



INVITATION TO BID #16ITB091416K-JD

CHATTACHOOCHEE III PUMP STATION UPGRADES

Volume I

FOR

DEPARTMENT OF PUBLIC WORKS

BID ISSUANCE DATE: September 26, 2016

BID DUE DATE AND TIME: Monday, November 7, 2016 at 11:00 A.M.

PRE-BID CONFERENCE DATE: October 13, 2016

PURCHASING CONTACT: Joyce Daniel, Assistant Purchasing Agent

E-MAIL: joyce.daniel@fultoncountyga.gov

**LOCATION: FULTON COUNTY DEPARTMENT OF PURCHASING
130 PEACHTREE STREET, S.W., SUITE 1168
ATLANTA, GA 30303**

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INVITATION TO BID
#16ITB091416K-JD
CHATTAHOOCHEE III PUMP STATION UPGRADES

Sealed Bids for furnishing all materials, labor, tools, equipment and appurtenances necessary for Chattahoochee III Pump Station Upgrades will be received by the Fulton County Department of Purchasing and Contract Compliance at 130 Peachtree Street, S.W. Suite 1168 Atlanta, GA 30303, **no later than 11:00 A.M.**, local time, on **Monday, November 7, 2016**.

SCOPE OF WORK

This project is to provide construction services, including all labor, materials, and equipment necessary to carry out the Chattahoochee III Pump Station Upgrades, which is to include removal of three existing pumps and Variable Frequency Drives (VFDs) and install four new pumps; check valves and plug valves; install four new (VFDs); install Programmable Logic Controls and Touch Screen Human Machine Interface Systems (HMI); construct new emergency by-pass pump connection; install new electrical upgrades; new odor control system, painting, paving, landscaping, wet well cleaning; by-pass pumping, temporary systems, and other facility/site improvements as described in the drawings and specifications. The work shall include all work, labor, tools and materials required for the complete installation, and all associated tasks while maintaining wastewater flow. The detailed scope of work and technical specifications are outlined in the Division of Work Section 01 10 00, Project Summary and Scope of Work of this bid document.

METHOD OF SOURCE SELECTION

This procurement is being conducted and the specific method of source selection in accordance with all applicable provisions of the Georgia Local Public Works Construction Law, O.C.G.A. §36-91-1 through 36-91-95 when a public works construction project cost exceeds \$100,000.

PERMITS

It will be the responsibility of the Contractor to obtain and pay for any permits or approvals from entities having jurisdiction over aspects of the project. Processing time for obtaining permits has been taken into consideration and included in the contract duration. As such, Contractor shall take this in consideration when developing the construction schedule. The Contractor will be responsible for procuring a Land Disturbance Permit from the City of Johns Creek.

RIGHTS OF WAY/EASEMENTS

All work is to be constructed within the existing pump station realty and Fulton County property and existing easements and no permanent Rights-of-Way or Easements will be required to be obtained.

TEMPORARY RIGHTS-OF-WAY AND EASEMENTS

The Contractor may independently secure temporary Easements and Rights of-Way for their use and convenience. The Contractor shall pay for any rights of-way or easements obtained. The Contractor shall submit written documentation to the Construction Manager for any Contractor secured Easements across privately held property. The Easement agreement shall specify terms and conditions of use and provisions for site restoration agreeable to the property owner. A written release from the property owner certifying that all terms of the easement agreement have been met by the Contractor shall be required and shall be furnished to the Construction Manager prior to final payment.

BID DOCUMENTS

This document and supporting documents can be downloaded at the Fulton County Website, <http://www.fultoncountyga.gov> under "Bid Opportunities".

The Drawings for this project may be obtained at a cost of \$10.00 for a CD of the Drawings at the following location:

Fulton County Government
Department of Public Works
Attn: Maureen Hill
404-612-7434
Fulton County Administration Building
141 Pryor Street, S.W., Suite 6001
Atlanta, GA 30303

A viewing copy (**FOR VIEWING PURPOSES ONLY**) of the Drawings will be available in the Department of Purchasing & Contract Compliance Plan Room located at 130 Peachtree Street, S.W. Suite 1168, Atlanta, Georgia 30303.

