duty, rising stem, wedge type with screwed or union bonnet. Valve ends shall be threaded or solder type as appropriate. Valves shall have a minimum 200 psi working pressure for water (125 psi working pressure for steam). Valves shall be made in the U.S.A. Gate valves shall be equal to Crane No. 428 (threaded) or Crane No. 1334 (solder end).
- D. Corporation Cocks and Curb Stops
1. Corporation cocks and curb stops shall be ground key type, shall be made of bronze conforming to ASTM B 61 or B 62, and shall be suitable for the working pressure of the system. Ends shall be suitable for grip type joint. Threaded ends for inlet and outlet of corporation cocks shall conform to AWWA C800; coupling nut for connection to flared copper tubing shall conform to ANSI B16.26.
  2. Corporation cocks and curb stops shall be manufactured by Mueller or Ford.
- E. Service Clamps
1. Clamp body shall be of epoxy coated ductile iron.
  2. The strap shall have a minimum width of 3-1/4-inches and shall be made of epoxy coated stainless steel.
  3. Service clamps shall be equal to Ford FC 202.
- F. Backflow Preventers, Reduced Pressure Zone Type (RPZ) (3/4 to 1-Inch Size)
1. Provide reduced pressure zone backflow preventers where noted on the Drawings. Backflow preventers shall be rated for operation with inlet water pressures up to 175 psig and water temperatures up to 140-1/2 degrees F. Backflow preventers shall be tested and certified in accordance with ASSE 1013 and AWWA C506

and C511.

2. Provide with bronze body construction, rubber check valve and relief valve assemblies, and Clecon check seats.
  3. Provide isolation valves on the inlet and outlet of each backflow preventer for maintenance. These valves shall be quarter turn, full port, resilient seated, bronze ball valves.
  4. Provide bronze ball body valve test cocks.
  5. Provide bronze body strainer on the inlet of each backflow preventer.
  6. Acceptable Manufacturers: Watts Series 909 or approved equal.
- G. Post Hydrants: Post hydrants shall be non-freeze design, bronze exposed head with aluminum casing guard and bronze casing. Minimum depth of bury shall be two feet. Post hydrants shall be equal to Zurn Z-1385.
- H. Detection Tape & Wire

Detection tape shall be composed of a solid aluminum foil encased in a protective plastic jacket. Tapes shall be color coded in accordance with APWA color codes with the following legends: Water Systems, Safety Precaution Blue, "Caution: Water Line Buried Below". Colors may be solid or striped. Tape shall be permanently printed with no surface printing allowed. Tape width shall be minimum 2-inches when buried less than 10-inches below the surface. Tape width shall be minimum 3-inches when buried greater than 10-inches and less than 20-inches. Detection tape shall be equal to Lineguard Type III Detectable or Allen Systems Detectatape.

## **PART 3 EXECUTION**

### **3.01 INSTALLATION**

- A. Connections to Water Mains
1. Connections to ductile iron pipe water mains shall be by the direct tap method or service clamp, as detailed on the Drawings in full accordance with AWWA requirements.
  2. Connections to polyvinyl chloride pipe water mains shall be made using a full

body service clamp.

3. Pressure ratings shall be as required for the installation.

B. Water Service Connections

1. Water service connections installed under roadway shall be pulled through a bored hole approximately equal in diameter to the external diameter of the service line. No casing will be required. Minimum cover under roadway shall be four feet. At other locations minimum cover shall be two feet.
2. Installation shall conform to the details for water service connections appearing schematically on the Drawings. Contractor shall provide any and all appurtenant work required to provide the intended water service connections.

C. Permanent Water Services

1. Each new service line shall be tapped into the main through a corporation stop, utilizing a service clamp, as detailed on the Drawings. A new service line shall be provided to the meter as shown on the Drawings.
2. A corporation cock shall be provided in the water main for each service line.
3. A curb stop shall be provided at each existing or future water meter location.

D. Backflow preventers shall be provided on all water services.

E. Detection tape and wire to be provided and installed for all service lines.

**END OF SECTION**

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**PART 1 GENERAL**

**1.01 SCOPE**

- A. This Section describes products to be incorporated into sewers and accessories and requirements for the installation and use of these items. Furnish all products and perform all labor necessary to fulfill the requirements of these Specifications.
- B. General: Supply all products and perform all work in accordance with applicable American Society for Testing and Material (ASTM), American Water Works Association (AWWA), American National Standards Institute (ANSI), or other recognized standards. Latest revisions of all standards are applicable.

**1.02 QUALIFICATIONS**

If requested by the County, submit evidence that manufacturers have consistently produced products of satisfactory quality and performance for a period of at least two years.

**1.03 SUBMITTALS**

Complete shop drawings, product data and engineering data, including shop drawings, shall be submitted to the County.

**1.04 TRANSPORTATION AND HANDLING**

- A. Unloading: Furnish equipment and facilities for unloading, handling, distributing and storing pipe, fittings, valves and accessories. Make equipment available at all times for use in unloading. Do not drop or dump materials. Any materials dropped or dumped will be subject to rejection without additional justification.
- B. Handling: Handle pipe, fittings, valves and accessories carefully to prevent shock or damage. Handle pipe by rolling on skids, forklift, or front loader. Do not use material damaged in handling.
- C. Lined pipe shall be handled and transported to prevent damage to linings.

**1.05 STORAGE AND PROTECTION**

- A. Store all pipe which cannot be distributed along the route. Make arrangements for the use of suitable storage areas.

## **SEWERS AND ACCESSORIES**

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- B. Stored materials shall be kept safe from damage. The interior of all pipe, fittings and other appurtenances shall be kept free from dirt or foreign matter at all times.
- C. Pipe shall not be stacked higher than the limits recommended by the manufacturer. The bottom tier shall be kept off the ground on timbers, rails or concrete. Pipe in tiers shall be alternated: bell, plain end; bell, plain end. At least two rows of timbers shall be placed between tiers and chocks, affixed to each other in order to prevent movement. The timbers shall be large enough to prevent contact between the pipe in adjacent tiers.
- D. Store joint gaskets in a cool location, out of direct sunlight. Gaskets shall not come in contact with petroleum products. Gaskets shall be used on a first-in, first-out basis.

### **1.06 QUALITY ASSURANCE**

- A. Product manufacturers shall provide the County with written certification that all products furnished comply with all applicable provisions of these Specifications.
- B. If ordered by the County, each pipe manufacturer shall furnish the services of a competent factory representative to supervise and/or inspect the installation of pipe. This service will be furnished for a minimum of five days during initial pipe installation.

### **1.07 RELATED SECTIONS**

- 1. Section 02200-Basic Pipeline Construction

## **PART 2 PRODUCTS**

### **2.01 DUCTILE IRON PIPE (DIP)**

- A. Ductile iron pipe shall be utilized where shown on the Drawings. All pipe, except specials, shall be furnished in nominal lengths of 18 to 20 feet, with a bituminous outside coating.
- B. Ductile iron pipe shall be manufactured in accordance with AWWA C151. All pipe, except specials, shall be furnished in nominal lengths of 18 to 20 feet. Sizes will be as shown on the Drawings. All pipe shall have a minimum pressure rating as indicated in the following table, and corresponding minimum wall thickness, unless otherwise specified or shown on the Drawings:

Pipe Sizes (inches)	Pressure Class (psi)
4 - 12	350
16 - 24	250

- C. Flexible Joint (Ball Joint) Pipe: Flexible, restrained joint pipe shall be minimum Thickness Class 56. Appropriate transition pieces shall be utilized on each end of run of flexible joint pipe.
- D. Fittings and Accessories
1. Fittings shall be ductile iron and shall conform to AWWA C110/ANSI A21.10 or AWWA C153/ANSI A21.53 with a minimum rated working pressure of 250 psi, and shall be furnished with a bituminous outside coating.
  2. Thrust Collars: Thrust collars shall be welded-on ductile iron body type capable of withstanding a thrust due to 250 psi internal pressure on a dead end from either direction on that pipe size. Weld-on collars shall be continuously welded to the pipe by the pipe manufacturer.
  3. Solid Sleeves: Solid sleeves shall permit the connection of plain end ductile iron pipe and plain end PVC pipe. Solid sleeves shall meet the requirements of ANSI/AWWA C110 for long pattern and have a minimum pressure rating of 250 psi. Solid sleeves shall have a mechanical or restrained joint as specified in this Section and as shown on the Drawings. Solid sleeves shall be provided with gaskets suitable for the type of pipe to be connected. Solid sleeves shall be used only in locations shown on the Drawings or at the direction of the County. Solid sleeves shall be manufactured by ACIPCO, U.S. Pipe or McWane (Clow).
- E. Joints for Ductile Iron Pipe and Fittings
1. General
    - a. Joints for ductile iron pipe and fittings shall be mechanical joint, flanged joint, ball joint, restrained joint, or push-on joint as shown on the Drawings or specified herein.
    - b. Unless otherwise shown on the Drawings, specified or directed, all ductile

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- iron pipe laid underground shall be joined using push-on type joints.
- c. In all cases, gaskets shall be made of material that will not be damaged by the fluid being transported nor by the environment in which the pipe is installed.
  - d. Provide the necessary bolts for connections. All bolts and nuts shall be threaded in accordance with ANSI B1.1, Coarse Thread Series, Class 2A external and 2B internal fit. All bolts and nuts shall be made in the U.S.A.
2. Mechanical Joints
- a. Joints shall conform to AWWA C111/ANSI A21.11.
  - b. Bolts and nuts shall be Tee Head Bolts and nuts of high strength low-alloy steel in accordance with ASTM A 242 to the dimensions shown in AWWA C111/ANSI A21.11.
  - c. Gaskets shall be in accordance with AWWA C111/ANSI A21.11 and shall be constructed of plain rubber.
  - d. Mechanical joint glands shall be ductile iron.
3. Push-On Joints: Push-on joints and gaskets shall conform to AWWA C111/ANSI A21.11. Details of the joint design shall be in accordance with the manufacturer's standard practice such as ACIPCO "Fastite", McWane (Clow) "Bell-Tite", or U.S. Pipe "Tyton" joints.
4. Flanged Joints
- a. Flanged joints shall conform to AWWA C115/ANSI A21.15. Flanges shall be ductile iron and shall be furnished by the pipe manufacturer.
  - b. Gaskets shall be made of 1/8-inch thick, cloth reinforced rubber. Gaskets may be ring type or full face type.
  - c. Flanged ductile iron pipe shall have flanges cast solidly or threaded to the pipe barrel. Pipe threads shall be of such length that with flanges screwed home, the end of the pipe shall project beyond the face line of the flange. Flange and pipe shall then be machined to give a flush finish to the pipe and the flange and surface shall be normal to the axis of the pipe. Ductile iron flanges shall be of such design that the flange neck completely covers the threaded portion of the pipe to protect same against corrosion. All pipe with threaded type flanges shall be assembled, faced, and drilled at the point of manufacture, unless otherwise approved by the County.
  - d. Flange filler shall conform to AWWA C110/ANSI A21.10. Joint bolt length shall be increased by the thickness of the flange filler.
  - e. Where tap or stud bolts are required, flanges shall be drilled and tapped

accordingly.

- f. Bolt length and diameter shall conform to ANSI/AWWA C115 for Class 125 flanges shown in ANSI/ASME B16.1.
- g. Bolts for exposed service shall be zinc plated, cold pressed, steel machine bolts conforming to ASTM A 307, Grade B. Nuts for exposed service shall be zinc plated, heavy hex conforming to ASTM A 563. Zinc plating shall conform to ASTM B 633, Type II.
- h. Bolts for submerged service shall be stainless steel machine bolts conforming to ASTM A 193, Grade B8. Nuts shall be heavy hex, stainless steel conforming to ASTM A 194, Grade 8.

5. Restrained Joints

- a. Restrained joints shall be ACIPCO "FLEX-RING" or "FAST-GRIP", or U.S. "TR-FLEX" or "FIELD LOK".
- b. Bolts and nuts shall be in accordance with the manufacturer's recommendations.
- c. Gaskets shall be in accordance with the manufacturer's recommendations.

F. Interior Lining: Ductile iron pipe and fittings shall be lined with polyethylene, polyurethane or epoxy, as specified below:

- 1. Linings shall cover all exposed surfaces of pipe and fittings subject to contact with sewer liquid or gas. The lining of the pipe barrel shall extend from spigot end through the socket to the edge of the gasket sealing area or recess for pipe using push-on gaskets, and to the edge of the gasket seat for mechanical joints. The lining shall also cover the exterior of the spigot end from the end of the pipe to beyond the gasket sealing area. The lining in fittings shall cover the interior surfaces including the socket areas as defined above. All linings shall be hermetically sealed at the ends.

2. Lining Materials

- a. Polyethylene lining material for pipe barrel shall conform to ASTM D 1248, compounded with an inert filler and with sufficient carbon black to resist ultraviolet rays during aboveground storage. The polyethylene shall be bonded to the interior of the pipe or fitting by heat. Lining material for exterior of spigot and interior of socket shall be equal to Roskote Mastic B-151 or Madewell 1104 Coal Tar Epoxy. Polyethylene lining system shall be ACIPCO Polybond or U.S. Pipe Polylined.
- b. Polyurethane lining material shall consist of a two-part polyurethane coating system conforming to ASTM D 16, Type V, consisting of a

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- polyisocyanate resin and a polyol resin. Polyurethane for pipe barrel and fittings shall be Corropipe II Wasteliner as manufactured by Madison Chemical Industries, Inc. Polyurethane lining material for exterior of spigot and interior of socket shall be equal to Corropipe 'S' as manufactured by Madison Chemical Industries, Inc. Polyurethane lining system shall be equal to U.S. Pipe Polythane.
- c. Epoxy: The lining material shall be Protecto 401 Ceramic Epoxy, a two component, modified epoxy formulated for corrosion control with the following minimum requirements:
- (1) A permeability rating of 0.0 perms when measured by ASTM E 96, Procedure A. Duration of test shall be six weeks.
  - (2) A direct impact resistance of 125 inch-pounds with no cracking when measured by ASTM D 2794.
  - (3) The ability to build at least 50 mils dry in one coat.
  - (4) The material shall be recoatable with itself for at least seven days with no additional surface preparation when exposed to direct summer sun and a temperature of 90 degrees F.
  - (5) The material shall contain at least 20 percent by volume of ceramic quartz pigment.
  - (6) A test and service history demonstrating the ability of the material to withstand the service expected.
  - (7) Possess a minimum solids volume content of 88 percent,  $\pm$  one percent.
  - (8) Possess a maximum drying time to allow recoating as follows: 50 degrees F - 72 hours; 75 degrees F - 18 hours; 90 degrees F - 8 hours. If recoating cannot be accomplished within seven days, a light brush blast shall be performed to improve intercoat adhesion.
3. All surfaces to be lined with polyethylene shall be blast cleaned equal to the requirements of SSPC-SP6. All surfaces to be lined with polyurethane shall be blast cleaned equal to the requirements of SSPC-SP10. All surfaces to be lined with epoxy shall be blasted and cleaned to remove all loose laitance, scale, or other loose material. No lining shall take place over grease, oil, etc., that would be detrimental to the adhesion of the compound to the substrate.
4. Application
- a. Lining of pipe barrel and fittings shall be 40 mils nominal thickness; minimum lining thickness shall be 30 mils. Lining thickness for exterior of spigot and interior of socket shall be 8 to 10 mils.
  - b. The lining shall be applied using a centrifugal lance applicator by applicators certified by the lining manufacturer. The workers shall be

experienced and competent in the surface preparation, application and inspection of the lining to be applied. The compound shall not be applied when the substrate temperature is below 40 degrees F or in adverse atmospheric conditions which will cause detrimental blistering, pinholing or porosity of the film.

5. All pipe and fitting linings shall be tested for pinholes in accordance with ASTM G 62, Method B and shall be holiday free.
  6. All pipe linings shall be checked for thickness using a magnetic film thickness gauge.
  7. Each pipe joint and fitting shall be marked with the date of application of the lining system and with the numerical sequence of application of that date.
- G. Polyethylene Encasement: Where shown on the Drawings, ductile iron pipe shall be encased with polyethylene film. Polyethylene film shall have a minimum thickness of 8 mils.

## 2.02 POLYVINYL CHLORIDE (PVC) GRAVITY SEWER PIPE

- A. Acceptability of PVC pipe for gravity sewers is indicated in the following table:

Standard Min Thick Type PVC <sup>1</sup>	Wall	Acceptable Manufacturers	≤ 6	8 to 15	18	21	24
ASTM D 3034 SDR 35 12454B	SW	Open	Yes	Yes	No	No	No
ASTM F-679	SW	Open	No	No	Yes	Yes	Yes
ASTM F 794 Series 46 12454C	OP	Ultra-Rib	No	No	No	No	Yes
ASTM F 794	CP	Vylon	Yes	No	No	No	Yes

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Series 46 12454C							
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<sup>1</sup> As specified in ASTM D 1784

SW Solid Wall  
OP Open Profile  
CP Closed Profile

Open shall mean any manufacturer whose products meet the specified standard is acceptable.

- B. All pipe shall have a minimum pipe stiffness of 46 psi at five percent deflection as determined by ASTM D 2412.
- C. PVC gravity sewer pipe shall be supplied in lengths not longer than 20 feet.
- D. Each length of pipe shall be marked with the manufacturer's name, trade name, nominal size, class, hydrostatic test pressure, manufacturer's standard symbol to signify it was tested, and date of manufacture. Each rubber ring shall be marked with the manufacturer's identification, the size, the year of manufacture, and the classes of pipe with which it can be used.
- E. Fittings 15 inches in diameter and less shall be manufactured in accordance with ASTM D 3034. PVC compound shall be 12454B or 12454C as specified in ASTM D 1784.
  - 1. For sizes 8-inches and less in diameter, fittings shall be molded in one-piece with no solvent welded joints. Minimum socket depths shall be as specified in ASTM D 3034, Table 2.
  - 2. For sizes 10-inches and larger in diameter, fittings shall be fabricated from pipe conforming to ASTM D 3034 using solvent welding. No field fabrication of fittings will be allowed. All such fabrication shall be performed at the factory and the fittings shall be delivered ready for use.
- F. Joints: Joints for pipe and fittings shall be of the integral bell and spigot type with a confined elastomeric gasket having the capability of absorbing expansion and contraction without leakage, when tested in accordance with ASTM D 3212. Gaskets shall meet the requirements of ASTM F 477. The joint system shall be subject to the approval of the County and shall be identical for pipe and fittings.

G. Manhole Connections

1. Solid Wall and Closed Profile Wall Pipe: The sewer shall be connected to manholes utilizing a standard pipe section.
2. Open Profile Wall Pipe: The sewer shall be connected to manholes with an adapter piece. The adapter piece shall have an open profile pipe bell and a solid wall pipe spigot for penetrating the manhole wall.

- H. Acceptance: Acceptance will be on the basis of the County's inspection and the manufacturer's written certification that the pipe and fittings were manufactured and tested in accordance with the applicable standards.

### 2.03 MANHOLES AND PRECAST CONCRETE PRODUCTS

- A. Provide manholes and other precast concrete products, including pumping station wetwell and valve vault, in accordance with the following:

1. Precast Concrete Sections

- a. Precast concrete sections shall meet the requirements of ASTM C 478. The minimum compressive strength of the concrete in precast sections shall be 4,000 psi.
- b. The minimum wall thickness shall be one-twelfth of the inside diameter of the base, riser or the largest cone diameter. Additionally, the wall thickness shall be sufficient for the proper installation of the rubber boots.
- c. Transition slabs which convert bases larger than four feet in diameter to four foot diameter risers shall be designed by the manhole manufacturer to carry the live and dead loads exerted on the slab.
- d. Seal joints between precast sections by means of rubber O-ring gaskets or flexible butyl rubber sealant. Butyl rubber sealants shall meet the requirements of AASHTO M-198. Sealant shall be pre-formed type with a minimum nominal diameter of 1-inch. Butyl rubber sealant shall be equal to Kent Seal No. 2 or Concrete Sealants CS202.
- e. Precast manhole bases, excluding pumping station wetwells and valve vaults, shall be provided with a minimum 8-inch wide extension.

2. Brick and Mortar: Brick shall be whole and hardburned, conforming to ASTM C 32 Grade MS. Mortar shall be made of one part Portland cement and two parts clean sharp sand. Cement shall be Type 1 and shall conform to ASTM C 150. Sand shall meet ASTM C 144.

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3. Iron Castings
  - a. Cast iron manhole frames and covers shall meet the requirements of ASTM A 48 for Class 30 gray iron and all applicable local standards. All castings shall be tough, close grained, smooth and free from blow holes, blisters, shrinkage, strains, cracks, cold shots and other imperfections. No casting will be accepted which weighs less than 95 percent of the design weight. Shop drawings must indicate the design weight and provide sufficient dimensions to permit checking. All castings shall be thoroughly cleaned in the shop and given two coats of approved bituminous paint before rusting begins.
  - b. Manhole frames and covers shall be as shown on the Standard Detail Drawings.
  - c. All frames and covers shall have machined horizontal bearing surfaces.
  - d. All manholes shall have standard frames and covers except where specifically shown otherwise on the Drawings.
4. Rubber Boots: Provide preformed rubber boots and fasteners equal to those manufactured by Kor-N-Seal or Press Seal Gasket Corporation.
5. Interior Lining
  - a. Precast concrete wetwells, valve vaults, drop manholes, receiving manholes and air release valve manholes shall be lined (interior) with Green Monster Lining as manufactured by GML Coatings, LLC of Sarasota, FL, or equal as approved by the County.
    - (1) Surface Preparation and Application: Plug the structure to control flow coming into the work area. Sand blast the entire substrate so that the surface is structurally intact and clean of all corrosion. Power wash at 4000 psi to rid the substrate of all dust and sand. Apply a cementitious concrete to all voids to coat the entire surface 0.5 inches to 1 inch thick. Completely dry the work area using indirect heat. Apply primer to the clean dry substrate providing maximum adhesion and waterproofing for the final coating. Spray apply final coating at 90-110 mil thickness.
  - b. Standard precast concrete manholes and valve vaults shall be lined (interior) with a coal tar epoxy equal to Carboline (Kop-Coat) Bitumastic 300M.
    - (1) Surface Preparation and Application: After the manhole has cured,

the equivalent of seven days at 77 degrees F, the interior of the manhole exposed to liquids and gases shall be blasted and cleaned to remove all loose laitance, form oil, or other loose material. After cleaning, the lining material shall be applied to yield 21 mils for the complete system using a centrifugal lance applicator. No lining shall take place over grease, oil, etc., that would be detrimental to the adhesion of the compound to the substrate. The compound shall not be applied when the substrate temperature is below 40 degrees F or in adverse atmospheric conditions which will cause detrimental blistering, pinholing or porosity of the film. In no case shall the lining be applied when the concrete surface is above 14 percent moisture content. The lining shall be applied by applicators certified by the lining manufacturer. The workers shall be experienced and competent in the surface preparation, application and inspection of the lining to be applied.