PURCHASING CONTACT

Information regarding the bid or bid requirements, either procedural or technical, may be obtained by submitting questions in writing to:

Fulton County Government
Department of Purchasing & Contract Compliance
Attn: Joyce Daniel, Assistant Purchasing Agent
Fulton County Public Safety Building
130 Peachtree Street, S.W. Suite 1168
Atlanta, GA 30303
Email: joyce.daniel@fultoncountyga.gov
Fax: 404-335-5806
Reference Bid #: 16ITB091416K-JD

PRE-BID CONFERENCE

Date: Thursday, October 13, 2016
Time: 10:00 A.M.
Location: Johns Creek Environmental Campus
Dr. Robert E. "Bob" Fulton Environmental Education Center – Lecture Hall
8100 Holcomb Bridge Road
Alpharetta, GA 30022

The pre-bid conference will be at the Johns Creek Environmental Campus, Dr. Robert E. "Bob" Fulton Environmental Education Center – Lecture Hall, 8100 Holcomb Bridge Road, Alpharetta, GA 30022. A Mandatory Site Visit will be held at the Chattahoochee III Pump Station immediately following the pre-bid conference.

Inquiries regarding the solicitation either technical or otherwise may be submitted in writing prior to the pre-bid conference and will be addressed at the pre-bid conference.

Any additional questions asked at the Pre-Bid Conference must be submitted in written form at the Pre-Bid conference and will be responded to in the form of an addendum with the County's official responses.

The Pre-Bid Conference will be conducted for the purpose of explaining the County's bid process, the specifications/technical documents, and to provide non-binding verbal responses to questions concerning these bid specifications and to discuss issues from the Bidders perspective. However, no verbal response provided at the Pre-Bid Conference binds the County. Only those responses to written questions that are responded to by the County in written communications will be official.

Fulton County does not discriminate on the basis of disability in the admission or access to its programs or activities. Any requests for reasonable accommodations required by individuals to fully participate in any open meeting, program or activity of Fulton County Government should be directed to Rholanda Stanberry, Contract Compliance Administrator at (404) 612-6304 or email: rholanda.stanberry@fultoncountyga.gov.

BONDING REQUIREMENTS

Each Bid must be accompanied by a Bid Bond, prepared on the Bid Bond provided in this Bid Document or a Surety Company's Standard Bid Bond, duly executed by the Bidder as principal and having as surety, a surety company licensed to do business in the State of Georgia by the Georgia Insurance Commissioner and listed in the latest issue of U.S. Treasury Circular 570, in the amount of five percent of the Bid.

The successful Bidder for this Contract will be required to furnish a satisfactory Performance and Payment Bond each in the amount of 100 percent of the Bid, and proof of insurance in accordance with the requirements set forth in Section 3 of this Bid Document.

END OF SECTION

OWNER - CONTRACTOR AGREEMENT

**#16ITB091416K-JD
CHATTAHOOCHEE III PUMP STATION UPGRADES**

Contractor: _____ Project No. _____

Address: _____ Telephone: _____

Contact: _____ Facsimile: _____

THIS AGREEMENT is effective as of the _____ day of _____, 20____, by and between Fulton County, a political subdivision of the State of Georgia (hereinafter called the "County"), and the above named CONTRACTOR in accordance with all provisions of this Construction Agreement ("Contract"), which consists of the following: Owner-Contractor Agreement, Owner's invitation for bid, instructions to bidders, bid form, performance bond, payment bond, acknowledgments, general conditions, special conditions, scope of work and specifications, plans, drawings, exhibits, addenda, Purchasing forms, Office of Contract Compliance Forms, Risk Management insurance provisions forms and written change orders.

The specific Exhibits of this Contract are as follows:

- Exhibit A: General Conditions
- Exhibit B: Special Conditions (if applicable)
- Exhibit C: Addenda
- Exhibit D: Bid Form
- Exhibit E: Bonds (Bid, Payment & Performance)
- Exhibit F: Scope of Work and Technical Specifications
- Exhibit G: Exhibits
- Exhibit H: Purchasing Forms
- Exhibit I: Office of Contract Compliance Forms
- Exhibit J: Risk Management Insurance Provisions Forms

WITNESSETH: That the said Contractor has agreed, and by these present does agree with the said County, for and in consideration of a Contract Price of **[INSERT CONTRACT AMOUNT IN WORDS]**, (**[\$[INSERT CONTRACT AMOUNT IN NUMBERS]**) and other good and valuable consideration, and under the penalty expressed on Bonds hereto attached, to furnish all equipment, tools, materials, skill, and labor of every description necessary to carry out and complete in good, firm, and workmanlike manner, the Work specified, in strict conformity with the Drawings and the Specifications hereinafter set forth, which Drawings and Specifications together with the bid submittals made by the Contractor, General Conditions, Special Provisions, Detailed Specifications, Exhibits, and this Construction Agreement, shall all form essential parts of this Contract. The Work covered by this Contract includes all Work indicated on Plans and Specifications and listed in the Bid entitled:

Project Number: #16ITB091416K-JD

CHATTAHOOCHEE III PUMP STATION UPGRADES

The Contractor, providing services as an Independent Contractor, shall commence the Work with adequate force and equipment within 10 days from receipt of Notice to Proceed ("NTP") from the County, and shall complete the work within 270 calendar days from the Notice to Proceed or the date work begins, whichever comes first. The Contractor shall remain responsible for performing,

in accordance with the terms of the Contract, all work assigned prior to the expiration of the said calendar days allowed for completion of the work even if the work is not completed until after the expiration of such days. The Contractor shall agree that in the performance of this Contract he will comply with all lawful agreements, if any, which the contractor has made with any association, union or other entity, with respect to wages, salaries and working conditions, so as to cause inconvenience, picketing or work stoppage.

[Insert if applicable For each calendar day that any work remains uncompleted after the time allowed for completion of the work, the Contractor shall pay the County the sum of \$ 500.00 not as a penalty but as liquidated damages, which liquidated damages the County may deduct from any money due the contractor. At the County's convenience and not to its prejudice the County may provide written notice of the commencement of the assessment of liquidated damages].

As full compensation for the faithful performance of this Contract, the County shall pay the Contractor in accordance with the General Conditions and the prices stipulated in the Bid, hereto attached.

It is further mutually agreed between the parties hereto that if, at any time after the execution of this Agreement and the Surety Bonds hereto attached for its faithful performance, the County shall deem the surety or sureties upon such bonds to be unsatisfactory, or, if, for any reason, such bonds cease to be adequate to cover the performance of the Work, the Contractor shall, at his expense, within five days after receipt of notice from the County so to do, furnish an additional bond or bonds in such form and amount, and with such surety or sureties as shall be satisfactory to the County. In such event no further payment to the Contractor shall be deemed to be due under this Agreement until such new or additional security for the faithful performance of the Work shall be furnished in manner and form satisfactory to the County.

The Contractor hereby assumes the entire responsibility and liability for any and all injury to or death of any and all persons, including the Contractor's agents, servants, and employees, and in addition thereto, for any and all damages to property caused by or resulting from or arising out of any act or omission in connection with this contract or the prosecution of work hereunder, whether caused by the Contractor or the Contractor's agents, Servants, or employees, or by any of the Contractor's subcontractors or suppliers, and the Contractor shall indemnify and hold harmless the County, the Construction Manager, County's Commissioners, officers, employees, successors, assigns and agents, or any of their subcontractors from and against any and all loss and/or expense which they or any of them may suffer or pay as a result of claims or suits due to, because of, or arising out of any and all such injuries, deaths and/or damage, irrespective of County or Construction Manager negligence (except that no party shall be indemnified for their own sole negligence). The Contractor, if requested, shall assume and defend at the Contractor's own expense, any suit, action or other legal proceedings arising there from, and the Contractor hereby agrees to satisfy, pay, and cause to be discharged of record any judgment which may be rendered against the County and the Construction Manager arising there from.