- (2) Inspection: All manholes shall be checked for thickness using a magnetic film thickness gauge on metal coupons attached to five percent of the manhole coated. All manholes shall be pinhole detected with a non-destructive 2,500 volt test. Each manhole section shall be marked with the date of application of the lining system and with its numerical sequence of application of that date.
- (3) Handling: Equipment used to handle and transport the lined manholes shall be suitably designed and operated not to damage the lining. Any damage which occurs shall be repaired prior to the installation of the manholes in accordance with the manufacturer's recommendations, so the repaired area is equal to the undamaged lining and coating in all respects.
- (4) Joints: All surfaces in the joint areas that are concrete and that are in contact with the sewer liquids and gases shall be prepared for coating and coated as specified for the manhole. Any area in the joint area that is not smooth shall be made so using a quick setting epoxy grout. Care shall be exercised so that all areas exposed to the sewer liquids and gases are coated.
- (5) Lining shall be applied at the point of manufacture of the manhole and precast concrete product.

## 6. Exterior Coating

- a. The exterior of manholes, wetwells and valve vaults shall be coated with a product as specified in Paragraph 5. above or with Farbertite, as manufactured by Briggs Bituminous Composition Company of Philadelphia, PA.

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- b. Surface preparation, application, inspection, handling and joints shall be as specified in Paragraph 5. above to yield 7 mils
  - c. Coating shall be applied at the point of manufacture of the manhole and precast concrete product.
7. Aluminum Floor Doors
- a. Door shall be a single or double leaf type as shown on the Drawings built to withstand 150 pounds per square foot.
  - b. The frame shall be 1/4-inch extruded aluminum with built-in neoprene cushion and with strap anchors bolted to the exterior. Door leaf shall be 1/4-inch aluminum diamond plate reinforced with aluminum stiffeners as required. Stainless steel hinges shall be bolted to the underside and pivot on torsion bars that counterbalance the door for easy operation. The door shall open to 90 degrees and lock automatically in that position. A vinyl grip handle shall be provided to release the cover for closing. Doors shall be equipped with a snap lock and removable handle. Bituminous coating shall be applied to the exterior of the frame by the manufacturer. All hardware shall be stainless steel.
  - c. Door shall be Type S1R (single door) or S2R (double door), manufactured by Halliday or Type E, manufactured by Washington Aluminum Company.
8. Sand-Cement Grout
- a. Column baseplates, pipe support baseplates, tanks and miscellaneous small items of equipment shall be grouted in place using a sand-cement grout consisting of one part Portland cement, two parts fine aggregate and a maximum of 4.5 gallons of water per sack (cubic foot) of cement. Portland cement shall be Type III conforming to ASTM C 150. Fine aggregate shall be natural siliceous sand, consisting of hard, clean, sharp, dense, durable and uncoated particles.
  - b. Fine aggregate shall be free from organic material and injurious amounts of deleterious substances and shall be graded as follows:

Sieve Size No.	Percent (by weight) Passing
4	100
8	95 - 100
16	60 - 100

30	35 - 70
50	15 - 35
100	2 - 15

- c. Except as modified herein, fine aggregate shall conform to the requirements of ASTM C 144.
  - d. Fine aggregate to be used with epoxy binders shall be dried prior to use to remove any free moisture.
9. Non-Shrink Grout: All pumps, compressors, motors and other heavy equipment items shall be grouted in place with a nonmetallic, noncorrosive, nongaseous, nonshrink grout requiring no cutback or protective coating. Nonshrink grout shall show zero shrinkage from the placement volume or initial expansion volume as determined by ASTM C 827, and shall have an initial set time at 70 degrees F of not less than 45 minutes as determined by ASTM C 191. When tested in accordance with ASTM C 109, nonshrink grout shall have a one-day compressive strength of not less than 2,000 psi and a 28-day compressive strength of not less than 9,000 psi at a flow of not less than 100 percent determined in accordance with Corps of Engineers Specification CRD-C-621. The grout shall contain no corrosive irons, calcium chloride, oxidizing catalysts, gas-forming agents, harmful aluminums or corrosive chemicals and shall be resistant to oil, water and sewage. The grout shall be premixed and shall require only the addition of water prior to placement. The grout shall be delivered to the job site in unopened, plastic-lined bags and shall have the manufacturer's mixing instructions printed on the back of each bag. Nonshrink grout shall be EUCO N-S Grout as manufactured by the Euclid Chemical Company, Masterflow 713 Grout as manufactured by Master Builders Company, or Upcon High Flow Grout as manufactured by UPCO Division of Emhart Chemical Company.

## 2.04 MISCELLANEOUS ACCESSORIES

### A. Flexible Adaptor Couplings

1. Couplings for pipe sizes 15-inches in diameter and less shall be elastomeric plastic sleeves designed to connect pipes of dissimilar materials. Adapters shall provide a positive seal against infiltration and exfiltration and remain leakproof and rootproof up to 4.3 psi. The adaptor manufacturer shall provide all stainless steel clamps and required accessories.
2. Couplings shall be products of Fernco and shall be installed in accordance with the manufacturer's recommendations.

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- B. Flexible Adaptor Donuts
1. Adaptor donuts shall be elastomeric polyvinyl chloride (PVC), compressible seals designed for sealing joints between sewer pipes of different sizes and/or dissimilar materials. Adaptors shall provide a positive seal against infiltration and exfiltration and remain leakproof and rootproof up to 4.3 psi.
  2. Donuts shall be products of Fernco and shall be installed in accordance with the manufacturer's recommendations.
- C. Detection Tape and Tracer Wire: Detection tape shall be composed of a solid aluminum foil encased in a protective plastic jacket. Tapes shall be color coded in accordance with APWA color codes with the following legends: Sanitary Sewerage Systems, Safety Green, "Caution: Sewer Line Buried Below". Colors may be solid or striped. Tape shall be permanently printed with no surface printing allowed. Tape width shall be minimum 2-inches when buried less than 10-inches below the surface. Tape width shall be minimum 3-inches when buried greater than 10-inches and less than 20-inches. Detection tape shall be equal to Lineguard Type III Detectable or Allen Systems Detectatape. In addition, prior to backfill of trench the Contractor shall furnish and install 14 gauge coated copy wire. The wire shall be installed along the pipe during the backfill operation. Wire shall be brought up at each manhole.
- D. Raised Pavement Markers: Raised pavement markers shall meet the specifications and requirements set forth in the most current edition of the State of Georgia Department of Transportation "Standard Specifications for the Construction of Roads and Bridges", Section 654.
- E. Backwater Valves: It is recommended that a backwater valve be placed on all service connections to prevent backflow or waste from street sewers. Backwater Valves to include elastomeric seal in quick action flapper to ensure a water tight seal, threaded access cap with neoprene seal for positive sealing as well as a valve hub to fit DWV pipe of which can be adapted for sewer and drain pipe.

## PART 3 EXECUTION

**3.01 LOCATION AND GRADE**

- A. The Drawings show the alignment and grade of the gravity sewer and the position of manholes and other appurtenances. The slope shown on the gravity sewer profile and/or called for in the Specifications is the slope of the invert of the pipe.
- B. After the Contractor locates and marks the manhole centerlines or baselines of the gravity sewer, the Contractor shall perform clearing and grubbing.

**3.02 LAYING AND JOINTING PIPE AND ACCESSORIES**

- A. Lay all pipe and fittings to accurately conform to the lines and grades established by the construction drawings.
- B. Pipe Installation
  - 1. Proper implements, tools and facilities shall be provided for the safe performance of the Work. All pipe, fittings and valves shall be lowered carefully into the trench by means of slings, ropes or other suitable tools or equipment in such a manner as to prevent damage to sewer materials and protective coatings and linings. Under no circumstances shall sewer materials be dropped or dumped into the trench.
  - 2. All pipe, fittings, valves and other appurtenances shall be examined carefully for damage and other defects immediately before installation. Defective materials shall be marked and held for inspection by the County, who may prescribe corrective repairs or reject the materials.
  - 3. All lumps, blisters and excess coating shall be removed from the socket and plain ends of each pipe, and the outside of the plain end and the inside of the bell shall be wiped clean and dry and free from dirt, sand, grit or any foreign materials before the pipe is laid. No pipe which contains dirt shall be laid.
  - 4. Foreign material shall be prevented from entering the pipe while it is being placed in the trench. No debris, tools, clothing or other materials shall be placed in the pipe at any time.
  - 5. As each length of pipe is placed in the trench, the joint shall be assembled and the pipe brought to correct line and grade. The pipe shall be secured in place with approved backfill material.
  - 6. It is common practice to lay pipe with the bells facing the direction in which work

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is progressing.

7. Applying pressure to the top of the pipe, such as with a backhoe bucket, to lower the pipe to the proper elevation or grade shall not be permitted.
8. Polyethylene Encasement: Installation shall be in accordance with AWWA C105 and the manufacturer's instructions. All ends shall be securely closed with tape and all damaged areas shall be completely repaired to the satisfaction of the County.

### C. Alignment and Gradient

1. Lay pipe straight in alignment and gradient or follow true curves, where shown on the Drawings, as nearly as practicable. Do not deflect any joint more than the maximum deflection recommended by the manufacturer.
2. Maintain a transit, level and accessories on the job to lay out angles and ensure that deflection allowances are not exceeded.
3. The Contractor shall check the invert elevation at each manhole and the gravity sewer invert elevation at least three times daily, start, mid-day and end of day. Elevations shall be checked more frequently if more than 100 feet of pipe is installed in a day or if the gravity sewer is being constructed at minimum slope.
4. The Contractor shall check the horizontal alignment of the gravity sewer at the same schedule as for invert elevations.

D. Expediting of Work: Excavate, lay the pipe, and backfill as closely together as possible. Do not leave unjointed pipe in the trench overnight. Backfill and compact the trench as soon as possible after laying and jointing is completed. Cover the exposed end of the installed pipe each day at the close of work and at all other times when work is not in progress. If necessary to backfill over the end of an uncompleted pipe or accessory, close the end with a suitable plug, either push-on, mechanical joint, restrained joint or as approved by the County.

E. Joint Assembly: Push-on, mechanical, flange and restrained type joints shall be assembled in accordance with the manufacturer's recommendations.

### F. Cutting Pipe

1. Cut ductile iron pipe using an abrasive wheel saw.

2. Cut PVC pipe using a suitable saw.
  3. Remove all burrs and smooth the end before jointing.
  4. The Contractor shall cut the pipe and bevel the end, as necessary, to provide the correct length of pipe necessary for installing the fittings, valves, accessories and closure pieces in the correct location. Only push-on or mechanical joint pipe shall be cut.
- G. House Connections: Install wyes or tees in locations designated by the County for future connection of service lines. Plug the branch of the wye or tee. Record the location of fittings installed on the Record Drawings.

### **3.03 CONNECTION TO AN EXISTING MANHOLE**

Connection to an existing manhole shall be made by mechanically coring into the wall structure of the manhole. Cored opening shall be sized to properly accommodate a rubber boot seal as specified in this section.

### **3.04 CONNECTION AND REPAIRS TO AN EXISTING SEWER MAIN**

Where connections or repairs are required, Contractor shall only use solid sleeves and provide all materials and labor necessary to make the connection or repair to the existing pipeline, excluding service lines 6" or smaller.

### **3.05 MANHOLE AND PRECAST CONCRETE PRODUCT CONSTRUCTION**

- A. Construct manholes as shown on the Standard Detail Drawings.
- B. Precast Concrete: Handle sections carefully to prevent cracking or chipping. Provide uniform bedding of the bottom section to prevent uneven loading. Install gaskets and joint sealants in accordance with manufacturer's recommendations to produce a watertight structure.
- C. Brick: Bed the bottom and sides of every brick in mortar. Apply a smooth coat of mortar, 3/4-inch thick, on the inside and outside.
- D. Inverts: Form channels as shown on the Drawings, rounded, and troweled smooth. Maintain consistent grade through the invert. Use sand-cement grout.
- E. Top Elevations: Build manholes outside of paved areas to 18-inches above finished grade unless otherwise shown on the Drawings or directed by the County. Build

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manholes in paved areas to existing grades.

- F. Drop Connections: Manholes requiring drop connections are shown on the Drawings. Construct drop connections of the same materials as the upstream sewer and in accordance with the details shown on the Drawings.
- G. Frames and Covers: Unless frame and cover is at grade, the frame shall be cast into the cone section.
- H. Seal all manhole joints and lift holes, both inside and out, with grout. Between precast sections, this is in addition to joint sealant.
- I. Invert Elevations: The invert elevations shown on the Drawings shall be for the invert at the centerline of the precast concrete manhole. Prior to setting the laser or other vertical alignment control system for the sewer upstream of the manhole, the Contractor shall verify the elevation of the sewer installed at the manhole.
- J. Manholes shall be constructed such that their walls are plumb.
- K. Floor doors shall be integrally cast into the top slab, and shall be cast into the concrete in accordance with the manufacturer's recommendations.

### **3.06 CONCRETE COLLARS**

Construct collars as shown on the Drawings.

### **3.07 DETECTION TAPE AND TRACER WIRE**

Detection tape and tracer wire shall be provided over all sewers constructed by the open cut method, except those lengths of sewers directly underneath paved surfaces of County-owned roadways.

### **3.08 RAISED PAVEMENT MARKERS**

Raised pavement markers (RPM's) shall be provided and installed along the appropriate roadway centerline for each manhole not located within paved surfaces. RPM's for manholes shall be Type I, two-way, and green in color.

### **3.09 INSPECTION AND TESTING**

- A. Clean and flush lines prior to testing. Clean and test lines before requesting final

acceptance. Where any obstruction is met, clean the sewers by means of rods, swabs, or other instruments. When requested by the County, flush out lines and manholes before final inspection.

B. Gravity Sewers: Pipe lines shall be straight and show a uniform grade between manholes. Correct any discrepancies discovered during inspection.

1. Infiltration Tests: Use only when groundwater is more than two feet above the top of the pipe.

a. Install suitable weirs in manholes selected by the County to determine the leakage of ground water into the sewer. The maximum length of line for each infiltration test shall be 5,000 feet. Measure leakage only when all visible leaks have been repaired and the ground water is two feet above the top of the pipe. If leakage in any section of the sewer line exceeds 100 gpd/inch diameter/mile, locate and repair leaks. Repair methods must be approved by the County. After repairs are completed, re-test for leakage.

b. Furnish, install, and remove the necessary weirs, plugs, and bulkheads required to perform the leakage tests. Where continuous monitoring of flow level is required, the County will provide and operate monitoring equipment.

2. Exfiltration Tests: Choose one of the following when groundwater is less than two feet above the top of the pipe.

a. Hydrostatic Test

(1) Test pipe between manholes with a minimum of 10 feet hydrostatic pressure, measured at the center of the pipe at the upstream manhole.

(2) The ends of the pipe in the test section shall be closed with suitable watertight bulkheads. Inserted into the top of each bulkhead shall be a 2-inch pipe nipple with an elbow. At the upper end of the test section, a 12-inch riser pipe shall be connected to the 2-inch nipple. The test section of pipe shall be filled through the pipe connection in the lower bulkhead which shall be fitted with a valve, until all air is exhausted and until water overflows the riser pipe at the upper end.

Water may be introduced into the pipe 24 hours prior to the test period to allow complete saturation. House service lines, if installed, shall also be fitted with suitable bulkheads having provisions for the release of air while the test section is being filled with water.

(3) During the test period, which shall extend over a period of two hours, water shall be introduced into the riser pipe from measured containers at such intervals as are necessary to maintain the water level at the top

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of the riser pipe. The total volume of water added during the test period shall not exceed that specified for infiltration.

b. Low-Pressure Air Test

- (1) Prior to air testing, the section of sewer between manholes shall be thoroughly cleaned and wetted. Immediately after cleaning or while the pipe is water soaked, the sewer shall be tested with low-pressure air. At the Contractor's option, sewers may be tested in lengths between manholes or in short sections (25 feet or less) using inflatable balls pulled through the line from manhole to manhole. Air shall be slowly supplied to the plugged sewer section until internal air pressure reaches approximately 4.0 psi. After this pressure is reached and the pressure allowed to stabilize (approximately two to five minutes), the pressure may be reduced to 3.5 psi before starting the test. If a 1.0 psi drop does not occur within the test time, then the line has passed the test. If the pressure drops more than 1.0 psi during the test time, the line is presumed to have failed the test, and the Contractor will be required to locate the failure, make necessary repairs, and retest the line. Minimum test time for various pipe sizes, in accordance with ASTM C 828 is as follows:

<b>Nominal Pipe Size, inches</b>	<b>T (Time Min/100 Feet)</b>
6	0.7
8	1.2
10	1.5
12	1.8
15	2.1
18	2.4
21	3.0
24	3.6

- (2) Required test equipment, including inflatable balls, braces, air hose, air source, timer, rotameter as applicable, cut-off valves, pressure reducing valve, 0-15 psi pressure gauge, 0-5 psi pressure gauge with gradations in 0.1 psi and accuracy of  $\pm$  two percent, shall be provided by the Contractor. Testing equipment shall be equal to Cherne Air-Loc Testing Systems.
- (3) The Contractor shall keep records of all tests made. Copy of such records will be given to the County. Such records shall show date, line number and stations, operator, and such other pertinent information as required by the County.
- (4) The Contractor is cautioned to observe proper safety precautions in performance of the air testing. It is imperative that plugs be properly secured and that care be exercised in their removal. Every precaution shall be taken to avoid the possibility of over-pressurizing the sewer line.

### 3. Deflection Test

- a. Test PVC gravity sewer for excessive deflection by passing a mandrel through the pipe. Deflection of the pipe shall not exceed the following:

Nominal Pipe Diameter	Maximum Allowable Deflection
$\leq$ 12-inches	5%
15 to 30-inches	4%
$>$ 30-inches	3%

- b. The mandrel size shall be based upon the maximum possible inside diameter for the type of pipe being tested, taking into account the allowable

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manufacturing tolerances of the pipe. The mandrel shall have an odd number of legs, or vanes, with a quantity of such equal to or greater than nine. The legs of the mandrel shall be permanently attached to the mandrel.

A mandrel with variable sizes shall not be allowed. The mandrel shall be constructed of steel aluminum or other material approved by the County, and shall have sufficient rigidity so the legs of the mandrel will not deform when pulling through a pipe. The mandrel dimensions shall be checked by the County before use by the Contractor.

- c. Excavate and install properly any section of pipe not passing this test. Re-test until results are satisfactory.
- d. This test shall be performed within the first 30 days of installation and during final inspection, at the completion of this contract.

3. Closed Circuit Television: If deemed necessary by the County, the interior of the gravity sewers shall be subjected to a televised inspection. Prior to Final Acceptance the County shall be provided with one copy of the TV inspection report and video cassette showing the entire length of gravity sewer being tested. The report shall contain the condition of pipe, type of pipe, depth, location of services, length, type joint, roundness, and distance between manholes. Any

pipe found to be cracked, leaking, misaligned, bellied or otherwise defective shall be removed and replaced.

- C. Manholes: Prior to testing manholes for watertightness, all liftholes shall be plugged with a non-shrink grout, all joints between precast sections shall be properly sealed and all pipe openings shall be temporarily plugged and properly braced. Each manhole shall pass one of the following tests:

1. Exfiltration Tests: The manhole, after proper preparation as noted above, shall be filled with water. The maximum allowable leakage shall be eight gallons per foot of depth per 24 hours for 48-inch diameter manholes. Tests shall last a minimum of eight hours. The manholes may be backfilled prior to testing.
2. Vacuum Tests: The manhole, after proper preparation as noted above, shall be vacuum tested prior to backfilling. The test head shall be placed at the inside of the top of the cone section and the compression head inflated to 40 psi to effect a seal between the vacuum base and the manhole structure. Connect the vacuum pump to the outlet port with the valve open. A vacuum of 10-inches of mercury shall be drawn and the vacuum pump shut off. With the valves closed, the time shall be measured for the vacuum to drop to 9-inches. The manhole shall pass if the time is greater than 60 seconds for 48-inch diameter manholes. If the manhole fails the initial test, necessary repairs shall be made with non-shrink grout while

the vacuum is still being drawn. Retesting shall proceed until a satisfactory test is obtained. Vacuum testing equipment shall be equal to that as manufactured by P.A. Glazier, Inc.

- D. Re-Testing: Any alterations made to pipeline or manholes performed after initial testing shall be re-tested and pass again, regardless of initial test results.
- E. Notification: Lowndes County shall be notified 24-hours in advance prior to Contractor performing any testing.

**END OF SECTION**

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**PART 1 GENERAL****1.01 SCOPE**

- A. This Section describes products to be incorporated into force mains, pressure sewers, pressure sewer services, gravity sewer services and individual pressure systems and accessories and requirements for the installation and use of these items. Furnish all products and perform all labor necessary to fulfill the requirements of these Specifications.
- B. General: Supply all products and perform all work in accordance with applicable American Society for Testing and Material (ASTM), American Water Works Association (AWWA), American National Standards Institute (ANSI), or other recognized standards. Latest revisions of all standards are applicable.

**1.02 QUALIFICATIONS**

If requested by the County, submit evidence that manufacturers have consistently produced products of satisfactory quality and performance for a period of at least two years.

**1.03 SUBMITTALS**

Complete shop drawings, product data and engineering data, including shop drawings, shall be submitted to the County.

**1.04 TRANSPORTATION AND HANDLING**

- A. Unloading: Furnish equipment and facilities for unloading, handling, distributing and storing pipe, fittings, valves and accessories. Make equipment available at all times for use in unloading. Do not drop or dump materials. Any materials dropped or dumped will be subject to rejection without additional justification.
- B. Handling: Handle pipe, fittings, valves and accessories carefully to prevent shock or damage. Handle pipe by rolling on skids, forklift, or front loader. Do not use material damaged in handling.
- C. Lined pipe shall be handled and transported to prevent damage to linings.

**1.05 STORAGE AND PROTECTION**

- A. Store all pipe which cannot be distributed along the route. Make arrangements for the

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use of suitable storage areas.

- B. Stored materials shall be kept safe from damage. The interior of all pipe, fittings and other appurtenances shall be kept free from dirt or foreign matter at all times. Valves shall be drained and stored in a manner that will protect them from damage by freezing.
- C. Pipe shall not be stacked higher than the limits recommended by the manufacturer. The bottom tier shall be kept off the ground on timbers, rails or concrete. Pipe in tiers shall be alternated: bell, plain end; bell, plain end. At least two rows of timbers shall be placed between tiers and chocks, affixed to each other in order to prevent movement. The timbers shall be large enough to prevent contact between the pipe in adjacent tiers.
- D. Store joint gaskets in a cool location, out of direct sunlight. Gaskets shall not come in contact with petroleum products. Gaskets shall be used on a first-in, first-out basis.

### **1.06 QUALITY ASSURANCE**

- A. Product manufacturers shall provide the County with written certification that all products furnished comply with all applicable provisions of these Specifications.
- B. If ordered by the County, each pipe manufacturer shall furnish the services of a competent factory representative to supervise and/or inspect the installation of pipe. This service will be furnished for a minimum of five days during initial pipe installation.

### **1.07 RELATED SECTIONS**

- 1. Section 02200-Basic Pipeline Construction.

## **PART 2 PRODUCTS**

### **2.01 DUCTILE IRON PIPE (DIP)**

- A. Ductile Iron Pipe (DIP)
  - 1. Ductile iron pipe shall be manufactured in accordance with AWWA C151. All pipe, except specials, shall be furnished in nominal lengths of 18 to 20 feet. Sizes will be as shown on the Drawings. All pipe shall have a minimum pressure rating as indicated in the following table, and corresponding minimum wall thickness, unless otherwise specified or shown on the Drawings:

Pipe Sizes (inches)	Pressure Class (psi)
4 - 12	350
16 - 24	250

B. Fittings and Accessories

1. Fittings shall be ductile iron and shall conform to AWWA C110/ANSI A21.10 or AWWA C153/ANSI A21.53 with a minimum rated working pressure of 250 psi.
2. Thrust Collars: Thrust collars shall be welded-on ductile iron body type capable of withstanding a thrust due to 250 psi internal pressure on a dead end from either direction on that pipe size. Weld-on collars shall be continuously welded to the pipe by the pipe manufacturer. Retainer glands may be used for thrust collars where shown on the Drawings and as specified in this Section.
3. Solid Sleeves: Solid sleeves shall permit the connection of plain end ductile iron pipe and plain end PVC pipe. Solid sleeves shall meet the requirements of ANSI/AWWA C110 for long pattern and have a minimum pressure rating of 250 psi. Solid sleeves shall have a mechanical or restrained joint as specified in this Section and as shown on the Drawings. Solid sleeves shall be provided with gaskets suitable for the type of pipe to be connected. Solid sleeves shall be used only in locations shown on the Drawings or at the direction of the County. Solid sleeves shall be manufactured by ACIPCO, U.S. Pipe or McWane (Clow).

C. Joints for Ductile Iron Pipe and Fittings

1. General
  - a. Joints for ductile iron pipe and fittings shall be mechanical joint, flanged joint, restrained joint, push-on joint or as shown on the Drawings or specified herein.
  - b. Unless otherwise shown on the Drawings, specified or directed, all ductile iron pipe laid underground shall be joined using push-on type joints. All fittings shall be mechanical joint.
  - c. In all cases, gaskets shall be made of material that will not be damaged by the fluid being transported nor by the environment in which the pipe is installed.
  - d. Provide the necessary bolts for connections. All bolts and nuts shall be

threaded in accordance with ANSI B1.1, Coarse Thread Series, Class 2A external and 2B internal fit. All bolts and nuts shall be made in the U.S.A.

2. Push-On Joints: Push-on joints and gaskets shall conform to AWWA C111/ANSI A21.11. Details of the joint design shall be in accordance with the manufacturer's standard practice such as ACIPCO "Fastite", McWane (Clow) "Bell-Tite", or U.S. Pipe "Tyton" joints.
  3. Restrained Joints
    - a. Restrained joints shall be ACIPCO "FLEX-RING" or "FAST-GRIP" or U.S. "TR-FLEX" or "FIELD LOK".
    - b. Bolts and nuts shall be in accordance with the manufacturer's recommendations.
    - c. Gaskets shall be in accordance with the manufacturer's recommendations.
- D. Interior Lining: Ductile iron pipe and fittings shall be lined with polyethylene, polyurethane or epoxy, as specified below:
1. Linings shall cover all exposed surfaces of pipe and fittings subject to contact with sewer liquid or gas. The lining of the pipe barrel shall extend from spigot end through the socket to the edge of the gasket sealing area or recess for pipe using push-on gaskets, and to the edge of the gasket seat for mechanical joints. The lining shall also cover the exterior of the spigot end from the end of the pipe to beyond the gasket sealing area. The lining in fittings shall cover the interior surfaces including the socket areas as defined above. All linings shall be hermetically sealed at the ends.
  2. Lining Materials
    - a. Polyethylene lining material for pipe barrel shall conform to ASTM D 1248, compounded with an inert filler and with sufficient carbon black to resist ultraviolet rays during aboveground storage. The polyethylene shall be bonded to the interior of the pipe or fitting by heat. Lining material for exterior of spigot and interior of socket shall be equal to Roskote Mastic B-151 or Madewell 1104 Coal Tar Epoxy. Polyethylene lining system shall be ACIPCO Polybond or U.S. Pipe Polylined.
    - b. Polyurethane lining material shall consist of a two-part polyurethane coating system conforming to ASTM D 16, Type V, consisting of a polyisocyanate resin and a polyol resin. Polyurethane for pipe barrel and fittings shall be Corropipe II Wasteliner as manufactured by Madison Chemical Industries, Inc. Polyurethane lining material for exterior of spigot

and interior of socket shall be equal to Corropipe 'S' as manufactured by Madison Chemical Industries, Inc. Polyurethane lining system shall be equal to U.S. Pipe Polythane.

- c. Epoxy: The lining material shall be Protecto 401 Ceramic Epoxy, a two component, modified epoxy formulated for corrosion control with the following minimum requirements:
  - (1) A permeability rating of 0.0 perms when measured by ASTM E 96, Procedure A. Duration of test shall be six weeks.
  - (2) A direct impact resistance of 125 inch-pounds with no cracking when measured by ASTM D 2794.
  - (3) The ability to build at least 50 mils dry in one coat.
  - (4) The material shall be recoatable with itself for at least seven days with no additional surface preparation when exposed to direct summer sun and a temperature of 90 degrees F.
  - (5) The material shall contain at least 20 percent by volume of ceramic quartz pigment.
  - (6) A test and service history demonstrating the ability of the material to withstand the service expected.
  - (7) Possess a minimum solids volume content of 88 percent,  $\pm$  one percent.
  - (8) Possess a maximum drying time to allow recoating as follows: 50 degrees F - 72 hours; 75 degrees F - 18 hours; 90 degrees F - 8 hours. If recoating cannot be accomplished within seven days, a light brush blast shall be performed to improve intercoat adhesion.
3. All surfaces to be lined with polyethylene shall be blast cleaned equal to the requirements of SSPC-SP6. All surfaces to be lined with polyurethane shall be blast cleaned equal to the requirements of SSPC-SP10. All surfaces to be lined with epoxy shall be blasted and cleaned to remove all loose laitance, scale, or other loose material. No lining shall take place over grease, oil, etc., that would be detrimental to the adhesion of the compound to the substrate.
4. Application
  - a. Lining of pipe barrel and fittings shall be 40 mils nominal thickness; minimum lining thickness shall be 30 mils. Lining thickness for exterior of spigot and interior of socket shall be 8 to 10 mils.
  - b. The lining shall be applied using a centrifugal lance applicator by applicators certified by the lining manufacturer. The workers shall be experienced and competent in the surface preparation, application and inspection of the lining to be applied. The compound shall not be applied when the substrate temperature is below 40 degrees F or in adverse

atmospheric conditions which will cause detrimental blistering, pinholing or porosity of the film.

5. All pipe and fitting linings shall be tested for pinholes in accordance with ASTM G 62, Method B and shall be holiday free.
  6. All pipe linings shall be checked for thickness using a magnetic film thickness gauge.
  7. Each pipe joint and fitting shall be marked with the date of application of the lining system and with the numerical sequence of application of that date.
- E. Polyethylene Encasement: Ductile iron pipe shall be encased with polyethylene film where shown on the Drawings. Polyethylene film shall have a minimum thickness of 8 mils.

## **2.02 POLYVINYL CHLORIDE (PVC) PIPE**

- A. 2-Inches in Diameter and Larger
1. Pipe: PVC pipe shall conform to ASTM D 2241. The pipe shall have a Standard Dimensional Rating (SDR) of 21. PVC pipe shall be the color green. PVC pressure pipe shall be supplied in 20 foot nominal lengths.
  2. Fittings
    - a. 4-Inches in Diameter and Greater: All fittings shall be of ductile iron meeting the requirements of AWWA C110/ANSI A21.10 or AWWA C153/ANSI A21.53 with a minimum rated working pressure of 250 psi. Fittings shall be cement lined in accordance with AWWA C104/ANSI A21.4. Fittings shall be mechanical joint. Fittings shall be furnished with a bituminous outside coating. Special adapters shall be provided, as recommended by the manufacturer, to adapt the PVC pipe to mechanical jointing with cast or ductile iron pipe, fittings or valves.
    - b. Less Than 4-Inches in Diameter: Fittings shall be of the same material, strength and dimension as the pipe to which it connects.
  3. Joints: Pipe and fittings 2-inches in diameter and greater shall have integral bell and spigot type joints with elastomeric gaskets having the capability of absorbing expansion and contraction without leakage. Joints shall meet the requirements of ASTM D 3139; gaskets shall meet the requirements of ASTM F 477. Joint

system shall be subject to the approval of the County.

4. Acceptance: Acceptance will be on the basis of the County's inspection and the manufacturer's written certification that the pipe was manufactured and tested in accordance with the applicable standards.

B. Less Than 2-Inches in Diameter

1. Pipe: Schedule 40 in accordance with ASTM D 1785.
2. Fittings: Solvent weld socket type, same schedule as piping, ASTM D 2466 or D 2467.
3. Solvent Cement: ASTM D 2564.

## 2.03 HIGH-DENSITY POLYETHYLENE PIPE

A. High Density Polyethylene Pipe (HDPE)

1. Polyethylene Piping Material
  - a. The pipe and fittings shall be made of High Density, Extra High Molecular Weight (EHMW) polyethylene with a standard thermoplastic material designation code of PE3408 and having a cell classification of 345444E per ASTM D3350. The molecular weight category shall be extra high (250,000 to 1,500,000) as per the Gel Permeation Chromatography determination procedure with a typical value of 300,000 to 330,000. The pipe shall be manufactured in accordance with ASTM F714 and/or ASTM D3035. The pipe shall meet the Utility Location and Coordination Council, "*Uniform Color Code*", for sewer and drain lines, per APWA/ULCC Standards Committee.
  - b. The polyethylene pipe manufacturer shall provide certification that the stress regression testing has been performed on the specific product. The said certification shall include a stress life curve per ASTM D2837. The stress regression testing shall have been performed in accordance with ASTM D2837, and the manufacturer shall provide a product supplying a minimum Hydrostatic Design Basis (HDB) of 1,600 psi as determined by ASTM D2837.
  - c. The material shall be listed by the Plastics Pipe Institute (PPI), a division of the Society of the Plastics Industry in PPI TR-4. The pipe material shall

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- d. The manufacturer's certification shall state that the pipe was manufacturer from one specific resin in compliance with these specifications. The certificate shall state the specific resin used and its source.
- e. Manufacturer shall further provide a sample piece of the product approximately 12" long in an outside diameter of choice to show the approximate color the manufacturer will provide.
- f. The materials used for the manufacture of polyethylene pipe and fittings shall meet the following nominal physical property requirements:

<u>Property</u>	<u>Specification</u>	<u>Units</u>	<u>Nominal Value</u>
Material Designation	PPI/ASTM	----	PE3408
Material Classification	ASTM D3350	----	III/C/5/P34
Cell Classification	ASTM D3350	----	345444E
Density	ASTM D1505	gm/cm <sup>3</sup>	0.950
Flow Rate	ASTM D1238(190/21.6)	gm/10 min.	8.5
Flexural Modulus	ASTM D790	psi	136,000
Tensile Strength @ Yield	ASTM D638	psi	3,500
ESCR	ASTM D1693	hours	F <sub>0</sub> >5,000
ESCR, Compressed ring	F1248	hours	F <sub>0</sub> >10,000
Hydrostatic Design Basis at 73°F	ASTM D2837	psi	1,600
Hardness	ASTM D2240	Shore "D"	66
Molecular Weight Category			Extra High
Tensile Strength @ Ultimate	ASTM D638	psi	5,000
Elongation	ASTM D638	percent	750 min.
Modulus of Elasticity	ASTM D638	psi	130,000
Linear Thermal Expansion Coefficient	ASTM D696	in/in-°F	1.1 X 10 <sup>-4</sup>
Thermal Conductivity	ASTM C177	Btu-in/ft-hr-°F	2.7
Brittleness Temperature	ASTM D746	°F	<-180
Heat Fusion Cond.		Psi @ °F	40 psi @ 500°F

U.V. stabilizer per manufacturer's recommendation shall be sufficient to provide for two years storage life.

Using the methods as specified in ASTM D2837 "Standard Test Method for Obtaining Hydrostatic Design Basin for Thermoplastic Pipe Materials", the pipe compound has been hydrostatically tested for a minimum of 10,000 hours at 73°F. This stress rupture

data resulted in a stress time regression curve that yields a Hydrostatic Design Basis of 1,600 psi when extrapolated out to the 100,000 hours intercept.

- g. HDPE pipe manufactured from materials meeting the specifications of this section shall have an Environmental Stress Crack Resistance of no failures in 10,000 hrs. (ESCR:  $F_0 > 10,000$ ) when tested in accordance with ASTM F1248.
- h. Unless otherwise shown on the Drawings, HDPE pipe shall have a Dimension Ratio of (DR) of 9.0 and shall be capable of withstanding a working pressure of 200 psi.

2. Pipe and Fittings

- a. Pipe and fittings shall be manufactured from material meeting the requirements of Section 2.01 C.1 listed above.
- b. Pipe and fittings shall be pressure rated using the certified HDB data from Section 2.01 C.1b. HDB, data from 2.01 C.1c shall not be allowed for this purpose. If HDB data in accordance with 2.01 C.1b is not available, pipe and fittings will not be acceptable. Pipe shall have a pressure rating in accordance with the following formula:

$$P = (2S/DR-1) \times DF \quad \text{and}$$

- P = internal pressure, psi
- S = long term hydrostatic strength, psi (1600)
- DR = Dimension Ratio = D/t
- D = outside diameter, actual, inches
- t = wall, minimum wall thickness, inches
- DF = design factor (0.5 for water @ 73.4°F)

- c. Pipe supplied under this specification shall have a nominal IPS (Iron pipe Size) outside diameter unless otherwise specified. The Dimension Ratio (DR) and pressure rating of the pipe at 73° shall match the following unless noted otherwise on the drawings:

DR 7.3 – 250 psi	DR 13.5 – 130 psi	DR 21 – 80 psi
DR 9 – 200 psi	DR 15.5 – 110 psi	DR 26 – 65 psi
DR 11 – 160 psi	DR 17 – 100 psi	DR 32.5 – 50 psi

- d. The pipe and fittings shall have product traceability. The manufacturer shall include a print line on the pipe. This shall notate the manufacturer's

name, date of manufacture, the lot and supplier of raw material, plant location, and production shift. The ASTM standard shall also appear as ASTM F714 with the material designation as PE3408. Colors of printline shall meet the Utility Location and Coordination Council, “*Uniform Color Code*”, set for sewer lines, per APWA/ULCC Standards Committee.

- e. Both pipe and fittings shall carry the same pressure rating. All fittings shall be pressure rated to match the system piping to which they are joined. At the point of fusion, the outside diameter and minimum wall thickness specifications of ASTM F714 for the same size pipe. Fittings shall be manufactured by the manufacturer of the pipe. Ells, tees, and wyes shall be manufactured by mitered fabrication. For force mains or pressure rated fittings, all fittings shall be derated according to the manufacturers written specifications, and clearly labeled on the fitting as such. For gravity or sanitary sewer, either direct bury or insertion lining fitting as such. For gravity or sanitary sewer, either direct bury or insertion-lining fittings will be fully pressure rated. All fittings will have a quality control label as approved by the manufacturer.
  - f. The manufacturer shall have a written specification for all standard mitered fittings, which establishes Quality Control criteria and tolerances. The manufacturer may be required to demonstrate its ability to produce product required by this specification.
3. Joining
- a. Heat fusion joining systems: Pipe and fittings shall be thermal butt fusion, saddle fusion, or socket fusion according to manufacturer recommended procedures.
  - b. The manufacturer shall provide fusion training. The Contractor (actual installers) and the onsite joint inspector shall be trained by the manufacturer or manufacturer’s authorized representative.
  - c. It will not be permitted to join unlike DR’s to one another. Transition from unlike SDR’s shall be accomplished by mechanical couplings capable of identical pressure ratings or machined polyethylene nipples where a thicker wall polyethylene has been matched to the companion pipe wall.
  - d. Mechanical joining systems: Polyethylene pipe and fittings shall be

connected by means of a polyethylene flange adapter and backup ring. The polyethylene flange adapter will be of the same specifications as the GreenView except will be made from black platestock. This method is also approved to join to another piping system or valves. Mechanical compression couplings or full circle encasement clamps may be used depending on the test specification.

- e. Mechanical couplings shall be installed in accordance with the mechanical coupling manufacturer's recommended procedures.
- f. Equipment: The fusion equipment and operator shall be required to demonstrate successful field experience. Regarding fusion over 36" capability, the fusion unit shall be field tested for a period of five years and the fusion operator shall have pipe size experience of the same size pipe on this project for five years or longer.

#### 4. Installation

- a. Installation shall be in accordance with ANSI/ASTM F585, "*Standard Practice for Insertion of Flexible Polyethylene Pipe into Existing Sewers*".
- b. Pressure or force mains shall follow installation procedures approved by the project engineer.
- c. Insertion lining by-pass pumping shall be necessary if the annular space and pulling head openings are incapable of handling the by-pass sewerage flow.

#### 5. Warranty

- a. The manufacturer shall provide evidence that their standard Terms and Conditions of Sales for warranty and guarantee have been one year from date of manufacture for a period of at least five years. It will not be permitted for a manufacturer to waive the date for the period of warranty and guarantee for this project to meet this specification. The one-year date of manufacture shall be covered under the standard Terms and Conditions of Sale.

## 2.04 MANHOLES AND PRECAST CONCRETE PRODUCTS

- A. Provide manholes and other precast concrete products in accordance with the following:

1. Precast Concrete Sections

- a. Precast concrete sections shall meet the requirements of ASTM C 478. The minimum compressive strength of the concrete in precast sections shall be 4,000 psi.
- b. The minimum wall thickness shall be one-twelfth of the inside diameter of the base, riser or the largest cone diameter. Additionally, the wall thickness shall be sufficient for the proper installation of the rubber boots.
- c. Transition slabs which convert bases larger than four feet in diameter to four foot diameter risers shall be designed by the manhole manufacturer to carry the live and dead loads exerted on the slab.
- d. Seal joints between precast sections by means of rubber O-ring gaskets or flexible butyl rubber sealant. Butyl rubber sealants shall meet the requirements of AASHTO M-198. Sealant shall be pre-formed type with a minimum nominal diameter of 1-inch. Butyl rubber sealant shall be equal to Kent Seal No. 2 or Concrete Sealants CS202.

2. Brick and Mortar: Brick shall be whole and hardburned, conforming to ASTM C 32 Grade MS. Mortar shall be made of one part Portland cement and two parts clean sharp sand. Cement shall be Type 1 and shall conform to ASTM C 150. Sand shall meet ASTM C 144.

3. Iron Castings

- a. Cast iron manhole frames and covers shall meet the requirements of ASTM A 48 for Class 30 gray iron and all applicable local standards. All castings shall be tough, close grained, smooth and free from blow holes, blisters, shrinkage, strains, cracks, cold shots and other imperfections. No casting will be accepted which weighs less than 95 percent of the design weight. Shop drawings must indicate the design weight and provide sufficient dimensions to permit checking. All castings shall be thoroughly cleaned in the shop and given two coats of approved bituminous paint before rusting begins.
- b. Manhole frames and covers shall be as shown on the Standard Detail Drawings.
- c. All frames and covers shall have machined horizontal bearing surfaces.
- d. All manholes shall have standard frames and covers except where specifically shown otherwise on the Drawings.

4. Rubber Boots: Provide preformed rubber boots and fasteners equal to those

manufactured by Kor-N-Seal or Press Seal Gasket Corporation.