In the event of any such loss, expense, damage, or injury, or if any claim or demand for damages as heretofore set forth is made against the County or the Construction Manager, the County may withhold from any payment due or thereafter to become due to the Contractor under the terms of this Contract, an amount sufficient in its judgment to protect and indemnify it and the Construction Manager, County's Commissioners, officers, employees, successors, assigns and agents from any and all claims, expense, loss, damages, or injury; and the County, in its discretion, may require the Contractor to furnish a surety bond satisfactory to the County providing for such protection and indemnity, which bond shall be furnished by the Contractor within five (5) days after written demand has been made therefore. The expense of said Bond shall be borne by the Contractor. **[See General Conditions for similar provision]**

This Contract constitutes the full agreement between the parties, and the Contractor shall not sublet, assign, transfer, pledge, convey, sell or otherwise dispose of the whole or any part of this

Contract or his right, title, or interest therein to any person, firm or corporation without the previous consent of the County in writing. Subject to applicable provisions of law, this Contract shall be in full force and effect as a Contract, from the date on which a fully executed and approved counterpart hereof is delivered to the Contractor and shall remain and continue in full force and effect until after the expiration of any guarantee period and the Contractor and his sureties are finally released by the County.

This agreement was approved by the Fulton County Board of Commissioner on [Insert approval date and item number].

[SIGNATURES NEXT PAGE]

Sample Contract

IN WITNESS THEREOF, the Parties hereto have caused this Contract to be executed by their duly authorized representatives as attested and witnessed and their corporate seals to be hereunto affixed as of the day and year date first above written.

OWNER:

CONTRACTOR:

FULTON COUNTY, GEORGIA

[Insert Contractor COMPANY NAME]

John H. Eaves, Commission Chair
Board of Commissioners

[Insert Name & Title of person authorized to sign contract]

ATTEST:

ATTEST:

Mark Massey
Clerk to the Commission (Seal)

Secretary/
Assistant Secretary

(Affix Corporate Seal)

APPROVED AS TO FORM:

Office of the County Attorney

APPROVED AS TO CONTENT:

[Insert Department Head Name]
[Insert Department Head Title]

END OF SECTION

Sample Contract

INSTRUCTIONS TO BIDDERS

1. CONTRACT DOCUMENTS

The Contract Documents include the Contract Agreement, Contractor's Bid (including all documentation accompanying the Bid and any post-Bid documentation required by the County prior to the Notice of Award), Bonds, all Special Conditions, General Conditions, Supplementary Conditions, Specifications, Drawings and addenda, together with written amendments, change orders, field orders and the Construction Manager's written interpretations and clarifications issued in accordance with the General Conditions on or after the date of the Contract Agreement.

Shop drawing submittals reviewed in accordance with the General Conditions, geotechnical investigations and soils report and drawings of physical conditions in or relating to existing surface structures at or contiguous to the site are not Contract Documents.

The Contract Documents shall define and describe the complete work to which they relate.

2. BID PREPARATION

Bidders shall **SUBMIT ONE (1) ORIGINAL, SIGNED AND DATED, AND TWO (2) COPIES** on the forms provided in the Bid Document.

All bids must be made on the bid forms contained herein and shall be subject to all requirements of the Agreement Documents. All bids must be regular in every respect and no interlineations, excisions, or special conditions shall be made or included in the bid by the Bidder.

Lump sum, unit price and extensions of unit prices must be entered in the appropriate spaces provided on the Bid Schedule/Bid Form. Unit prices shall include an appropriate allocation of overhead and other indirect costs so that the summation of unit price extensions and lump sum items represents the total bid amount. All blank spaces must be typed or hand written in blue ink on the "Original". All dollar amounts must be BOTH in writing and figures and represent prices for the published scope of work without exceptions.

The County may, in its sole discretion, reject any bid determined as irregular, a conditional bid or any bid on which there is an alteration of, or departure from the Bid Schedule attached.

Erasures or other changes in the bids must be explained or noted over the signature of the Bidder. All corrections to any entry must be lined out and initialed by the Bidder. Please do not use correction tapes or fluid. Failure to do so shall render the Bidder as non-responsive and cause rejection of the bid.