5. Interior Lining

- a. Precast concrete wetwells, valve vaults, drop manholes, receiving manholes and air release valve manholes shall be lined (interior) with Green Monster Lining as manufactured by GML Coatings, LLC of Sarasota, FL, or equal as approved by the County.
  - (1) Surface Preparation and Application: Plug the structure to control flow coming into the work area. Sand blast the entire substrate so that the surface is structurally intact and clean of all corrosion. Power wash at 4000 psi to rid the substrate of all dust and sand. Apply a cementitious concrete to all voids to coat the entire surface 0.5 inches to 1 inch thick. Completely dry the work area using indirect heat. Apply primer to the clean dry substrate providing maximum adhesion and waterproofing for the final coating. Spray apply final coating at 90-110 mil thickness.
- b. Standard precast concrete manholes and valve vaults shall be lined (interior) with a coal tar epoxy equal to Carboline (Kop-Coat) Bitumastic 300M.
  - (1) Surface Preparation and Application: After the manhole has cured, the equivalent of seven days at 77 degrees F, the interior of the manhole exposed to liquids and gases shall be blasted and cleaned to remove all loose laitance, form oil, or other loose material. After cleaning, the lining material shall be applied to yield 21 mils for the complete system using a centrifugal lance applicator. No lining shall take place over grease, oil, etc., that would be detrimental to the adhesion of the compound to the substrate. The compound shall not be applied when the substrate temperature is below 40 degrees F or in adverse atmospheric conditions which will cause detrimental blistering, pinholing or porosity of the film. In no case shall the lining be applied when the concrete surface is above 14 percent moisture content. The lining shall be applied by applicators certified by the lining manufacturer. The workers shall be experienced and competent in the surface preparation, application and inspection of the lining to be applied.
  - (2) Inspection: All manholes shall be checked for thickness using a magnetic film thickness gauge on metal coupons attached to five percent of the manhole coated. All manholes shall be pinhole detected with a non-destructive 2,500 volt test. Each manhole

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section shall be marked with the date of application of the lining system and with its numerical sequence of application of that date.

- (3) Handling: Equipment used to handle and transport the lined manholes shall be suitably designed and operated not to damage the lining. Any damage which occurs shall be repaired prior to the installation of the manholes in accordance with the manufacturer's recommendations, so the repaired area is equal to the undamaged lining and coating in all respects.
- (4) Joints: All surfaces in the joint areas that are concrete and that are in contact with the sewer liquids and gases shall be prepared for coating and coated as specified for the manhole. Any area in the joint area that is not smooth shall be made so using a quick setting epoxy grout. Care shall be exercised so that all areas exposed to the sewer liquids and gases are coated.
- (5) Lining shall be applied at the point of manufacture of the manhole and precast concrete product.

### 6. Exterior Coating

- a. The exterior of manholes, wetwells and valve vaults shall be coated with a product as specified in Paragraph 5. above or with Farbertite, as manufactured by Briggs Bituminous Composition Company of Philadelphia, PA.
- b. Surface preparation, application, inspection, handling and joints shall be as specified in Paragraph 5. above to yield 7 mils.
- c. Coating shall be applied at the point of manufacture of the manhole and precast concrete product.

## 2.05 MISCELLANEOUS ACCESSORIES

- A. Detection Tape and Tracer Wire: Detection tape shall be composed of a solid aluminum foil encased in a protective plastic jacket. Tapes shall be color coded in accordance with APWA color codes with the following legends: Sanitary Sewerage Systems, Safety Green, "Caution: Sewer Line Buried Below". Colors may be solid or striped. Tape shall be permanently printed with no surface printing allowed. Tape width shall be minimum 2-inches when buried less than 10-inches below the surface. Tape width shall be minimum 3-inches when buried greater than 10-inches and less than 20-inches. Detection tape shall be equal to Lineguard Type III Detectable or Allen Systems Detectatape. In addition, prior to backfill of trench the Contractor shall furnish and install 14 gauge coated copy wire. The wire shall be installed along the pipe during the backfill operation. Wire shall be brought up at each manhole.

- B. Retainer Glands
1. Retainer glands for ductile iron pipe shall be Megalug, Series 1100, as manufactured by EBBA Iron Sales, Inc.
  2. Retainer glands for polyvinyl chloride pipe shall be Megalug Series 2000 PV, as manufactured by EBAA Iron Sales, Inc.
- C. Anchor Couplings: Lengths and sizes shall be as shown on the Drawings. Anchor couplings shall be equal to Tyler Pipe 5-198.
- D. Flange Adapter: The flange adapter shall permit the connection of unthreaded, ungrooved, open-ended ductile iron pipe to ANSI/ASME B16.1, Class 125 flanges. The flange adapter shall meet the test requirements of ANSI/ASME B16.1 for Class 125 flanges. The adapter shall be a ductile iron casting incorporating a flange with extended throat, set screws and gasket. The gasket shall provide a compression seal between the adapter, the pipe and the adjacent flange. Flange adapters shall be used only in locations specifically shown on the Drawings or at the direction of the County, and in accordance with the manufacturer's recommendations. The flange adapter shall be manufactured by McWane or EBAA Iron. Additionally, flange adapters shall be provided with 304 stainless steel harness rods of the diameter and quantity shown on the Drawings or directed by the County.
- E. Pipe Supports: Pipe supported from underneath and not subject to expansion shall have adjustable pipe saddle supports on properly sized pipe stanchions and ample, properly grouted floor flanges. Saddle supports shall be equal to Grinnell, Figure 264 or Fee and Mason, Figure 291.
- F. Pressure Gauges with Diaphragm Seal: Pressure gauges and diaphragm shall be installed as shown on the drawings. Pressure gauges shall be equal to DASCO 987 Series process gauge, Type 4501S, 1/2" connection, glycerine filled or approved equal. Diaphragm seal shall be equal to an Ashcroft Type 500 or approved equal.

## 2.06 CONCRETE

Concrete shall have a compressive strength of not less than 3000 psi, with not less than 5.5 bags of cement per cubic yard and a slump between 3 and 5-inches. For job mixed concrete, submit the concrete mix design for approval by the County. Ready-mixed concrete shall be mixed and transported in accordance with ASTM C 94. Reinforcing steel shall conform to the requirements of ASTM A 615, Grade 60.

**2.07 PLUG VALVES (PV)**

- A. Valves shall be 90 degree turn, non-lubricated, eccentric type with resilient faced plugs. Design of the valve shall provide that contact between the seat and the plug shall only occur in the final degrees of plug movement. Valves shall be suitable for throttling service and service where valve operation is infrequent.
- B. Valves shall provide drip-tight shut-off up to the full pressure rating with pressure in either direction. Pressure ratings shall be established by hydrostatic tests conducted in accordance with ANSI B16.1. Valves shall be rated at a minimum of 150 psi.
- C. Valves shall have a port area equal to at least 80 percent of the full pipe area.
- D. Bodies shall be cast-iron, conforming to ASTM A 126, Class B (carbon steel for 2-inch valves).
- E. Valve ends shall be a mechanical joint type, except where flanged or restrained joint ends are shown on the Drawings. Mechanical joint valves shall have bell ends conforming to applicable requirements of AWWA C111/ANSI A21.11. Flanged joints shall meet the requirements of ANSI B16.1, Class 125. Flanged valves with flange-to-MJ adapters shall not be acceptable in lieu of MJ valves.
- F. Valve seats shall be a raised, welded-in overlay of not less than 90 percent pure nickel, machined to mate with the resilient faced plug. Overlay shall be minimum of 1/8-inch thick.
- G. The plug shall be of semi-steel, conforming to ASTM A 126, Class B. The plug facing shall be a synthetic rubber compound of approximately 70 durometer hardness bonded to the plug. Facing material shall be abrasion resistant and suitable for service in sewage and sludge applications.
- H. Valves shall be furnished with replaceable, sleeve-type bearings in the upper and lower journals. Bearings shall comply with applicable requirements of AWWA C507. Bearing materials shall have a proven record of service of not less than five years.
- I. The valve body shall be fitted with a bolted bonnet incorporating a stuffing box and pull-down packing gland. Packing shall be the split chevron type. Design of exposed valves shall allow visible inspection of the shaft seal, adjustment of the packing, and replacement of the packing, all without disturbing the bonnet or valve operator. The shaft seal shall comply with the requirements of AWWA C504.
- J. Actuators

1. Valves for exposed service, 3 through 8-inches in diameter, shall be lever operated. Hand levers shall be steel with a non-metallic grip.
2. Actuators for buried service and valves 10-inches and larger, shall be equipped with manual operated geared actuators. Geared actuators shall be totally enclosed, oil lubricated, worm and gear type. Shaft seals shall be provided to prevent entry of dirt and water into the actuator. All shaft bearings shall be permanently lubricated bronze bushings. Actuators shall clearly indicate valve position and an adjustable stop shall be provided to set closing torque. Construction of actuator housing shall be semi-steel. Gear actuators shall comply with requirements of AWWA C504.
3. Gear actuators for buried valves 10-inches and larger in diameter shall be mounted above ground on an extended bonnet.
4. Motorized actuators shall be provided where shown on the Drawings and as specified in this Section.
5. Valves and operators for submerged or buried service shall have seals on all shafts and gaskets on valve operator covers to prevent the entry of water. Operator mounting brackets for submerged service shall be totally enclosed and shall have gasket seals.

K. Operators

1. Valves for non-buried service, six feet or more above the operating floor shall be furnished with a chainwheel operator and chain for operation from floor level. All other valves shall be equipped with a handwheel operator.
2. Valves, 3 through 8-inches, for buried service shall have a nut type operator and shall be equipped with a valve box and stem extension required to bring the operation nut within 6-inches of finished grade. Valve boxes and extension stems shall be as specified in this Section.

L. All exposed bolts, nuts, and washers for buried or submerged valves shall be stainless steel. All exposed nuts, bolts, springs, washers, and miscellaneous hardware shall be zinc coated in accordance with ASTM A 153 unless specified otherwise.

M. The exterior of all buried valves shall have a factory applied, two coat coal tar epoxy coating system. The coal tar epoxy shall be Tnemec Tneme-Tar 46-413, Indurall Ruffstuff 2100 Coal Tar Epoxy or Kop-Coat Bitumastic No. 300-M. Each coating shall have a minimum dry film thickness of 8-10 mils.

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- N. All ferrous metal interior surfaces of plug valves shall be provided with a factory applied epoxy interior coating conforming to the requirements of AWWA C550. The coating shall be either TNEMEC Series 20 Pota Pox, Valspar Series 78 or Kopcoat Hi Gard Epoxy. Each coating shall have a minimum dry film thickness of 4 to 6 mils.
- O. Acceptable Manufacturers: All plug valves shall be products of a single manufacturer who must submit evidence of five years satisfactory service in sewage applications of the same design and of the sizes required. Valves shall be manufactured by DeZurik or Keystone.

### **2.08 CHECK VALVES**

- A. Check valves shall be hinged disc type with cast iron body and bronze or bronze-fitted disc. Valves shall be designed for 200 psi and shall not slam shut on pump shutdown. Valves shall be equipped with a ½ inch stop cock at the high point of the valve for bleeding air from the line.
- B. Valves shall be outside spring and lever type.
- C. Valves shall be of the globe design with ANSI 125 pound flanges.
- D. Valves shall be G.A. Industries APCO, M&H C508 or AVK.

### **2.09 AIR VALVES FOR SEWERAGE SERVICE**

- A. General: Unless specifically approved by the County, combination air valves shall be installed in accordance with these Specifications.
- B. Air/Vacuum Valves: Valves shall be automatic air and vacuum valves designed to allow escape of air, close water-tight when liquid enters the valve, and allow air to enter in the event of a vacuum. The valve body and all inner metal parts shall be stainless steel. The float shall be plastic. The valve design shall prevent contact between the sewage and sealing mechanism. Valves shall be equipped with the necessary attachments, including valves, quick disconnect couplings and hose, to permit back flushing after installation without dismantling the valve. The valves shall have an orifice diameter of 2-inches and NPT inlet and outlet diameters of 2 x 2-inches.
- C. Valves shall be recommended by the manufacturer for wastewater service with normal operating pressures to approximately 60 psig, and frequent surge pressures of

approximately 175 psig and shall be equal to A.R.I. D-025.

## **2.10 VALVE BOXES (VB) AND EXTENSION STEMS**

### **A. Valve Boxes**

1. Unless shown otherwise on the Drawings, all valves shall be equipped with valve boxes. The valve boxes shall be cast iron two-piece screw type with drop covers. Valve boxes shall have a 5.25-inch inside diameter. Valve box covers shall weigh a minimum of 13 pounds. The valve boxes shall be adjustable to 6-inches up or down from the nominal required cover over the pipe. Valve boxes shall be of sufficient length that bottom flange of the lower belled portion of the box is below the valve operating nut. Ductile or cast iron extensions shall be provided as necessary. Covers shall have "SEWER" cast into them. Valve boxes shall be manufactured in the United States.

2. Valve boxes shall be manufactured by Tyler or Opelika.

B. Extension Stems: Extension stems shall be provided if depth of bury places the operating nut in excess of 60-inches beneath finished grade, so as to set the top of the operating nut 30-inches below finished grade. Connection to the valve shall be with a wrench nut coupling and a set screw to secure the coupling to the valve's operating nut. The coupling and square wrench nut shall be welded to the extension stem. Extension stems shall be equal to Mueller 26441 or M & H Valve, Style 3801.

## **2.11 CORPORATION COCKS AND CURB STOPS**

Corporation cocks and curb stops shall be ground key type, shall be made of bronze conforming to ASTM B 61 or B 62, and shall be suitable for the working pressure of the system. Ends shall be suitable for grip type joint. Threaded ends for inlet and outlet of corporation cocks shall conform to AWWA C800; coupling nut for connection to flared copper tubing shall conform to ANSI B16.26. Corporation cocks and curb stops shall be manufactured by Mueller or Ford.

## **PART 3 EXECUTION**

### **3.01 LAYING AND JOINTING PIPE AND ACCESSORIES**

A. Lay all pipe and fittings to accurately conform to the lines and grades established by the construction drawings.

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### B. Pipe Installation

1. Proper implements, tools and facilities shall be provided for the safe performance of the Work. All pipe, fittings and valves shall be lowered carefully into the trench by means of slings, ropes or other suitable tools or equipment in such a manner as to prevent damage to sewer materials and protective coatings and linings. Under no circumstances shall sewer materials be dropped or dumped into the trench.
2. All pipe, fittings, valves and other appurtenances shall be examined carefully for damage and other defects immediately before installation. Defective materials shall be marked and held for inspection by the County, who may prescribe corrective repairs or reject the materials.
3. All lumps, blisters and excess coating shall be removed from the socket and plain ends of each pipe, and the outside of the plain end and the inside of the bell shall be wiped clean and dry and free from dirt, sand, grit or any foreign materials before the pipe is laid. No pipe which contains dirt shall be laid.
4. Foreign material shall be prevented from entering the pipe while it is being placed in the trench. No debris, tools, clothing or other materials shall be placed in the pipe at any time.
5. As each length of pipe is placed in the trench, the joint shall be assembled and the pipe brought to correct line and grade. The pipe shall be secured in place with approved backfill material.
6. It is common practice to lay pipe with the bells facing the direction in which work is progressing, however, it is not mandatory.
7. Applying pressure to the top of the pipe, such as with a backhoe bucket, to lower the pipe to the proper elevation or grade shall not be permitted.
8. Provide tracer wire and detection tape for all non-metallic pressure pipe. The tracer wire shall be wrapped around the pipe and shall be looped up to the surface at all valve and/or manhole locations. Detection tape shall be installed on top of all pipe.
9. Polyethylene Encasement: Installation shall be in accordance with AWWA C105 and the manufacturer's instructions. All ends shall be securely closed with tape and all damaged areas shall be completely repaired to the satisfaction of the County.

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C. Alignment and Gradient

1. Lay pipe straight in alignment and gradient or follow true curves, where shown on the Drawings, as nearly as practicable. Do not deflect any joint more than the maximum deflection recommended by the manufacturer.
2. Maintain a transit, level and accessories on the job to lay out angles and ensure that deflection allowances are not exceeded.
3. Do not install force main such as to generate a high point except where shown on the Drawings. Prior to backfilling trench, the Contractor shall survey elevation of force main top of pipe barrel at minimum 100-foot intervals, at all bends, at all air valves, and where elevations are shown on the Drawings. The location description and elevation of each benchmark used for this survey shall be recorded. Vertical deflections required to avoid existing underground obstructions shall not result in a high point in the force main unless approved by the County.
4. Any section of force main which is determined to have been installed such that a high point is generated at a location other than that shown on the Drawings shall be removed and reinstalled to the correct elevation, unless the variation in elevation was approved in writing by the County.

- D. Expediting of Work: Excavate, lay the pipe, and backfill as closely together as possible. Do not leave unjointed pipe in the trench overnight. Backfill and compact the trench as soon as possible after laying and jointing is completed. Cover the exposed end of the installed pipe each day at the close of work and at all other times when work is not in progress. If necessary to backfill over the end of an uncompleted pipe or accessory, close the end with a suitable plug, either push-on, mechanical joint, restrained joint or as approved by the County.

E. Joint Assembly

1. Push-on, mechanical, flange and restrained type joints shall be assembled in accordance with the manufacturer's recommendations.
2. Each restrained joint shall be inspected by the Contractor to ensure that it has been "homed" 100 percent.

F. Cutting Pipe

1. Cut ductile iron pipe using an abrasive wheel saw.

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2. Cut PVC pipe using a suitable saw.
3. Remove all burrs and smooth the end before jointing.
4. The Contractor shall cut the pipe and bevel the end, as necessary, to provide the correct length of pipe necessary for installing the fittings, valves, accessories and closure pieces in the correct location. Only push-on or mechanical joint pipe shall be cut.

### G. Valve, Fitting and Pressure Gauge Installation

1. Prior to installation, valves shall be inspected for direction of opening, number of turns to open, freedom of operation, tightness of pressure-containing bolting and test plugs, cleanliness of valve ports and especially seating surfaces, handling damage and cracks. Defective valves shall be corrected or held for inspection by the County. Valves shall be closed before being installed.
2. Valves, fittings, plugs and caps shall be set and joined to the pipe in the manner specified in this Section for cleaning, laying and joining pipe, except that 12-inch and larger valves shall be provided with special support, such as treated timbers, crushed stone, concrete pads or a sufficiently tamped trench bottom so that the pipe will not be required to support the weight of the valve.
3. A valve box shall be provided on each underground valve. They shall be carefully set, centered exactly over the operating nut and truly plumbed. The valve box shall not transmit shock or stress to the valve. The bottom flange of the lower belled portion of the box shall be placed below the valve operating nut. This flange shall be set on brick, so arranged that the weight of the valve box and superimposed loads will bear on the base and not on the valve or pipe. Extension stems shall be installed where depth of bury places the operating nut in excess of 30-inches beneath finished grade so as to set the top of the operating nut 30-inches below finished grade. The valve box cover shall be flush with the surface of the finished area or such other level as directed by the County.
4. Three pressure gauges shall be installed within valve vault. Pressure gauges shall have bronze or stainless bourbon tube elements. Lens shall be heavy glass, with an oil-resistant gasket seal. The dial shall be a minimum of 4.5-inches in diameter with white coated metal lithographed with black metal graduations and numerals; graduations shall be in feet; mount as required. Connection shall be ½-inch NPT with square wrench surface. Provide cartridge snubber, diaphragm seal unit and polished brass gauge cock. Range shall be 0 to 150 feet. Accuracy shall be +/-

0.5 percent.

5. In no case shall valves be used to bring misaligned pipe into alignment during installation. Pipe shall be supported in such a manner as to prevent stress on the valve.

#### H. Air Valve Manholes

1. Construct the vault or manhole as detailed on the Drawings.
2. The frame and cover shall be cast into the top slab or cone.
3. Where vent pipe are shown on the Drawings, vents shall be of one-piece, welded steel construction. Vent pipes shall equal air valve size, but no less than 4-inches. The vent pipe shall be grouted into a precast hole in the vault. The discharge of the vent pipe shall be provided with a 3/16-inch PVC coated mesh screen.

### 3.02 MANHOLE AND PRECAST CONCRETE PRODUCT CONSTRUCTION

- A. Construct manholes as shown on the Drawings.
- B. Precast Concrete: Handle sections carefully to prevent cracking or chipping. Provide uniform bedding of the bottom section to prevent uneven loading. Install gaskets and joint sealants in accordance with manufacturer's recommendations to produce a watertight structure.
- C. Brick: Bed the bottom and sides of every brick in mortar. Apply a smooth coat of mortar, 3/4-inch thick, on the inside and outside.
- D. Top Elevations: Build manholes outside of paved areas to 18-inches above finished grade unless otherwise shown on the Drawings or directed by the County. Build manholes in paved areas to existing grades.
- E. Frames and Covers: Unless frame and cover is at grade, the frame shall be cast into the cone section.
- F. Manholes shall be constructed such that their walls are plumb.

### 3.03 THRUST RESTRAINT

- A. Provide restraint at all points where hydraulic thrust may develop.
- B. Retainer Glands: Provide retainer glands where shown on the Drawings and all associated fittings, valves and related piping. Retainer glands shall be installed in

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accordance with the manufacturer's recommendations, particularly, the required torque of the set screws. The Contractor shall furnish a torque wrench to verify the torque on all set screws which do not have inherent torque indicators.

- C. **Harnessing:** Provide harness rods only where specifically shown on the Drawings or directed by the County. Harness rods shall be manufactured in accordance with ASTM A 36 and shall have an allowable tensile stress of no less than 22,000 psi. Harness rods shall be hot dip galvanized or field coated with bitumastic before backfilling. Where possible, harness rods shall be installed through the mechanical joint bolt holes. Where it is not possible, provide 90 degree bend eye bolts. Eye bolts shall be of the same diameter as specified in AWWA C111 for that pipe size. The eye shall be welded closed. Where eye bolts are used in conjunction with harness rods, an appropriate size washer shall be utilized with a nut on each end of the harness rod. Eye bolts shall be of the same material and coating as the harness rods.
  
- D. **Concrete Blocking**
  - 1. Provide concrete blocking for all other bends, tees, valves, and other points where thrust may develop, except where other means of thrust restraint are specifically shown on the Drawings.
  - 2. Form and pour concrete blocking at fittings as shown on the Drawings and as directed by the County. Pour blocking against undisturbed earth. Increase dimensions when required by over excavation.
  
- E. **Thrust Collars:** Collars shall be constructed as shown on the Drawings. Concrete and reinforcing steel shall meet the requirements specified in Article 2.03 of this Section. The welded-on collar shall be attached to the pipe by the pipe manufacturer.

### **3.04 CONCRETE COLLARS**

Construct collars as shown on the Drawings.

### **3.05 INSPECTION AND TESTING**

- A. **Pressure and Leakage Test**
  - 1. All sections of pipeline subject to internal pressure shall be pressure tested in accordance with AWWA C600. A section of line will be considered ready for testing after completion of all thrust restraint and backfilling. Each segment of pipeline between line valves shall be tested individually.
  
  - 2. **Test Preparation**

- a. Flush pipeline section thoroughly at flow velocities adequate to remove debris from pipe and valve seats. Partially operate valves and hydrants to clean out seats. Provide correctly sized temporary outlets in number adequate to achieve flushing velocities.
  - b. Provide temporary blocking, bulkheads, flanges and plugs as necessary, to assure all new pipe, valves and appurtenances will be pressure tested.
  - c. Before applying test pressure, air shall be completely expelled from the pipeline and all appurtenances. Unless permanent air vents are in place, insert temporary corporation stops at highpoints to expel air as line is filled with water.
  - d. Fill pipeline slowly with water. Provide a suitable pump with an accurate water meter to pump the line to the specified pressure. Differential pressure at valves and hydrants shall equal the maximum possible, but shall not exceed manufacturer's pressure rating.
3. Test Pressure: Test the pipeline such that no point has a pressure less than 100 psi for at least two hours. The test pressure shall not vary by more than 5 psi for the test duration. Should the pressure drop more than 5 psi at any time during the test period, the pressure shall be restored to the specified test pressure. Provide an accurate pressure gage with graduation not less than 5 psi.
  4. Leakage: Leakage shall be defined as the quantity of water that must be pumped into the test section equal to the sum of the water, to maintain pressure within 5 psi of the specified test pressure for the test duration. Leakage shall be the total cumulative amount measured on a water meter. The County assumes no responsibility for leakage occurring through existing valves.
  5. Test Results: No test section shall be accepted if the leakage exceeds the limits determined under Section 4 of AWWA C600. The leakage test shall be repeated until the test section is accepted. All visible leaks shall be repaired regardless of leakage test results.
  6. Completion: After a pipeline section has been accepted, relieve test pressure. Record type, size and location of all outlets on record drawings.
- B. Re-Testing: Any alterations made to pipeline or manholes performed after initial testing shall be re-tested and pass again, regardless of initial test results.
  - C. Notification: Lowndes County shall be notified 24-hours in advance prior to Contractor performing any testing.

**FORCE MAINS**

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**END OF SECTION**

**PART 1 GENERAL****1.01 DESCRIPTION**

The work covered by this Section includes all labor, materials and equipment required to furnish a complete service lateral fitting kits each consisting of one (1) male adapter for attachment to the station and one (1) check valve assembly with curb box. All plastic valves and fittings are to be molded from engineered thermoplastic resins. All polypropylene and nylon fittings shall be tested for resistance to aging, pressure rating, tensile strength and flexural strength. All components shall incorporate compression fitting connections for easy, reliable installation of piping. All fittings and valves shall be rated for 150 psi service. Completed assembly shall be as provided by Environment One Corporation, or approved equal.

**1.02 SHOP DRAWINGS**

Submit a minimum of six (6) sets of shop drawings detailing the equipment to be furnished including dimensional data and materials of construction.

**PART 2 PRODUCTS****2.01 ENGINEERED THERMOPLASTIC VALVES AND FITTINGS**

All plastic valve and fitting components are to be tested for compliance with ASTM D1599 (Categories 7.1.1, 7.2.2, and 7.2.3). Components shall be tested against the requirements of ASTM D2513 (Categories 6.10.1 and 6.10.2).

**2.02 CONNECTIONS**

All pipe connections shall be made using compression fitting connections including a Buna-N O-ring for sealing to the outside diameter of the pipe. A split collet locking device shall be integrated into all pipe connection fittings to securely restrain the pipe from hydraulic pressure and external loading caused by shifting and settling.

**2.03 GLASS FILLED NYLON VALVES**

Glass filled nylon valves shall be pressure tight in both directions. The tee-head shall include a ratcheting feature to prevent breaking from over-torquing the valve

handle. Buna-N O-rings shall be used to provide a redundant, watertight seal on the stem. A spherical, Teflon filled polypropylene ball shall be supported in molded, Teflon seats to provide watertight seals in either direction, as well as maximum flow capacity and ease of operation. Valves shall be designed to withstand a working pressure of 150 psi minimum.

#### **2.04 CHECK VALVES**

Check Valves shall be injection molded from non-corroding, glass fiber reinforced PVC for durability. The check valve flapper shall include a non-fouling, integral hinge made from fabric reinforced synthetic elastomer to assure corrosion resistance, dimensional stability, fatigue strength and trouble free operation. The check valve will provide a full-ported passageway and shall introduce a friction loss of less than 6 inches of water at maximum rated flow. A nonmetallic hinge shall be an integral part of the flapper assembly providing a maximum degree of freedom to assure seating at low back pressure.

#### **2.05 CURB BOXES**

Curb boxes shall be constructed of iron filled polypropylene to provide durability and magnetic detectability. All components shall be inherently corrosion resistant to assure durability in the ground. Curb boxes shall provide height adjustment downward (shorter) from their nominal height.

#### **2.06 HIGH DENSITY POLYETHYLENE PIPE**

- A. Pipe shall be high performance, high molecular weight, high density polyethylene pipe equal to Driscopipe\* 1000 as manufactured by Phillips Driscopipe, Inc., Dallas, Texas. The pipe material shall be a Type III, Class C, Category 5, P34 material as described in ASTM D 1248. Minimum cell classification values of the pipe material shall be 345434 C as referenced in ASTM D 3350 - 84. The density shall be 0.941 - 0.957 gms/cm<sup>3</sup> when tested in accordance with ASTM D 1505.
- B. Melt Flow shall be no greater than 0.15 gms/10 min. when tested in accordance with ASTM D 1238 - Condition E. (Melt Flow shall be no greater than 4.0 gms/10 min. when tested in accordance with ASTM D 1238 - Condition F.)  
Flexural Modulus shall be 110,000 psi to less than 160,000 psi when tested in accordance with ASTM D 790. Tensile strength at yield shall be 3,200 psi to less than 3,500 psi when tested in accordance with ASTM D 638. Environmental Stress Crack Resistance shall be in excess of 5,000 hours with zero failures when tested in accordance with ASTM D 1693 - Condition C.

- C. Hydrostatic Design Basis shall be 1,600 psi at 23°C when tested in accordance with ASTM D 2837.

**2.07 PIPE DIMENSIONS**

The SDR (Standard Dimension Ratio) of the pipe supplied shall be as specified by the design engineer.

**2.08 DETECTION TAPE AND TRACER WIRE**

Detection tape shall be composed of a solid aluminum foil encased in a protective plastic jacket. Tapes shall be color coded in accordance with APWA color codes with the following legends: Sanitary Sewerage Systems, Safety Green, "Caution: Sewer Line Buried Below". Colors may be solid or striped. Tape shall be permanently printed with no surface printing allowed. Tape width shall be minimum 2-inches when buried less than 10-inches below the surface. Tape width shall be minimum 3-inches when buried greater than 10-inches and less than 20-inches. Detection tape shall be equal to Lineguard Type III Detectable or Allen Systems Detectatape. In addition, prior to backfill of trench the Contractor shall furnish and install 14 gauge coated copy wire. The wire shall be installed along the pipe during the backfill operation. Wire shall be brought up at each valve box and grinder pump station.

**PART 3 EXECUTION**

**3.01 FACTORY TEST**

All service lateral assemblies are to be 100% hydrostatically tested to 150 psi at the factory.

**3.02 CONSTRUCTION PRACTICES**

- A. Pipe shall be stored on clean, level ground to prevent undue scratching or gouging of the pipe. If the pipe must be stacked for storage, such stacking should be in accordance with the pipe manufacturer's recommendations. The pipe should be handled in such a manner that it is not damaged by being dragged over sharp objects or cut by chokers or lifting equipment.
- B. Segments of pipe having cuts or gouges in excess of 10% of the wall thickness of the pipe shall be cut out and removed. The undamaged portions of the pipe shall be rejoined using the butt fusion joining method.

- C. Sections of polyethylene pipe should be joined into continuous lengths on the job site above ground. The joining method shall be the butt fusion method and shall be performed in strict accordance with the pipe manufacturer's recommendations. The butt fusion equipment used in the joining procedure shall be capable of meeting all conditions recommended by the pipe manufacturer, including, but not limited to, fusion temperature, alignment, and fusion pressure.
- D. Fused segments of pipe shall be handled so as to avoid damage to the pipe. When lifting fused sections of pipe, chains or cable-type chokers should be avoided. Nylon slings are preferred. Spreader bars should be used when lifting long, fused sections. Care should be exercised to avoid cutting or gouging the pipe.

**3.03           INSTALLATION**

- A. The trench and trench bottom should be constructed in accordance with ASTM D 2321 - Section 7. Embedment materials should be Class I, Class II or Class III materials as defined in ASTM D 2321 - Section 6. The use of Class IV and/or Class V materials for embedment is not recommended and should be allowed only with the approval of the County. Bedding of the pipe should be performed in accordance with ASTM D 2321 - Section 8. Compaction should be as specified in ASTM D 2321. Deviations from the specified compaction shall be approved by the County.
- B. Haunching and initial backfill should be as specified in ASTM D 2321 - Section 9 using Class I, Class II or Class III materials. Materials used and compaction shall be as approved by the County. In cases where a compaction of 90 percent of the maximum dry density is not attainable, the County may require the SDR of the pipe to be increased to provide adequate stiffness. ASTM D 2321 - Section 11.2, Minimum Cover for Load Application, Section 11.3, Use of Compaction Equipment and Section 11.4, Removal of Trench Protection, should apply unless directed otherwise by the County.

**END OF SECTION**

**PART 1 GENERAL****1.01 SCOPE**

The work covered by this Section shall consist of furnishing and installing service connections in the sewers, of the size and type shown on the Drawings and specified herein.

**PART 2 PRODUCTS****2.01 MATERIALS**

- A. Service connections shall be made from the side at 45 degrees of the sewer line using minimum 6-inch diameter pipe as shown on the Drawings. Service pipe shall be of the same material and quality as the main sewer line.
- B. Riser connections shall be required when the main sewer line is 10 feet or more below finished grade, unless otherwise directed by the County.
- C. The service connection shall extend from the sewer line to the edge of the permanent easement or right-of-way and be plugged.
- D. If the service connection ends in rock, the Contractor shall excavate the rock an additional 10 feet beyond the plugged end.
- E. Connection of service lines or risers to sewer line shall be by means of standard tees or wyes, or as indicated on the Drawings.
- F. When required, a V-Notch (60 Degree) flume sewer meter shall be installed within a pre-cast concrete structure. Meter shall be manufactured by Free Flow, Inc. or approved equal.
- G. Detection tape and tracer wire shall be provided over all sewers constructed by the open cut method, except those lengths of sewers directly underneath paved surfaces of County-owned roadways.

**PART 3 EXECUTION****3.01 INSTALLATION**

Laying of service connection lines shall be in accordance with Section 02730 of these Specifications.

**END OF SECTION**

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**PART 1 GENERAL**

**1.01 SCOPE**

- A. The Contractor shall furnish all labor, materials, equipment and miscellaneous items as necessary for the installation of a complete chain link fence system around the sewage pumping stations. Fencing shall be installed in the location as shown on the Drawings in complete conformity with the manufacturer's written recommendations and as specified herein.
- B. Security fencing for the Contractor is at Contractor's option and is not included as part of the work specified.

**1.02 DELIVERY AND HANDLING**

- A. Deliver materials with the manufacturer's tags and labels intact.
- B. Handle and store materials in such a manner that will avoid damage.

**1.04 STORAGE AND PROTECTION**

Provide storage and protection in accordance with the manufacturer's requirements.

**1.04 QUALITY ASSURANCE**

- A. Standards of manufacturer shall comply with the standards of the Chain Link Manufacturers Institute and these Specifications.
- B. Provide fencing as a complete unit produced by a single manufacturer including the required erection accessories, fittings and fasteners.

**PART 2 PRODUCTS**

**2.01 GENERAL**

- A. Overall height for new fencing shall be seven feet including three strands of barbed wire on malleable iron post tops. Posts shall be set at no more than 10 foot centers, a full three feet deep in concrete footings, poured the full size of the holes as excavated. Corner posts shall have the necessary strut and tie bracing. Gates shall be provided of the size and at the locations indicated on the Drawings.
- B. Where fencing crosses ditches, steep grades, and other unusual conditions, make special

provisions to insure that the security, appearance, maintainability and permanence of the standard fencing are equalled or exceeded.

## 2.02 MATERIALS AND CONSTRUCTION

### A. Materials:

1. Wire: Fabric shall be of the "chain link" type, composed of individual wire pickets, helically wound and interwoven to form a square mesh. Wire used in the fabric shall be #9 W & M gage, of basic open hearth steel, containing not less than 0.20% copper, and having a tensile strength after galvanizing of 90,000 psi. Fabric shall be woven so as to form mesh two inches square and shall measure six feet in width. The wire ends at the edges of the fabric shall be cut diagonally, and twisted to form barbs. The fabric shall be hot dipped galvanized after weaving, to produce a zinc coating weighing not less than 1.4 oz. per square foot of wire surface. Zinc coating shall withstand six one minute dips, when tested by methods outlined in ASTM Specification No. 391 Class I, or the latest revision thereof.
2. Line Posts: Line posts shall be 2" O.D. galvanized steel pipe weighing 2.72# per foot of length.
  1. Post shall be high carbon rail steel for rolled sections or of new high carbon steel for tubular sections. All posts shall be hot galvanized to withstand twelve one-minute dips when tested by methods outlined above.
3. Top Rails: Top rails shall be of new 1-5/8" O.D. schedule 10 steel pipe in random lengths averaging not less than 20 feet and joined with pressed steel sleeves. Rail and sleeves shall be hot dipped galvanized to produce a zinc coating equal to that of the fabric.
4. Fabric Ties: Fabric ties for attaching fabric to line posts, top rail, or top wire, shall be galvanized wire of approved gauge and design. Ties shall be located on top rail every 24 inches and on line posts every 14 inches.
5. Barbed Wire: The fabric shall be surmounted with three strands of barbed wire. Each strand shall consist of two No. 12-1/2 W & M gage twisted copperbearing steel line wires, hot dip galvanized with No. 14 W & M gage galvanized steel 4-point barbs spaced not more than four inches apart.
6. Barbed Wire Extension: All intermediate and corner posts shall be equipped with extension arms for supporting barbed wire. The base shall be of malleable

**CHAIN LINK FENCES AND GATES**

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iron and the extension presses Armco Ingot Iron, hot galvanized after the fabrication. The intermediate arm shall have provision for passing top rail, and corner arm casting equipped with set screw.

7. End and Corner Posts: Shall be hot galvanized basic open hearth or copper-bearing steel pipe, three-inch OD, weighing 5.79 pounds per foot.
8. Swing Gate Posts: Shall be same as end posts but in the following sizes:

<u>Pipe Size OD</u>	<u>Weight Per Foot</u>	<u>Gate Opening Single Inclusive</u>	<u>Gate Opening Double Inclusive</u>
To 6'	3"		5.79 lbs. Up to 12'
Over 6' to 13'	4"		9.11 lbs
Over 13' to 18'	Over 12'-26' 6-5/8"		19.97 lbs.
Over 18' to 32'	Over 26'-36' 8-5/8"		25.00 lbs.
Over 36'-64'			

9. Brace and Tension Bands: Bands shall be unclimbable bevelledge type with 3/8" diameter square shouldered, galvanized carriage bolts, non-removable from outside fence.
10. Bracing: All terminal posts shall be braced by means of 1-5/8" OD horizontal compression members, securely attached to terminal and first line posts with malleable iron fittings and beveled edge bands, and shall be truss braced from first line post to bottom of terminal posts with 1/2" rod and turn buckle. Corner posts shall be braced in each direction.
11. Tension Bars: Tension bars for attaching fabric to terminal posts shall be 3/16" x 3/4" high carbon steel attached to terminal post by means of beveled edge bands.
12. Swing Gate Frames: Swing gate frames shall be 2' OD Schedule 40 Pipe 2.72 #/Ft. with internal bracing of 1-5/8" OD Schedule 40 Pipe 2.27 #/Ft.
13. Gate Fillers: Gate frames shall be filled with same specifications of fabric as is used in line of fence.
14. Hinges: Hinges shall be double-clamping offset type, allowing gates to swing

back parallel with line of fence and shall be made of malleable iron and foregings.

15. Latches: Latches shall be of eccentric double-locking type which engage strikes securely bolted to either gate frame or gate post at both top and bottom and in case of double gates engage also a heavy malleable iron non-freezing gate stop anchored in concrete footing. For walk gates up to and including 4' opening, a malleable iron gravity type latch shall be furnished which automatically engages pin welded in gate frame. All latches shall be made so as to be readily locked with padlock.
16. Gate Keeper: Each gate frame shall be equipped with a keeper which automatically engages the gate frame when swung to the open position.
17. Miscellaneous Fittings: All fittings entering into the fence, necessary to make a complete installation, shall be malleable iron, pressed steel, or foregings. All material shall be thoroughly galvanized by the hot dip method.
18. Quality: All fencing, posts, and gates shall be of a quality equal to standard seven foot fencing as furnished and erected by Hurricane Fence Company or Cyclone Fence Company.

### **PART 3 EXECUTION**

#### **3.01 INSTALLATION**

- A. Fence installation shall not be started before the final grading is completed, with finish grade elevations established, unless otherwise permitted.
- B. Excavation: Drill holes of diameters and spacings shown, for post footings in firm, undisturbed or compacted soil.
  1. Excavate holes to the minimum diameters as recommended by fence manufacturer.
  2. Excavate hole depths approximately 3-inches lower than the post bottom, with bottom of posts set not less than 36-inches below the surface when in firm, undisturbed soil.
  3. If solid rock is encountered near the surface, drill into rock at least 12-inches for line posts and at least 18-inches for end, pull corner, and gate posts. Drill hole at

least 1-inch greater diameter than the largest dimension for the post to be placed. If solid rock is below soil overburden, drill to full depth required. Penetration into rock need not exceed the minimum depths specified above.

- C. Setting Posts: Remove loose and foreign materials from sides and bottoms of holes and moisten soil prior to placing concrete.
  - 1. Center and align posts in holes 3-inches above bottom of excavation.
  - 2. Place concrete around posts in a continuous pour and vibrate or tamp for consolidation. Check each post for vertical and top alignment and hold in position during placement and finishing operations.
  - 3. Trowel finish tops of footings and slope of dome to direct water away from posts. Extend footings for gate posts to the underside of bottom hinge. Set keeps, stops, sleeves and other accessories into concrete as required.
  - 4. Grout-in posts set into sleeved holes, concrete constructions or rock excavations with non-shrink Portland cement grout or other acceptable grouting material.
- D. Concrete Strength: Allow concrete to attain at least 75 percent of its minimum 28 day compressive strength, but in no case sooner than seven days after placement, before rails, tension wires, barbed wire or fabric is installed. Do not stretch and tension fabric and wires and do not hang gates until the concrete has attained its full design strength.
- E. Top Rails: Run rail continuously through post caps or extension arms, bending to radius for curved runs. Provide expansion couplings as recommended by fencing manufacturer.
- F. Brace Assemblies: Install braces so posts are plumb when diagonal rod is under proper tension.
- G. Tension Wire: Install tension wires by weaving through the fabric and tying to each post with not less than 6 gauge galvanized wire or by securing the wire to the fabric.
- H. Fabric: Pull fabric taut and tie to posts, rails and tension wires. Install fabric on security side of fence and anchor to framework so that fabric remains in tension after pulling force is released.
- I. Repair damaged coatings in the shop or during field erection by recoating with manufacturer's recommended repair compound, applied per manufacturer's directions.
- J. Stretcher Bars: Thread through or clamp to fabric 4-inches on center and secure to posts

with metal bands spaced 15-inches on center.

- K. Barbed Wire: Install three parallel wires on each extension arm; on security side of fence, unless otherwise indicated. Pull wire taut and fasten securely to each extension arm.
- L. Tie Wires: Use U-shaped wire appropriate for the diameter of pipe. Attach pipe and fabric firmly with tie wire ends twisted at least two full turns. Bend ends of wire to minimize hazard to persons or clothing.
- M. Fasteners: Install nuts for tension band and hardware bolts on side of fence opposite fabric side. Peen ends of bolts or score threads to prevent removal of nuts.

### **3.02 CLEANING**

Perform cleaning during installation of the work and upon completion of the work. Remove from site all debris and equipment. Repair all damage resulting from chain link fence system installation.

**END OF SECTION**

**PART 1 GENERAL****1.01 SCOPE**

- A. Work described in this Section includes furnishing all labor, materials, equipment, tools and incidentals required for a complete and operable installation of all submersible pumps, motors and controls. All equipment shall be installed, adjusted, tested and placed in operation in accordance with these Specifications and the manufacturer's recommendations.
- B. Associated wetwell, piping, valves and valve vault shall be as specified in Sections 02730 and 02731.

**1.02 QUALIFICATIONS**

The pump manufacturer shall have similar units in operation for a minimum of five years in the United States.