Failure to execute the Bid Schedule/Bid Form documents may result in Bidder being deemed non-responsive and cause rejection of the bid.

3. RECEIPT AND OPENING OF BIDS

Sealed bids will be received by the Fulton County Department of Purchasing & Contract Compliance at Fulton County Public Safety Building, 130 Peachtree Street, S.W., Suite 1168 Atlanta, Georgia 30303. All submitted bids shall be time and date stamped according to the clock at the front desk of the Fulton County Department of Purchasing & Contract Compliance. The original signed Bid with three (3) copies shall be submitted in a sealed envelope, addressed to the Department of Purchasing and Contract Compliance and labeled **#16ITB090116K-JD – Chattahoochee III Pump Station Upgrades.**

REQUIRED SUBMITTALS: The bidder **must complete and execute** the following:

1. Bid Form
2. Acknowledgement of each Addendum
3. Bid Bond
4. Purchasing Forms (See Submittal Check List at end of this Section), fully executed
5. Contract Compliance Forms (See Submittal Check List at end of this Section), fully executed
6. Risk Management Insurance Provisions Form

Any bids received after the stated time and date will not be considered. It shall be the sole responsibility of the bidder to have his/her bid delivered to the Fulton County Department of Purchasing and Contract Compliance for receipt on or before the stated time and date. If a bid is sent by U.S. Mail, the bidder shall be responsible for its timely delivery to the Purchasing Department. Bids delayed by mail will not be considered, shall not be opened, and arrangements shall be made for their return at the bidder's request and expense.

Bid shall be publicly opened, with only the names and total bid price of the bidders disclosed at the opening.

4. ADDENDA AND INTERPRETATIONS

No interpretations of the meaning of the Drawings, Specifications or other pre-bid documents will be made to any Bidder orally.

Bidders requiring clarification or interpretation of the Contract Documents shall make a request in writing, either by mail, hand delivery, e-mail or fax, to the Purchasing Agent at the address below. To be given consideration, requests must be received no later than **2:00 P.M., Thursday, October 27, 2016**. The County will not respond to any requests, oral or written, received after this date. Telephone inquiries will not be accepted.

Department of Purchasing and Contract Compliance
Attn: Joyce Daniel, Assistant Purchasing Agent
Fulton County Public Safety Building
130 Peachtree Street, S.W., 1168
Atlanta, GA 30303
Fax: (404) 404-355-5806
joyce.daniel@fultoncountyga.gov
Bid # #16ITB091416K-JD

Only communications from firms that are in writing and signed will be recognized by the County as duly authorized expressions on behalf of proposers/bidders. Any and all such interpretations and any supplemental instructions will be in the form of written Addenda to the Specifications which, if any addend are issued to this Invitation to Bid.

Failure of Bidders to receive or acknowledge any Addendum shall not relieve them of any obligation under the Bid. All Addenda shall become part of the Contract Documents.

5. **SITE EXAMINATION**

There will be a Mandatory Site Visit for this project. It will be held on Thursday, October 13, 2016 immediately following the Pre-Bid Conference at the Chattahoochee III Pump Station. **Bidders are required to attend.** See site map and directions at the end of this section.

6. **BIDDER'S MODIFICATION AND WITHDRAWAL OF BIDS**

A Bidder may modify or withdraw its bid by written request, provided that the request is received by the County prior to the bid due date and time at the address to which bids are to be submitted. Provided further, that in case of an electronic request (i.e. facsimile, e-mail, etc.) a written confirmation thereof over the authorized signature of the Bidder must be received by the County at the address to which original Bids are to be submitted within three (3) calendar days after issue of the electronic message. Following withdrawal of its bid, the Bidder may submit a new bid, providing delivery is affected prior to the established bid opening date and time. **No bid may be withdrawn after bid due date for sixty (60) calendar days.**

7. **BID AND CONTRACT SECURITY**

A Bid Bond for an amount equal to five percent (5%) of the bid amount must accompany each Proposal. The bid bond shall be submitted in a separate, sealed envelope marked "Bid Bond".