**1.03 DESIGN REQUIREMENTS**

- A. Pumps shall be totally submersible, electric motor driven, non-clog, sewage pumps.
- B. The pump manufacturer shall review design and layout drawings to insure that installation arrangements are suitable for their equipment. Any potential conflicts or recommended modification shall be noted on the shop drawings or by a pre-submittal request for information if appropriate. Any modifications required to satisfy manufacturer's recommendations shall be at the Contractor's expense.
- C. Operating requirements for pumps shall be as shown in Table 1 of this Section.
- D. The operating range of the pump shall include minimum head, rated and shut-off conditions. The pumps shall be non-overloading throughout the entire range of the pump curve.
- E. Pumps with cooling jackets shall allow for continuous, unsubmerged operation without supplementary cooling. Pumps without cooling jackets shall allow continuous operation with a minimum submergence of one-half the stator housing height. Pumps shall be capable of running continuously at design capacity and head for a period of at least two hours with a water level at the top of the pump volute without overheating or damage to seals or watertight integrity.
- F. Pump design shall incorporate an automatic discharge connection, allowing each unit to be removed for inspection or service by simply lifting the pump. Re-connection shall require only lowering of the pump into position.

**1.04 SUBMITTALS**

- A. Submit shop drawings for all equipment furnished. Specific submittal information shall include:
1. Pump manufacturer's name, pump size or model number, weight and a descriptive bulletin of the pump to be furnished.
  2. Outline dimension drawings of the pump.
  3. Pump characteristic curves showing head capacity and horsepower, including minimum head, rated and shutoff conditions.
  4. Motor manufacturer's name, motor horsepower, RPM and frame size, weight and descriptive bulletin of the motor to be furnished. Include motor manufacturer's certified dimension sheet that lists motor features and include typical motor data sheet.
  5. Control panel schematics, panel dimensions and layout, and product data sheets.
- B. Operation and maintenance manuals shall be furnished for the equipment.

**1.05 STORAGE AND PROTECTION**

Pumps and accessories shall be stored and protected in accordance with the manufacturer's recommendations.

**1.06 QUALITY ASSURANCE**

The manufacturer shall provide a written certification to the County that all equipment furnished complies with all applicable requirements of these Specifications.

**PART 2 PRODUCTS****2.01 ACCEPTABLE MANUFACTURERS**

Pumps shall be as manufactured by Flygt.

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## 2.02 MATERIALS AND CONSTRUCTION

### A. Pump Construction

1. All major parts, such as the stator casing, oil casing, volute, sliding bracket and discharge connection shall be of gray iron. All exposed bolts and nuts shall be stainless steel. All mating surfaces of major parts shall be machined and fitted with rubber O-ring seals where watertight sealing is required. All parts shall be interchangeable and watertight sealing shall not require additional machining of replacement parts, sealing compounds, or the application of specific torques to connectors.
2. No portion of the pump unit shall bear directly on the floor of the wet well. There shall be no more than one 90 degree bend allowed between the volute discharge flange and station piping.
3. A sliding guide bracket shall be an integral part of the pump unit. The volute casing shall have a machined discharge flange which automatically connects directly to, or through an intermediate coupling to a discharge base. The discharge base shall be bolted to the floor of the sump and shall have a flanged connection to the discharge piping. There shall be no need for adjustment, fasteners, clamps, or other devices to connect the pump to the discharge base.

### B. Impeller

1. A wear ring system shall be installed to provide efficient sealing between the volute and impeller. The impeller shall be gray cast iron, BN 200 minimum, of non-clogging design, capable of handling solids, fibrous material, heavy sludge and other matter found in normal sewage applications.
2. The impeller shall be constructed with a long throughlet without acute turns. The impeller shall be dynamically balanced. Static and dynamic balancing operations shall not deform or weaken it. The impeller shall be a slip fit or taper fit to the shaft and key driven. Non-corroding fasteners shall be used.

- C. Mix Flush Valve: One pump shall be equipped with an ITT-Flygt Mix-Flush Valve. This valve will automatically flush the sump during initial operation of the designated pump. The valve will be a ball type valve and will have a means of adjustment to obtain the desired flushing period. No electrical components or cables shall be required for any part of the valve operation.

#### D. Shaft Seals

1. Each pump shall be provided with a mechanical, rotating shaft seal system running in an oil reservoir having separate, constantly hydro-dynamically lubricated, lapped seal faces. The lower seal unit between the pump and oil chamber shall contain one stationary and one positively driven, rotating tungsten-carbide. The upper seal unit between the oil sump and motor housing shall contain one stationary tungsten-carbide and one positively driven rotating tungsten-carbide ring.
2. Each interface shall be held in contact by its own independent spring system, supplemented by external liquid pressures. The seals shall require neither maintenance nor adjustment, but shall be easily inspected and replaceable. No seal damage shall result from operating the pumping unit out of its liquid environment. The seal system shall not rely upon the pumped media for lubrication. The oil reservoir shall have a drain and inspection plug, with positive seal, which shall be easily accessible from outside the pump.

### 2.03 GUIDE BARS

Guide bars shall be stainless steel pipe attached to the automatic discharge connection at their lower end and to an upper guide bar bracket at their upper end. Intermediate guide bar supports shall be provided as required to insure a rigid installation. Guide bars shall not support any of the weight of the pump.

### 2.04 MOTOR

#### A. Pump Motor

1. Pump motors shall be designed in accordance with the standards of NEMA to operate at a standard 40 degree C ambient temperature. The motor shall be designed for continuous duty capable of sustaining a minimum of 15 evenly spaced starts per hour. Refer to Table 1 for additional pump characteristics.
2. The motor shall be housed in a watertight casing. The pump shaft shall be a one-piece, solid shaft of AISI 400 Series stainless steel or C1034 carbon steel and shall be completely isolated from the pumped liquid.
3. The shaft shall be supported above and below the rotor by anti-friction bearings designed to provide long life and minimize shaft deflection. At least one bearing shall be double row type. Bearings shall have a minimum AFBMA B10 life of 40,000 hours.
4. The design may, if required, incorporate a positive, circulated cooling system to

cool the motor. Passages for cooling media, where used, shall be adequately dimensioned to prevent clogging.

5. Thermal sensors shall be provided to monitor stator temperature. One thermal switch shall be imbedded in the end coils of each stator winding. The thermal switch shall be used in conjunction with, and in addition to, external motor protection and shall be wired into the control panel. Thermal switches will be set to open at 125 degrees Celsius.
6. Motors shall have a maximum rotating speed of 1,800 RPM.
7. Motors shall be 3-phase, 60 Hz, 230/460 volt electric current.

**B. Cable**

1. Cable shall be suitable for submersible pump applications and this shall be indicated by a code or legend permanently embossed on the cable. Cable sizing shall conform to NEC specifications for pump motors.
2. The cable entry sealing fitting shall relieve stress on conductors and provide a watertight and submersible seal, without the use of sealing compounds and without the application of specific torques to connectors. The conductors shall connect to a terminal board which shall be provided with a moisture-tight seal between the cable entry junction chamber and the motor.

## **2.05 CONTROLS**

**A. Supplier:** All controls specified shall be furnished by the pump manufacturer.

**B. Pump Control Panel**

1. Furnish a complete pump control package for each station as specified below and in Table 1.
2. **Power Supply:** Power supply shall be as shown in Table 1. Each control panel shall have a main disconnect switch. All controls shall operate on 120 volts maximum. Provide a suitably sized control power transformer, 120/240 volt secondary, with primary and secondary overcurrent protection. Provide control power transformer spare capacity and 2 pole, 240 volt breaker sized per Table 1 to supply generator accessories, or minimum 3kVA spare capacity for installations with no on-site generator. In addition, provide 4-20 amp 1 pole breakers to supply other station auxiliary devices. Equip one auxiliary circuit with front panel On/Off selector (area light).

3. Starters: NEMA rated, circuit breaker combination type, with overcurrent protection in each phase. Starters are reduced voltage type, solid state and shall be equivalent to Allen-Bradley (SMC) for 20hp and above. For starters below 20hp, across the line starters are to be used.
  4. Surge Protection: Equip each panel with main panel protection equal to Advanced Protection Technologies TE Thousand Series.
  5. Provide a means to automatically transfer service to the on-site generator or manually transfer service to the generator receptacle, as appropriate.
  6. Panel Construction: Route all wiring in Panduit or similar wireways. Protect all wiring across panel hinges. Provide numbered terminal strips for all field wiring terminations. Use barriers to separate 480 volt from 120 and lower voltage sections.
- C. Alarm Horn: Alarm horn shall be weatherproof, flush-mounted on side end of the control panel.
- D. Alarm Light: Shall be red, weatherproof, flush-mounted on top of the control panel.
- E. Generator Receptacle: If required, the generator receptacle shall be compatible with the Lowndes County portable generator and equal to Model JRS1044FR manufactured by Russellstoll.
- F. Enclosures: Control panels shall be housed in NEMA 3R rated enclosure. The enclosure shall provide temperature and climate control suitable for the equipment furnished in the enclosure. Enclosure shall incorporate a single handle actuated three-point latch closing mechanism.
- G. Liquid Level Sensor: Level sensing and monitoring shall be accomplished utilizing a MultiTrode level sensing probe and MT2PC pump controller.
- H. Downloadable Control/Communicator (ADAM) – (If required)
1. Provide one downloadable control/communicator in each pumping station control panel. The unit shall be a "DSC PC1555MX" model as manufactured by Digital Security Controls Ltd, Toronto Canada, and as installed by Action Alarms, Inc., Valdosta, Georgia. Provide accessory package B-1204, 12 volt, 4 ampere-hour battery back-up. The unit shall be configured to automatically notify Lowndes County operating personnel of the following conditions:
    - a. High Wet Well Level

- b. Loss of normal electrical power (from automatic transfer switch, normally open contact close on loss of utility power, as applicable)
  - c. Low Wet Well Level
2. The Contractor shall arrange with the local telephone company to provide voice-grade dial-up telephone line to the pumping station. The telephone line shall terminate within the control panel in close proximity to the downloadable control/communicator.
  3. ADAM unit and a 110-volt receptacle shall be provided in a separate NEMA 4X enclosure. This enclosure and receptacle shall be provided by the Contractor, not Action Alarms, Inc.

## **2.06 ACCESSORIES**

- A. Lifting Cable: Provide each pump with a lifting device equal to Flygt's "Grip Eye" system. This system shall consist of stainless steel cable connected to stainless steel chain, attached to the lifting bail of the pump. A forged "grip-eye" of wrought alloy steel shall be provided to be used with the hoist or lifting mechanism.
- B. Aluminum Floor Doors: Provide as specified in Section 02730 of these Specifications.

## **PART 3 EXECUTION**

### **3.01 INSTALLATION**

- A. Equipment Installation: All equipment shall be installed in accordance with approved shop drawings, the manufacturer's recommendations and these Specifications.
- B. Anchorage: Stainless steel anchor bolts, nuts and washers, as well as any templates necessary for setting the anchorage, shall be furnished by the equipment manufacturer. Placement of the anchor bolts shall be done by the Contractor from certified dimension shop drawings supplied by the equipment manufacturer.
- C. Leveling and Grouting
  1. Level and align pump and motor in accordance with the respective manufacturer's published data.
  2. Grout pump and discharge base with non-shrink grout in accordance with the ACI and the equipment manufacturer's and grout manufacturer's published specifications.
- D. Floor Doors: Floor doors shall be integrally cast into the top of the manhole. The pump manufacturer shall verify the size and location with the Contractor prior to installation of

each floor door. Floor doors shall be cast into concrete in accordance with the manufacturer's recommendations.

**3.02 INSPECTION AND TESTING**

Following installation, operating tests will be performed demonstrating to the County that each mechanism and the system as a whole will function in a satisfactory manner. The Contractor shall make, at Contractor's own expense, all necessary changes, modifications and/or adjustments required to ensure satisfactory performance.

**3.03 CLEANING**

Prior to acceptance of the work of this Section, thoroughly clean all installed materials, equipment and related areas.

**TABLE 1  
SUBMERSIBLE PUMPS**

Pumping Station Name	*
Rated Capacity, gpm	*
Rated TDH, feet	*
Maximum Runout Head, feet	*
Maximum Capacity at Runout, gpm	*
Minimum Shutoff Head, feet	*
Motor Voltage/Phase	230/3 or 460/3
Motor Horsepower	*
Diameter Solids Handled, inches	3
Type of Control	Duplex
Control Panel Enclosure Type	SS NEMA 3R
Junction Box Type	SS NEMA 4X
Control Panel Designation	CP-*
Level Controls Type	MultiTrode
Low Water Level Alarm	Yes
All Pumps Off	Yes
Lead Pump On	Yes
Lag Pump On	Yes
High Water Level Alarm	Yes
Miscellaneous Control Features	
Elapsed Time Meter for Each Pump	Yes
Alarm Light on Top of Control Panel	Yes
Alarm Horn w/Silence Button on Exterior of Control Panel	Yes
Pump No. 1 Run Light	Yes
Pump No. 2 Run Light	Yes
H-O-A Switch	Yes
Automatic Pump Alternation	Yes
Pump Sequence Selector	Yes
115 Volt Duplex Utility Outlet	Yes
Site Light On/Off Switch	Yes
Adjustable (5-120 second) Time Delay Relay in Lag Pump Starting Circuit	Yes
Alarm Horn and Alarm Light shall be Activated Simultaneously When any of these Faults Occur	Low Wet Well Level High Wet Well Level

\* To be determined by Developer's design Georgia registered professional engineer and which must meet the approval of Lowndes County.

**END OF SECTION**

**PART 1 GENERAL**

**1.01 GENERAL DESCRIPTION**

The work covered under this Section includes furnishing all labor, materials, equipment, tools and incidentals required for a complete and operable installation of a complete factory-built and tested Grinder Pump Station(s), each consisting of grinder pump(s) suitably mounted in a basin constructed of high density polyethylene (HDPE) for simplex stations and HDPE or Fiberglass Reinforced Polyester Resin for duplex stations, NEMA 6P electrical quick disconnect (EQD), pump removal system, shut-off valve, anti-siphon valve, check valve, each assembled in the basin, electrical alarm panel, and all necessary internal wiring and controls. Component type grinder pump systems that require field assembly will not be acceptable. For ease of serviceability, all pump(s), motor/grinder units shall be of like type and horsepower throughout the system.

**1.02 SUBMITTALS**

Submit a minimum of six (6) sets of shop drawings detailing the equipment to be furnished including dimensional data and materials of construction.

**1.03 MANUFACTURER**

Grinder pump station(s) shall be as manufactured by Environment One Corporation.

**1.04 OPERATING CONDITIONS**

The pumps shall be capable of delivering 15 GPM against a rated total dynamic head of 0 feet (0 PSIG) and 9 GPM against a rated total dynamic head of 138 feet (60 PSIG). The pump(s) must also be capable of operating at negative total dynamic head without overloading the motor(s). Under no conditions shall in-line piping or valving be allowed to create a false apparent head.

**1.05 WARRANTY**

Environment One Corporation shall provide a part(s) and labor warranty on the complete station and accessories, including, but not limited to, panel and redundant check valve, for a period of twenty-four (24) months after notice of County's acceptance, but no greater than twenty-seven (27) months after receipt of shipment. Any manufacturing defects found during the warranty period will be reported to Environment One Corporation by the County and will be corrected by

Environment One Corporation at no cost to the County.

**PART 2      PRODUCT**

**2.01          PUMP**

The pump shall be a custom designed, integral, vertical rotor, motor driven, solids handling pump of the progressing cavity type with a single mechanical seal. The rotor shall be through-hardened, highly polished, precipitation hardened stainless steel. Plating on the rotor will not be acceptable due to its tendency to delaminate. The stator shall be of a specifically compounded ethylene propylene synthetic elastomer. The material shall be suitable for domestic wastewater service. Its physical properties shall include high tear and abrasion resistance, grease resistance, water and detergent resistance, temperature stability, excellent aging properties, and outstanding wear resistance. Buna-N is not acceptable as a stator material because it does not exhibit the properties as outlined above and required for wastewater service.

**2.02          GRINDER**

- A. The grinder shall be placed immediately below the pumping elements and shall be direct-driven by a single, one-piece motor shaft. The grinder impeller assembly shall be securely fastened to the pump motor shaft by means of a threaded connection attaching the grinder impeller to the motor shaft. Attachment by means of pins or keys will not be acceptable. The grinder will be of the rotating type with a stationary hardened and ground stainless steel shredding ring spaced in close annular alignment with the driven impeller assembly, which shall carry two hardened type 400 series stainless steel cutter bars.
  
- B. This assembly shall be dynamically balanced and operate without objectionable noise or vibration over the entire range of recommended operating pressures. The grinder shall be constructed so as to eliminate clogging and jamming under all normal operating conditions including starting. Sufficient vortex action shall be created to scour the tank free of deposits or sludge banks which would impair the operation of the pump. These requirements shall be accomplished by the following, in conjunction with the pump:
  - 1. The grinder shall be positioned in such a way that solids are fed in an upward flow direction.
  - 2. The maximum flow rate through the cutting mechanism must not exceed 4

feet per second. This is a critical design element to prevent jamming and as such must be adhered to.

3. The inlet shroud shall have a diameter of no less than 5 inches. Inlet shrouds that are less than 5 inches in diameter will not be accepted due to their inability to maintain the specified 4 feet per second maximum inlet velocity which by design prevents unnecessary jamming of the cutter mechanism and eliminates blinding of the pump by large objects blocking the inlet shroud.
  4. The impeller mechanism must rotate at a nominal speed of no greater than 1800 rpm.
- C. The grinder shall be capable of reducing all components in normal domestic sewage, including a reasonable amount of "foreign objects," such as paper, wood, plastic, glass, rubber and the like, to finely-divided particles which will pass freely through the passages of the pump and the 1-1/4" diameter stainless steel discharge piping.

### **2.03 ELECTRIC MOTOR**

As a maximum, the motor shall be a 1 HP, 1725 RPM, 240 Volt 60 Hertz, 1 Phase, capacitor start, ball bearing, air-cooled induction type with a low starting current not to exceed 30 amperes and high starting torque of 8.4 foot pounds. Inherent protection against running overloads or locked rotor conditions for the pump motor shall be provided by the use of an automatic-reset, integral thermal overload protector incorporated into the motor. This motor protector combination shall have been specifically investigated and listed by Underwriters Laboratories, Inc., for the application. Non-capacitor start motors or permanent split capacitor motors will not be accepted because of their reduced starting torque and consequent diminished grinding capability. To reduce the potential of environmental concerns, the expense of handling and disposing of oil, and the associated maintenance costs, oil-filled motors will not be accepted.

### **2.04 MECHANICAL SEAL**

The pump/core shall be provided with a mechanical shaft seal to prevent leakage between the motor and pump. The seal shall have a stationary ceramic seat and carbon rotating surface with faces precision lapped and held in position by a stainless steel spring.

**2.05 TANK AND INTEGRAL ACCESSWAY: MODEL 2010**

- A. The tank shall be made of high density polyethylene, with a melt index of 2.0 grams/10 minutes or lower to assure high environmental stress cracking resistance. Corrugated sections are to be made of a double wall construction with the internal wall being generally smooth to promote scouring. Corrugations of the outside wall are to be of a minimum amplitude of 1 1/2" to provide necessary transverse stiffness. Any incidental sections of a single wall construction are to be a minimum .250 inch thick. All seams created during tank construction are to be thermally welded and factory tested for leak tightness. Tank wall and bottom must withstand the pressure exerted by saturated soil loading at maximum burial depth. All station components must function normally when exposed to 150 percent of the maximum external soil and hydrostatic pressure.
- B. The tank shall be furnished with one EPDM grommet fitting to accept a 4.50" OD DWV or Schedule 40 pipe. Tank capacities shall be as specified.
- C. The accessway shall be an integral extension of the wet well assembly and include a lockable cover assembly providing low profile mounting and watertight capability. Accessway design and construction shall enable field adjustment of station height in increments of 4" or less without the use of any adhesives or sealants requiring cure time before installation can be completed.
- D. The station shall have all necessary penetrations molded in and factory sealed. To ensure a leak free installation no field penetrations shall be acceptable.
- E. All discharge piping shall be constructed of 304 Series Stainless Steel and terminate outside the accessway bulkhead with a stainless steel, 1 1/4 inch female NPT fitting. The discharge piping shall include a stainless steel ball valve rated for 200 psi WOG; PVC ball valves will not be accepted. The bulkhead penetration shall be factory installed and warranted by the manufacturer to be watertight.
- F. The accessway shall include a single NEMA 6P electrical quick disconnect (EQD) for all power and control functions, factory installed with accessway penetrations warranted by the manufacturer to be watertight. Plug-type connections of the power cable onto the pump housing will not be acceptable due to the potential for leaks and electrical shorts. The accessway shall also include a 2-inch PVC vent to prevent sewage gases from accumulating in the tank.

**2.06 TANK & INTEGRAL ACCESSWAY: MODELS 2012 & 2014**

- A. The tank shall be made of rotationally molded high density polyethylene, with a melt index of 2.0 grams/10 minutes or lower to assure high environmental stress cracking resistance. The tank shall have a nominal thickness of 1/2". All seams created during tank construction are to be thermally welded and factory tested for leak tightness. Tank wall and bottom must withstand the pressure exerted by saturated soil loading at maximum burial depth. All station components must function normally when exposed to 150 percent of the maximum external soil and hydrostatic pressure.
- B. The tank shall be furnished with one EPDM grommet fitting to accept a 4.50" OD DWV or schedule 40 pipe. Tank capacities shall be as specified.
- C. The accessway shall be an integral extension of the wet well assembly and include a lockable cover assembly providing low profile mounting and watertight capability. Accessway design and construction shall facilitate field adjustment of station height in increments of 3" without the use of any adhesives or sealants requiring cure time before installation can be completed.
- D. The station shall have all necessary penetrations molded in and factory sealed. To ensure a leak-free installation, no field penetrations shall be acceptable.
- E. All discharge piping shall be constructed of 304 Series Stainless Steel and terminate outside the accessway bulkhead with a stainless steel, 1 1/4 inch female NPT fitting. The discharge piping shall include a stainless steel ball valve rated for 200 psi WOG; PVC ball valve will not be accepted. The bulkhead penetration shall be factory installed and warranted by the manufacturer to be watertight.
- F. The accessway shall include a single NEMA 6P electrical quick disconnect (EQD) for all power and control functions, factory installed with accessway penetrations warranted by the manufacturer to be watertight. Plug-type connections of the power cable onto the pump housing will not be acceptable due to the potential for leaks and electrical shorts. The accessway shall also include a 2 inch PVC vent to prevent sewage gases from accumulating in the tank.

**2.07 TANK & INTEGRAL ACCESSWAY: MODELS 2015 & 2016**

- A. The tank shall be custom molded of fiberglass reinforced polyester resin. Tank wall and bottom must withstand the pressure exerted by saturated soil loading at maximum burial depth. All station components must function normally when exposed to 150 percent maximum external soil and hydrostatic pressure.

- B. The tank shall be furnished with one EPDM grommet fitting to accept a 4.50" OD DWV or schedule 40 pipe. Tank capacities shall be as specified.
- C. The accessway shall be an integral extension of the wet well assembly and include a lockable cover assembly providing low profile mounting and watertight capability. Accessway design and construction shall facilitate field adjustment of station height in increments of 3" without the use of any adhesives or sealants requiring cure time before installation can be completed.
- D. The station shall have all necessary penetrations molded in and factory sealed. To ensure a leak-free installation, no field penetrations shall be acceptable.
- E. All discharge piping shall be constructed of 304 Series Stainless Steel and terminate outside the accessway bulkhead with a stainless steel, 1 1/4 inch female NPT fitting. The discharge piping shall include a stainless steel ball valve rated for 200 psi WOG; PVC ball valve will not be accepted. The bulkhead penetration shall be factory installed and warranted by the manufacturer to be watertight.
- F. The accessway shall include a single NEMA 6P electrical quick disconnect (EQD) for all power and control functions, factory installed with accessway penetrations warranted by the manufacturer to be watertight. Plug-type connections of the power cable onto the pump housing will not be acceptable due to the potential for leaks and electrical shorts. The accessway shall also include a 2 inch PVC vent to prevent sewage gases from accumulating in the tank.

**2.08 CHECK VALVE**

- A. The pump discharge shall be equipped with a factory installed, gravity operated, flapper-type integral check valve built into the stainless steel discharge piping. The check valve will provide a full-ported passageway when open, and shall introduce a friction loss of less than 6 inches of water at maximum rated flow. Moving parts will be made of a 300 series stainless steel and fabric reinforced synthetic elastomer to ensure corrosion resistance, dimensional stability, and fatigue strength. A nonmetallic hinge shall be an integral part of the flapper assembly providing a maximum degree of freedom to assure seating even at a very low back-pressure. The valve body shall be an injection molded part made of glass filled PVC. Ball type check valves are unacceptable due to their limited sealing capacity in slurry applications.
- B. Each grinder pump installation shall also include one separate check valve of the type detailed in paragraph above for installation in the 1 1/4" service lateral between the grinder pump station and the sewer main, preferably at the right-of-

way.

## **2.09 ANTI-SIPHON VALVE**

The pump discharge shall be equipped with a factory-installed, gravity-operated, flapper-type integral anti-siphon valve built into the stainless steel discharge piping. Moving parts will be made of 300 series stainless steel and fabric-reinforced synthetic elastomer to ensure corrosion resistance, dimensional stability, and fatigue strength. A nonmetallic hinge shall be an integral part of the flapper assembly, providing a maximum degree of freedom to ensure proper operation even at a very low pressure. The valve body shall be injection-molded from a glass-filled thermoplastic resin. Holes or ports in the discharge piping are not acceptable anti-siphon devices, due to their tendency to clog from the solids in the slurry being pumped.

## **2.10 CORE UNIT**

The Grinder Pump Station shall have cartridge type, easily removable core assembly consisting of pump, motor, grinder, all motor controls, check valve, anti-siphon valve, level control, electrical quick disconnect and wiring. The watertight integrity of each core unit, shall be established by 100 percent factory test at a minimum of 5 PSIG.

## **2.11 CONTROLS**

- A. All necessary controls, including motor and level controls, shall be located in the top housing of the core unit. The top housing will be attached with stainless steel fasteners.
- B. Non-fouling wastewater level controls for controlling pump operation shall be accomplished by monitoring the pressure changes in an integral air column connected to a pressure switch. The level detection device shall have no moving parts in direct contact with the wastewater. High-level sensing will be accomplished in the manner detailed above by a separate air-bell sensor and pressure switch of the same type. Closure of the high-level sensing device will energize an alarm circuit as well as a redundant pump-on circuit. For increased reliability, pump ON/OFF and High-level alarm functions shall not be controlled by the same switch. Float switches of any kind, including float trees, will not be accepted due to the periodic need to maintain (rinsing, cleaning) such devices.

- C. To assure reliable operation of the pressure switches, each core shall be equipped with a breather assembly, complete with a suitable means to prevent accidental entry of water into the motor compartment. The grinder pump will be furnished with a 6 conductor 14 gauge, type SJOW cable, pre-wired and watertight to meet UL requirements with a FACTORY INSTALLED NEMA 6P EQD half attached to it.

## **2.12 ALARM PANEL**

- A. Each grinder pump station shall include a NEMA 4X, UL listed ALARM PANEL suitable for wall mounting. The NEMA 4X enclosure shall be manufactured of thermoplastic to assure corrosion resistance. The enclosure shall include a hinged, lockable cover, padlock, and secured dead front. The enclosure shall not exceed 11.38"W x 13.5"H x 5.63"D.
- B. For each core, the panel shall contain one (1) 15 amp, double pole circuit breaker for the power circuit and one (1) 15 amp single pole circuit breaker for the alarm circuit. The panel shall contain terminal blocks, integral power bus, push to run feature and a complete alarm circuit.
- C. The Alarm Panel shall include the following features: audio & visual alarm, push-to-run switch, and high level (redundant) pump starting control. The alarm sequence is to be as follows:
  - 1. When liquid level in the sewage wet-well rises above the alarm level, visual and audio alarms will be activated. The contacts on the alarm pressure switch will close. The redundant pump starting system will be energized.
  - 2. The audio alarm may be silenced by means of the externally mounted, push-to-silence button.
  - 3. Visual alarm remains illuminated until the sewage level in the wet-well drops below the "off" setting of the alarm pressure switch.
- D. The visual alarm lamp shall be inside a red fluted lens at least 2 5/8" in diameter and 1 11/16" in height. Visual alarm shall be mounted to the top of the enclosure in such a manner as to maintain NEMA 4X rating. For duplex units, in addition to the above, two high level indicator lights shall be mounted behind the access cover.

- E. During a high level alarm condition on a duplex station, the appropriate light will illuminate to indicate which pump core requires servicing. The audio alarm shall be a printed circuit board in conjunction with an 86 dB buzzer with quick mounting terminal strip mounted in the interior of the enclosure. The audio alarm shall be capable of being deactivated by depressing a push-type switch which is encapsulated in a weatherproof silicone boot and mounted on the bottom of the enclosure.
- F. The entire Alarm Panel as manufactured, shall be listed by Underwriters Laboratories, Inc.

**2.13 SERVICEABILITY**

The grinder pump core unit shall have two lifting hooks complete with nylon lift-out harness connected to its top housing to facilitate easy core removal when necessary. All mechanical and electrical connections must provide easy disconnect capability for core unit removal and installation. A push-to-run feature will be provided for field trouble shooting. All motor control components shall be mounted on a readily replaceable bracket for ease of field service.

**2.14 OSHA CONFINED SPACE**

All maintenance tasks for the grinder pump station must be possible without entry into the grinder pump station (as per OSHA 1910.146, permit-required confined spaces). "Entry means the action by which a person passes through an opening into a permit-required confined space. Entry includes ensuing work activities in that space and is considered to have occurred as soon as any part of the entrant's body breaks the plane of an opening into the space."

**2.15 SAFETY**

- A. The Grinder Pump shall be free from electrical and fire hazards as required in a residential environment. As evidence of compliance with this requirement, the completely assembled and wired Grinder Pump Station shall be listed by Underwriters Laboratories, Inc., to be safe and appropriate for the intended use. UL listing of components of the station, or third-party testing to UL standard will not be acceptable.
- B. The grinder pump shall meet accepted standards for plumbing equipment for use in or near residences, shall be free from noise, odor, or health hazards, and shall have been tested by an independent laboratory to certify its capability to perform

as specified in either individual or low pressure sewer system applications. As evidence of compliance with this requirement, the grinder pump shall bear the seal of NSF International. Third-party testing to NSF standard will not be acceptable.

**PART 3 EXECUTION**

**3.01 FACTORY TEST**

- A. Each grinder pump shall be submerged and operated for 5 minutes (minimum). Included in this procedure will be the testing of all ancillary components such as, the anti-siphon valve, check valve, discharge assembly and each unit's dedicated level controls and motor controls. All factory tests shall incorporate each of the above listed items. Actual appurtenances and controls which will be installed in the field shall be particular to the tested pump only. A common set of appurtenances and controls for all pumps will not be acceptable. Certified test results shall be available upon request showing the operation of each grinder pump at two (2) different points on its curve, with the maximum pressure no less than 60 psi. The County reserves the right to inspect such testing procedures.
- B. All completed stations shall be factory leak tested to assure the integrity of all joints, seams and penetrations. All necessary penetrations such as inlets, discharge fittings and cable connectors shall be included in this test along with their respective sealing means (grommets, gaskets etc.).

**3.02 DELIVERY**

All Grinder Pump units will be delivered to the County Utility Shop 100 percent completely assembled, including testing, ready for installation. Grinder pump units will be individually mounted on wooden pallets. County will remove and store pump unit until such time that the tank assembly has been installed by the developer and/or contractor and approved by County.

**3.03 INSTALLATION**

- A. Earth excavation and backfill are specified under Section 02200 and Section 02225, but are also to be done as a part of the work under this section, including any necessary sheeting and bracing.
- B. The developer and/or contractor shall be responsible for handling ground water to provide a firm, dry subgrade for the structure, and shall guard against flotation or

## SEMI-POSITIVE DISPLACEMENT TYPE GRINDER PUMP STATIONS

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other damage resulting from general water or flooding.

- C. The Grinder Pump Stations shall not be set into the excavation until the installation procedures and excavation have been approved by the County.
- D. Remove packing material. User's instructions MUST be given to the County. Hardware supplied with the unit, if required, will be used at installation. The basin will be supplied with a standard 4" inlet grommet (4.50" OD) for connecting the incoming sewer line. Appropriate inlet piping must be used. The basin may not be dropped, rolled or laid on its side for any reason.
- E. Installation shall be accomplished so that 1" to 4" of accessway, below the bottom of the lid, extends above the finished grade line. The finished grade shall slope away from the unit. The diameter of the excavated hole must be large enough to allow for the concrete anchor, if needed.
- F. If the concrete is poured in place, the unit shall be leveled, and filled with water, to the bottom of the inlet, to help prevent the unit from shifting while the concrete is being poured. The concrete must be manually vibrated to ensure there are no voids. If it is necessary to pour the concrete to a level higher than the inlet piping, an 8" sleeve is required over the inlet prior to the concrete being poured. Another option is the use of a flowable fill (i.e., low slump concrete). Flowable fills should not be dropped more than four feet from the discharge to the bottom of the hole to avoid separation of the constituent materials.
- G. A 6" inch (minimum) layer of naturally rounded aggregate, clean and free flowing, with particle size of not less than 1/8" or more than 3/4" shall be used as bedding material under each unit.
- H. Provide and install a four (4) foot piece of four inch SCH 40 PVC pipe with water tight cap, to stub-out the inlet for the property owners' installation contractor, as depicted on the contract drawings.
- I. The electrical enclosure shall be furnished, installed and wired to the Grinder Pump Station. An alarm device is required on every installation. It will be the responsibility of the developer and/or contractor to coordinate with the individual property owner(s) to determine the optimum location for the Alarm Panel.
- J. The alarm device shall be mounted in a conspicuous location, as per national and local codes. The Alarm Panel will be connected to the Grinder Pump Station by a length of six (6) conductor 12 gauge type TC cable as shown on the contract drawings. The power and alarm circuits must be on separate power circuits. The

grinder pump stations will be provided with a minimum of 32', 25' of useable electrical supply cable outside the station, to connect to the alarm panel. This cable shall be supplied with a FACTORY INSTALLED EQD half to connect to the mating EQD half on the core.

**3.04 START-UP AND FIELD TESTING**

- A. Prior to a certificate of occupancy being issued, the County will perform the following test on each station:
1. Make certain the discharge shut-off valve is fully open. This valve must not be closed when the pump is operating. In some installations, there may be a valve(s) at the street main that must also be open.
  2. Turn ON the alarm power circuit.
  3. Fill the wet well with water to a depth sufficient to verify the high level alarm is operating. Shut off water.
  4. Turn ON pump power circuit. Initiate pump operation to verify automatic "on/off" controls are operative. Pump should immediately turn ON. Within one (1) minute alarm light will turn OFF. Within three (3) minutes the pump will turn OFF.

**END OF SECTION**

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**PART 1 GENERAL**

**1.01 SCOPE**

- A. The electrical work commences with the point of electrical service where shown on the Drawings and includes furnishing all material and labor for a complete electrical installation.
- B. The requirements of Section 1 and Section 2 apply to all work hereunder and are a part of this Division of the Specifications and all provisions contained therein which affect this work are as binding as though incorporated herein.

**1.02 DEFINITIONS**

- A. Provide: Furnish, install, and connect.
- B. Product Data: Catalog cuts and descriptive literature.
- C. Shop Drawings: Factory prepared specific to the installation.
- D. Low Voltage: 0 – 600 volts.
- E. Indicated: Shown of the Drawings.
- F. Noted: Indicated or specified elsewhere.

**1.03 LOCAL CONDITIONS**

- A. Power will be supplied by the utility company overhead distribution system for the equipment. Verify and comply with all power company requirements for metering. Make necessary arrangements with the power company for temporary service requirements.
- B. Verify and comply with all requirements of the local telephone company concerning the complete telephone system to the control panel dialer.

**1.04 QUALITY ASSURANCE**

- A. Provide the complete electrical installation in accordance with the National Electrical Code (NFPA 70), Life Safety Code (NFPA 101), and in accordance with applicable local codes. Obtain all necessary permits and have all work inspected by appropriate authorities.

- B. All products shall be designed, manufactured, and tested in accordance with industry standards. Where applicable, products shall be labeled or listed by third party certification agencies.
- C. Industry Standards: Standards organizations and their abbreviations, as used herein, are as follows. Applicable date for industry standards is that in effect on the date of advertisement of the Project.
  - 1. American National Standards Institute (ANSI)
  - 2. American Society for Testing and Materials (ASTM)
  - 3. Federal Specifications (FS)
  - 4. Institute of Electrical and Electronics (IEEE)
  - 5. Insulated Cable Engineers Association (ICEA)
  - 6. National Electrical Manufacturers Association (NEMA)
  - 7. National Fire Protection Association (NFPA)
  - 8. Underwriters Laboratories, Inc. (UL)

#### **1.05 SUBMITTALS**

- A. Make all submittals in accordance with the General Requirements. Approval drawings consist of shop drawings, product data and other information as noted in the individual equipment sections. Except as noted, submittals have been returned with stamped approval.
- B. Information required “for reference” such as product samples, similar unit test reports and time current curves is for the purpose of determining the suitability of a product, selecting breaker settings, etc. This information is to be submitted at the same time as approval data; however, this information will not be returned and stamped approval is not required prior to installation.
- C. Except as noted, installation instructions are not required to be submitted. However, it is the Contractor’s responsibility to obtain installation information from the manufacturer for all equipment prior to installing the equipment.

**1.06 RECORD DRAWINGS**

- A. Furnish record drawings in accordance with the General Requirements. Record drawings consist of submittal data as listed above, operation and maintenance data, and as-built drawings. Record drawings are to reflect the final installation, including any changes during approval, manufacturing tests, and installation.
- B. In addition to other required sets, furnish one set of operation and maintenance data for all apparatus requiring service. This set is to be bound in hardback, 3-ring binder(s) located in a hinged metal cabinet in the main electrical room and shall include:
  - 1. Title page with project name; installing contractor's name, address and telephone number; date of installation and warranty period.
  - 2. Index sheet.
  - 3. Complete manufacturer's operation and maintenance data with tabs (corresponding to the index) separating each item or system. Include the name, address, and phone number of the nearest sales and service organization for each item.
- C. As-Built Drawings: Furnish one set of prints maintained at the job site at all times with all changes during construction marked thereon. Include on the as-built drawings sufficient dimensions to permit location of underground conduits.
- D. Submit the results of any tests required in the individual equipment sections.

**1.07 DELIVERY, STORAGE AND HANDLING**

- A. Ship products to the job site in their original packaging. Receive and store products in suitable manner to prevent damage or deterioration. Keep equipment upright at all times.
- B. Investigate the spaces through which equipment must pass to reach its final destination. Coordinate with the manufacturer to arrange delivery at the proper stage of construction and to provide shipping splits where necessary.

**PART 2 PRODUCTS**

**2.01 MATERIALS**

Provide only new products of the manufacturer's latest design.

**2.02 SUBSTITUTIONS**

Where the words “equal to” follow or precede the listed acceptable manufacturers, equal products of other manufacturers are acceptable and request for substitution may be made during submittal stage.

**PART 3 PRODUCTS**

**3.01 INSTALLATION**

- A. The complete installation is to be accomplished by skill electrical tradesmen, with certified or suitably qualified individuals performing all special systems installation and testing. All workmanship shall be of the highest quality, sub-standard work will be rejected.
- B. Schedule the work and cooperate with all trades to avoid delays, interferences, and unnecessary work. If any conflicts occur necessitating departures from the Drawings and Specifications, details of departures and reasons therefore shall be submitted immediately for the County’s consideration.
- C. Prior to final inspection, clean all dirt, mud and construction debris from all boxes, cabinets, manholes and equipment enclosures.

**3.02 CERTIFICATION AND TESTS**

- A. Prior to request for final review, test all systems and repair or replace all defective work. Submit with request for final review, written certification that all electrical systems are complete and operational.
- B. At the time of final review of electrical work, demonstrate the operation of electrical systems. Furnish labor, apparatus and equipment for systems’ demonstration.
- C. After final review and acceptance, turn over to the County all keys for electrical equipment locks. Present to the County or the County’s designated representative, demonstrations and oral instructions for proper operation and maintenance of the electrical equipment and systems.

**END OF SECTION**

**PART 1 GENERAL**

**1.01 SCOPE**

This Section includes basic materials and methods to all Sections of Division 16.

**1.02 SUBMITTALS**

Submit product data.

**PART 2 PRODUCTS**

**2.01 SUPPORTING DEVICES**

- A. Support Channel: 304SS.
- B. Hardware: 304SS.

**2.02 ELECTRICAL IDENTIFICATION**

- A. Nameplates: Engraved three-layer laminated plastic, black letters on white background.
- B. Wire and Cable Markers: Plastic, split sleeve or tubing type.

**PART 3 EXECUTION**

**3.01 SUPPORTING DEVICES**

- A. Fasten hangar rods, support stands, conduit clamps, etc. to building structure using expansion anchors or beam clamps.
- B. Do not fasten supports to piping, ductwork, mechanical equipment or conduit. Do not use powder actuated fastening devices. Do not drill structural steel members.

**3.02 ELECTRICAL IDENTIFICATION**

Provide nameplates for all control panels, main breakers, manual transfer switches, junction boxes, disconnect switches and other items of electrical distribution equipment. Engrave with the equipment identification as indicated; and the voltage, current and interrupting rating. Attach nameplates with screws, rivets or two-part epoxy glue for NEMA 4X enclosure; adhesives are not acceptable.

**END OF SECTION**

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**PART 1 GENERAL****1.01 SCOPE**

- A. Rigid aluminum metal conduit above grade, terminate with threaded hubs.
- B. Non-metallic conduit and fittings below grade, Schedule 80 PVC.

**1.02 SUBMITTALS**

Do not submit equipment specified in this Section.

**PART 2 PRODUCTS****2.01 ACCEPTABLE MANUFACTURERS**

- A. Conduit: Allied, Republic, Triangle or Wheatland.
- B. PVC Conduit: Amoco, Carlon or Certainteed.
- C. Fittings: Appleton, Crouse-Hinds, Oz or Thomas & Betts.
- D. Substitutions: Products equal to those listed.

**2.02 PVC COATED RIGID METAL CONDUIT AND FITTINGS**

- A. Rigid Aluminum Conduit: UL 6; ANSI C80.1; minimum size 3/4-inch.
- B. Fittings and Conduit Bodies: NEMA FB-1; zinc coated; taper-threaded type, material to match conduit. Use threaded hubs for connection of coated conduits – locknuts are not acceptable.

## **CONDUIT**

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### **2.03 RIGID NONMETALLIC CONDUIT AND FITTINGS**

- A. Conduit: NEMA TC-2; Schedule 40 PVC.
- B. Fittings and Conduit Bodies: NEMA TC-3.

## **PART 3 EXECUTION**

### **3.01 CONDUIT SCHEDULE**

- A. Except as noted, use only aluminum conduits above grade, Schedule 80 PVC below grade.
- B. Rigid nonmetallic conduit may be used underground and in or below slab on grade.
- C. Make a transition to rigid aluminum below grade or slab and continue above with rigid aluminum conduit.
- D. Coat rigid aluminum conduit through concrete slab with corrosion inhibitor, bituminous compound, or corrosion inhibiting tape.

### **3.02 CONDUIT ARRANGEMENT AND SUPPORT**

Support conduits to prevent distortion of alignment by wire pulling operations. Fasten conduits with two-part 304SS clamps and channels. For multiple runs use channel and clamps. Wire, perforated pipe straps and the like are not acceptable support means.

### **3.03 CONDUIT INSTALLATION**

- A. Cut conduit square using a saw or pipecutter and de-burr cut ends. Paint threads with corrosion inhibiting compound (Nolox). Bring conduit to the shoulder of fittings and couplings and fasten securely. All connections are to be wrench tightened and electrically continuous. No running threads are permitted.
- B. Use conduit hubs for fastening conduit to metal boxes in damp or wet locations. Use conduit bodies to make sharp changes in direction. For sizes 2-inches and larger, use "LB" or similar fittings to permit a straight pull from either direction.
- C. Use hydraulic one-shot conduit bender or factory elbows for bends in conduit larger than 2-inch size. Crushed or deformed conduits may not be installed.

- D. Avoid moisture traps where possible; where unavoidable, provide junction box with drain fitting at conduit low point.
- E. Use suitable conduit caps to protect installed conduit against entrance of dirt and moisture.
- F. Provide a 200 pound tensile strength polyolefin line pulled through and tied off at each end of all empty conduits.
- G. Seal all conduits with electricians putty (Duct Seal).
- H. Protect conduit threads from damage during construction.
- I. Wipe plastic conduit clean and dry before joining. Apply full even coat of cement to entire area that will be inserted into fitting. Let joint cure for 20 minutes minimum.

**END OF SECTION**

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**PART 1 GENERAL**

**1.01 SCOPE**

- A. Building wire.
- B. Cable.
- C. Wiring connections and terminations.

**1.02 SUBMITTALS**

Submit product data.

**PART 2 PRODUCTS**

**2.01 ACCEPTABLE MANUFACTURERS**

- A. Low Voltage Conductors: Equal to Aetna, American, Cablec, Continental, Okonite, Pirelli, Southwire or Triangle.
- B. Signal Circuit Conductors: Equal to Belden, Continental, Dekoron or Penn.
- C. Low Voltage Connectors: Equal to Burndy, Thomas & Betts, Ideal or OZ.
- D. Pulling Compounds: Equal to Ideal Yellow 77, Electro Y-ER-EAS, Minerallac 100 or Burndy Slikon.
- E. Wire and Cable Markers: Plastic, split sleeve or tubing type, equal to Brady Type XC or T & B Type SM.

**2.02 BUILDING WIRE**

- A. Thermoplastic Insulated Building Wire: NEMA WC-5
- B. Feeder and Branch Circuits: Single conductor; 98 percent conductivity copper; 75/90 degrees C; 600 volt PVC insulated with nylon jacket; type THWN/THHN. Minimum size #12 AWG.
- C. Control Circuits: Same as specified above for feeder and branch circuits, except minimum size #14 AWG.

**2.03 REMOTE CONTROL AND SIGNAL CABLE**

Instrumentation Signal Cables: #16 AWG stranded tinned copper conductors; 600 volt polyethylene insulation; twisted pair or three conductor construction; 100 percent coverage aluminum polyester shield; #18 stranded tinned copper drain wire; vinyl outer jacket; UL listed.

**PART 3 EXECUTION**

**3.01 GENERAL WIRING METHODS**

- A. Use only stranded conductors. Exception: Solid conductors size #12 and #10 AWG may be used for receptacle branch circuit wiring.
- B. Use 10 AWG conductor for 20 ampere, 120 volt branch circuit home runs longer than 75 feet, and for 20 ampere, 277 volt branch circuit home runs longer than 200 feet.
- C. Place an equal number of conductors for each phase of a circuit in same raceway or cable.
- D. Identification: All conductors shall be identified throughout the electrical system. For control and signal conductors use wiremarkers at all terminals and connections. Color code power circuit conductors as follows:

	<b>120/208 Volt System</b>	<b>277/480 Volt System</b>
Phase A	Black	Brown
Phase B	Red	Orange
Phase C	Blue	Yellow
Neutral	White	Grey
Ground	Green	Green

- E. For conductors #8 AWG and larger color coding may be accomplished with 1-inch wide colored tape applied at each end of the conductor or at points where conductor is accessible so as to be visible inside the enclosure.
- F. Neatly train and lace wiring inside boxes, equipment and panelboards. Support to prevent conductor movement under fault conditions.

**3.02 WIRING INSTALLATION IN RACEWAYS**

- A. Unless otherwise indicated, install all conductors in conduit.

- B. Pull all conductors into a raceway at the same time. Thoroughly swab raceway system before installing conductors. Use wire pulling lubricant for all pulls. Do not exceed the manufacturer's pulling tension.
- C. Install wire in raceway after interior of building has been physically protected from the weather and all mechanical work likely to injure conductors has been completed.

### **3.03 WIRING CONNECTIONS AND TERMINATIONS**

- A. Avoid unnecessary splices. Splice only in accessible junction or outlet boxes.
- B. Make connections to circuit breakers, disconnect switches, panel mains, etc. with solderless lugs.
- C. Use mechanical connectors for low voltage splices, taps, fixture and motor connections. Exception: Square thread helical spring plastic cap (wire nut) type connectors are acceptable for solid conductor splices and taps.
- D. Use insulated throat, spade type crimp on connectors for strap screw device terminals. Exception: Receptacle back wiring provisions may be used for terminating solid conductors.
- E. Where possible use connectors with integral, insulating covers. Otherwise tape uninsulated conductors and connectors to 150 percent of the insulation value of conductor.
- F. Thoroughly clean wires before installing lugs and connectors.
- G. Make splices, taps and terminations to carry full ampacity of conductors without perceptible temperature rise.

### **3.04 FIELD QUALITY CONTROL**

- A. Inspect wire and cable for physical damage and proper connection.
- B. Touque test conductor connections and terminations to manufacturer's recommended values.
- C. Continuity Tests: ring all conductors for continuity and replace any open conductors.
- D. Low Voltage Ground Fault Tests: Meggar all feeder circuits for grounds. Compile and submit a list of meggar readings. Replace all conductors measuring less than 2

megohms to ground.

**END OF SECTION**

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**PART 1 GENERAL****1.01 SCOPE**

- A. Outlet boxes.
- B. Pull and junction boxes.

**1.02 SUBMITTALS**

Do not submit equipment specified in this Section.

**PART 2 PRODUCTS****2.01 ACCEPTABLE MANUFACTURERS**

Boxes shall be equal to Appleton, Crouse Hinds, Raco, or Steel City.

**2.02 OUTLET BOXES**

Cast Boxes: Cast ferrous alloy with galvanized or cadmium finish, deep type, gasketed cover, threaded hubs.

**2.03 PULL AND JUNCTION BOXES**

- A. Corrosion Resistant Boxes: UL 508 Type 4X stainless steel, gasketed hinged cover. For boxes larger than 12-inches in any dimension provide hinge on one side and trunk latches on the other three sides. Equal to Crouse Hinds or Type 304 stainless steel equal to Hoffman Bulletin A-51.

**PART 3 EXECUTION****3.01 COORDINATION OF BOX LOCATIONS**

- A. Provide boxes as shown on Drawings, and as required for splices, taps, wire pulling, and equipment connections.
- B. Box locations shown on the Drawings are approximate unless dimensioned. Verify box locations prior to rough-in.

**3.02 INSTALLATION**

- A. Support boxes independently of conduit.
- B. Unless otherwise noted, use only NEMA 4X SS junction boxes

## **BOXES**

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**16130-2**

- C. Field drill conduit holes in junction and pull boxes so as to afford the maximum bending radius for the conductors.
- D. Label cover of junction boxes with circuit numbers of conductors in the box.

**END OF SECTION**

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**PART 1 GENERAL**

**1.01 SCOPE**

- A. Hinged cover enclosures.
- B. Cabinets.
- C. Terminal blocks and accessories.

**1.02 SUBMITTALS**

- A. Submit product data.
- B. Shop Drawings for Equipment Panels: Include schematic diagram, wiring diagram, outline drawing and construction diagram as described in NEMA ICS-1.

**PART 2 PRODUCTS**

**2.01 ACCEPTABLE MANUFACTURERS**

Cabinets and enclosures shall be equal to Crouse Hinds, Hoffman or Weigmann.

**2.02 HINGED COVER ENCLOSURES**

- A. Construction: NEMA 250; 10 gauge steel, no knockouts, wall mounted or free-standing as indicated. Free-standing enclosures are minimum 20-inches deep. Unless otherwise noted, enclosures are NEMA 4X SS for outdoor, wet or damp locations.
- B. Covers: Continuous hinge, held closed by hasp and staple for padlock. Furnish three point latch for free standing enclosures, three point NEMA 4X latch for large enclosures.

**2.03 CABINETS**

- A. Cabinet Boxes: Code gauge stainless steel. Provide painted steel backplate painted matte white, for mounting terminal blocks.
- B. Cabinet Fronts: Stainless steel, surface type with door clamps, concealed hinge and flush lock.

## **CABINETS AND ENCLOSURES**

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### **2.04 TERMINAL BLOCKS AND ACCESSORIES**

- A. Terminal Blocks: NEMA ICS-4; UL listed.
- B. Power Terminals: One-piece phenolic closed-back type, with binding screw or stud terminal connectors, rated 600 volts.
- C. Signal and Control Terminals: Modular construction type, channel mounted with marking strip; screw terminals, rated 300 volts.

### **2.05 FABRICATION**

- A. Shop assemble enclosures and cabinets housing terminal blocks or electrical components in accordance with NEMA ICS-6.
- B. Selectors and Indicators: Door mounted for indoor enclosures. For outdoor enclosures provide a separate, hinged, inner door (dead front panel) for device mounting.
- C. Lace conductors with plastic ties to present a neat and orderly appearance. Provide nylon wrapping to protect conductors crossing hinges.
- D. Provide protective pocket inside front cover with control wiring and panel layout diagrams.

## **PART 3 EXECUTION**

### **3.01 INSTALLATION**

- A. Install cabinets and enclosures plumb, anchor securely to wall and structural supports at each corner, minimum.
- B. Provide accessory feet for free-standing equipment enclosures.

**END OF SECTION**

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**PART 1 GENERAL****1.01 SCOPE**

- A. Power system grounding.
- B. Electrical equipment and raceway grounding and bonding.

**1.02 SYSTEM DESCRIPTION**

- A. The system consists of ground clusters for supplemental electrodes; and connections thereto of structures, equipment and electrical systems.
- B. This Section is intended to supplement the requirements of the NEC, particularly Article 250, and to differentiate among options allowed by the NEC. This Section is not intended to reiterate explicit requirements of the NEC.
- C. Within this Section the following definitions apply:
  - 1. Ground Cluster: An assembly of three or more driven ground rods; spaced not closer than eight feet apart; each rod connected to the others in a closed delta configuration; and providing a resistance to ground of not more than 10 ohms.
  - 2. Connect or Bond: For underground or otherwise inaccessible locations – a permanent connection made by exothermic welding, brazing, or similar process. For exposed and accessible locations – a connection made with clamps, bolts or similar fittings approved for the purpose.

**1.03 SUBMITTALS**

Submit product data.

**PART 2 PRODUCTS****2.01 MATERIALS**

- A. Bare Conductors: ASTM B-8; stranded; hard drawn copper. Size unless otherwise noted is #4/0 AWG.
- B. Ground Rods: UL 425H; 5/8-inch x 8 feet; high strength steel core with metallurgically bonded copper jacket.

## **GROUNDING**

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### **PART 3 EXECUTION**

#### **3.01 INSTALLATION**

- A. Use an insulated ground conductor only installed in a non-metallic raceway. Use bare conductors for the ground rod connections, and bonding of structures etc. Where a bare conductor is installed in a raceway use only non-metallic raceways; do not install bare conductors in metallic raceways.
- B. Drive ground rods so the top is 12 inches below finished grade. If rock is encountered then rods may be driven at an angle or grounding plates, as approved by the Engineer, may be used. Terminations to ground rods shall be exothermic weld process (CAD Weld).
- C. Construct ground clusters as follows: Start with three driven ground rods and measure the resistance to ground of each rod. If the parallel combination exceeds 10 ohms then add sections and drive the rods deeper, or drive additional rods until the specified value is obtained. Connect each rod to every other rod in the cluster. Exception: not more than three additional rods or sections (six total) are required for any one cluster.
- D. Where bare conductors emerge from concrete encasement, provide a 4-inch length of Schedule 40 PVC conduit set in the concrete to protect the conductor.

#### **3.02 SERVICE ENTRANCE EQUIPMENT**

- A. Bond service entrance equipment ground bus to the ground grid with a copper conductor sized per NEC.
- B. Provide one neutral cluster at the closest practical location to the service entrance equipment and bond to ground bus with a copper conductor.
- C. If a metallic cold water pipe is available for a grounding electrode make connection on the street side and bond around the water meter.
- D. Prior to energizing the system remove the neutral link and meggar the system neutral. Repair any grounds then replace the neutral link.

#### **3.03 SEPARATELY DERIVED SYSTEMS**

- A. Ground enclosures and, where solidly grounded systems are indicated, the secondary neutral to a ground cluster.

- B. Ground generator frame and neutral to ground cluster.

**3.04 FIELD QUALITY CONTROL**

- A. Inspect grounding and bonding system conductors and connections for tightness and proper installation.
- B. Compile and submit a list of ground resistance measurements for each ground rod in ground clusters. Measure and submit resistance to ground of service equipment ground bus.
- C. Make resistance to ground measurements in normal, dry weather conditions not less than 24 hours after rainfall. Make measurements using the fall of potential method per IEEE Standard No. 142.

**END OF SECTION**

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**PART 1 GENERAL**

**1.01 SCOPE**

- A. Package engine generator.
- B. Automatic transfer switch.

**1.02 SYSTEM DESCRIPTION**

- A. Provide a standby power system for supply of power in event of failure of the normal supply, consisting of a liquid cooled, diesel engine directly coupled to an AC generator complete with fittings, connections, auxiliaries, control panels, safety devices, and meters necessary for a complete operating system.
- B. Provide fully automatic operation so that unit takes full load within 10 seconds after power failure.

**1.03 SUBMITTALS**

- A. Shop drawings: Complete rating and dimensional data including continuous and standby KW rating, generator subtransient reactance, RPM, numbers of cylinders, fuel consumption rates, piston displacement and piston speed.
- B. Submit installation instructions.

**1.04 RECORD DRAWINGS**

Provide record drawings plus operation and maintenance instructions, spare parts listing, service facilities and record of start-up tests.

**PART 2 PRODUCTS**

**2.01 ACCEPTABLE MANUFACTURERS**

- A. Engine/Generator: Caterpillar, Cummins, Kohler.
- B. Governor and Voltage Regulator: Equal to Basler or Woodward.
- C. Automatic Transfer Switch: Equal to Westinghouse/Cutler-Hammer, Thompson or GE.

## **PACKAGE ENGINE GENERATOR SET**

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### **2.02 RATING**

- A. KW: Equipment specific standby, capable of full load pickup in a single step for site.
- B. Power Factor: 80 percent.
- C. Maximum RPM: 1,800.
- D. Altitude: 1,000 feet above mean sea level.
- E. Ambient Temperature: 38 degrees C (100 degrees F).

### **2.03 GENERATOR**

- A. Output: 480 volts, 3 phase, 4 wire, 60 Hertz, or as appropriate for equipment.
- B. Construction: NEMA MG-1; revolving field type; brushless static or permanent magnet exciter; directly coupled to the engine flywheel through a flexible driving disc for positive alignment. Dynamically balance the rotor for up to 25 percent overspeed. Equip with Class F or H insulation with temperature rise not to exceed insulation temperature rating in accordance with NEMA standards for operation in a 40 degree C ambient.
- C. Voltage Regulator: Solid state construction with steady state regulation of one percent and transient regulation of 25 percent maximum from no load to full load with recovery to two percent or better within one second. Provide a minimum of 300 percent of rated current for 10 seconds under fault conditions.

### **2.04 ENGINE**

- A. Fuel: No. 2 diesel fuel.
- B. Construction: Heavy duty industrial type; water cooled; compression ignition diesel engine. Engine shall be either 2 or 4 cycle, solid injection, vertical in-line or V-type. Provide single piece alloy cast iron block; single piece drop forge steel crankshaft; precision insert, steel backed tri-metal bearings; forged connecting rods; cast pistons with positive pressure oil cooling.
- C. Governor: Solid state electronic/isochronous type with steady state speed regulation of 0.5 percent and transient speed regulation of three cycles maximum from no load to full load with two second maximum recovery to steady state.
- D. Lubricating Oil System: Gear type lubricating oil pump for supplying oil under pressure to the bearings, pistons, timing gears and valve rocker mechanism.

- E. Accessories: Provide replaceable automotive type oil filters, dry type air cleaners, lubricating oils, greases, and coolant. Provide tools required for normal maintenance of the unit in a metal box complete with lock and keys.
- F. Provide alternator for battery charging.

## **2.05 COOLING EQUIPMENT**

- A. Engine: Self-contained liquid cooling complete with unit mounted radiator, pusher type fan, water pump and thermostat.
- B. Coolant: Corrosion inhibiting ethylene/water 50/50 mix, glycol base anti-freeze good to -30 degrees C.
- C. Provide thermostatically controlled single phase 120, 208, 240 or 480 volt coolant heater, wattage as required to maintain coolant temperature of 80 degrees F. Where heater rating exceeds 3 kW, provide multiple units to balance phase loads on the auxiliary circuit breaker.

## **2.06 EXHAUST EQUIPMENT**

- A. Muffler and Piping: Critical-grade silencer, completely sealed, metal primed finish, sized so as not to exceed allowable engine backpressure.
- B. Connection: Provide 18-inch minimum length flexible stainless steel connection from manifold to muffler.
- C. Provide damper to close off exhaust when not in use, or 90 degrees elbow and rain cap.

## **2.07 CONTROLS AND ALARMS**

- A. Engine Control Panel: Mounted on the unit frame complete with oil pressure gauge, low oil pressure shutdown contacts, water temperature gauge, high water temperature shutdown contacts, overspeed shutdown contacts overcrank shutdown contacts, and dry contacts for remote indication of master alarm.
- B. Generator Control Panel: Mounted on the unit complete with ammeter, ammeter selector switch, voltmeter, voltmeter selector switch, frequency meter, voltage adjusting rheostat, elapsed time meter, and current and potential transformers as required. Provide a test-normal selector for manual operation of the unit. Provide numbered terminal strip for connection of accessory controls, incoming start command (from the automatic transfer switch), outgoing master alarm, and outgoing individual alarms as noted. Accessory controls (dampers, solenoids and other items not mounted on the unit and prewired) are powered contacts, rating as required. Outgoing alarms are normally open dry contacts,

## **PACKAGE ENGINE GENERATOR SET**

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**16622-4**

10 amp, 120 volt.

- C. Starting Control Panel: Mounted on the unit complete with battery charger, charging ammeter, and alarm contacts. Equipment with required cables for batteries mounted on the generator rails.
- D. Output Circuit Breaker: NEMA AB-1; molded case type; NEMA 1 unit mounted enclosure; current rating as recommended by the manufacturer for protection of the generator, 25,000 AIC.

### **2.08 BATTERIES**

- A. Type: Lead-Acid.
- B. Size batteries to provide cycle cranking of 10 seconds crank, and 10 seconds rest for 5 cycles at 32 degrees F.

### **2.09 FUEL SYSTEM**

- A. Equip engine with an engine driven fuel oil pump, fuel priming pump, and duplex fuel filters. Flexible fuel lines shall be provided between engine and fuel supply to isolate vibration.
- B. Provide a unit mounted 24 hour minimum capacity base type fuel tank for the site or as otherwise noted or required. Equip with the following:
  - 1. Secondary containment.
  - 2. Standard fuel group with U.L. sized vents.
  - 3. 6 point lift eyes.
  - 4. Generator/enclosure set mounting provisions.
  - 5. Electrical stub up access.
  - 6. Low fuel level switch.
  - 7. Rupture basin alarm switch.

### **2.10 AUTOMATIC TRANSFER SWITCH**

- A. Rating
  - 1. Voltage as designated, along with phase, AMP with appropriate AMP circuit breakers, 42,000 amp RMS symmetrical withstand.

- B. Construction: NEMA ICS-2; double throw circuit breaker type mechanism with normal and emergency contacts interlocked mechanically and electrically to prevent simultaneous closing. Equip with surge protection and U.L. service entrance label. Mount in separate free standing NEMA 4X stainless steel enclosure. Automatic transfer for switch shall be equal to Westinghouse/Cutler-Hammer, Type ATVS.
- C. Operating Sequence: Initiate transfer to the generator when any phase drops below 80 percent voltage for two seconds. Retransfer to normal when the normal source reaches 95 percent for adjustable one to 25 minute period. After retransfer operate the engine at no load for an adjustable one to 10 minute period for cool down.
- D. Accessories: Auxiliary contacts for loss of normal power, remote emergency status indication (generator run) and automatic exerciser time clock.

## **2.11 FABRICATION**

- A. Mount on common steel rail base with all electrical equipment completely prewired.
- B. Provide steel spring vibration isolators between rail base and concrete base. Provide protective guards over moving parts.
- C. Machine enamel finish shall be manufacturer's standard color.
- D. Provide manufacturer's standard weatherproof housing for unit.

## **PART 3 EXECUTION**

### **3.01 PREPARATION**

Coordinate with ventilation, fuel supply, and exhaust, to provide an efficient and well coordinated layout.

### **3.02 INSTALLATION**

- A. Install unit complete and make operational.
- B. Install engine at sufficient height above base to permit dropping oil pan without removing unit.
- C. Provide vibration isolation of exhaust equipment to prevent transfer of vibration into enclosure.

## **PACKAGE ENGINE GENERATOR SET**

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### **3.03 WIRING AND CONNECTIONS**

- A. Provide conduit, wiring and connections required and recommended by unit supplier.
- B. Install all control and alarm wiring in rigid steel conduit.
- C. Connect motorized dampers in cooling and exhaust equipment to open dampers when unit is started.

### **3.04 FIELD QUALITY CONTROL**

- A. Provide full NFPA 110, Level 1 load test utilizing portable test bank for four hours minimum.
- B. Record in 5 minute intervals during four hour test:
  - 1. Kilowatts
  - 2. Amps
  - 3. Voltage
  - 4. Coolant temperature
  - 5. Ambient temperature
  - 6. Frequency
  - 7. Oil pressure
- C. Test alarm and shutdown circuits by simulating conditions.
- D. Simulate power failure including operation of transfer switch, automatic starting cycle, and automatic shutdown and return to normal.
- E. Provide fuel for all tests.
- F. Provide factory representative to demonstrate and train the County's personnel on complete operation of the unit.

**END OF SECTION**