Bids must be accompanied by a bid bond or certified check in an amount of five percent (5%) of the TOTAL AMOUNT of the base bid. The bid bond or certified check shall apply ONLY TO THIS BID. The bid name and contract number must appear on the security instrument. The bond must remain in full

force and effect until the Bidder executes the final Contract. Bids not satisfying the bonding requirements of this project will be declared non-responsive.

Any bid bond, performance bond, payment bond, or security deposit required for public works construction contract shall be approved and filed with purchasing agent. At the option of the County, if the surety named in the bond is other than a surety company authorized by law to do business in this state pursuant to a current certificate of authority to transact surety business by the Commissioner of Insurance, such bond shall not be approved and filed unless such surety is on the United States Department of Treasury's list of approved bond sureties.

A Purchasing Agent shall approve as to form and as to the solvency of the surety any bid bond, performance bond, or payment bond required by this. In the case of a bid bond, such approval shall be obtained prior to acceptance of the bid or proposal. In the case of payment bonds and performance bonds, such approval shall be obtained prior to the execution of the contract.

Whenever, in the judgment of the County:

- (1) Any surety on a bid, performance, or payment bond has become insolvent;
- (2) Any corporation surety is no longer certified or approved by the Commissioner of Insurance to do business in the state; or
- (3) For any cause there are no longer proper or sufficient sureties on any or all the bonds

The County may require the contractor to strengthen any or all of the bonds or to furnish a new or additional bond or bonds within ten days. Thereupon, if so ordered by the County, all work on the contract shall cease unless such new or additional bond or bonds are furnished. If such bond or bonds are not furnished within such time, the County may terminate the contract and complete the same as the agent of and at the expense of the contractor and his or her sureties.

As a condition of responsiveness the bidder must contain a Bid Bond for an amount equal to 5% of the bid amount. The Bid Bond shall be included in a separate envelope marked on the outside "Bid Bond". Checks or letters of credit of any type will not be accepted. A certified cashier's check will be acceptable. Provide a completed and fully executed Bid Bond. When the bidder's package is opened, a purchasing agent will verify the presence of the Bid Bond and remove it from the Proposal Package.

If the bidder withdraws its bid from the competition after the selection of its bid for a reason not authorized by Georgia law, the County will proceed on the Bid Bond, along with any other available remedies.

The Surety of the Bid Bond shall be from a surety company authorized to do business in the State of Georgia, shall be listed in the Department of Treasury Circular 570, and shall have an underwriting limitation in excess of 100% of the bid amount. The Bonds and Surety shall be subject to approval by the County Attorney.

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

8. SURETY BONDS

The submission of surety bonds subsequent to the Bid submission shall be:

- a. Any surety bond submitted in accordance with the Bid or Agreement requirements must be issued by a corporate surety company satisfactory to the Commission and authorized to act as such in the State of Georgia;
- b. Such bonds shall conform to the forms provided with the Bid Documents and be completed in accordance with the instructions thereon; and
- c. In accordance with Georgia law, and upon award of the Agreement, separate performance and payment bonds shall be required of the successful Bidder, each in an amount not less than the total amount payable under the Agreement. The performance bond shall remain in effect for one (1) year after final acceptance of the Work or the guaranty period under the Agreement, whichever is the larger.

The payment bond shall remain in effect for the period required under Georgia law for the payment bonds on public construction agreements. Reference is made to the bond forms and the Agreement Documents for additional particulars of the terms required in the bonds. In the case of any inconsistency between the Bond Forms and Georgia law, the law shall control. Alterations, extension of the time allowed for performance, extra and additional Work, and other changes authorized under the Agreement may be made without notice to or consent of the surety or sureties.

9. INSURANCE REQUIREMENTS

The Contractor shall procure and maintain during the life of this Agreement, Workmen's Compensation, Public Liability, Property Damage, Automobile Liability insurance and any other insurance necessary to satisfy the requirements of the Agreement Documents. At the time of award, a copy of the successful Bidder's Certificate of Insurance must be provided through the County's online insurance compliance system.

The County has implemented an online insurance compliance system designed to make the experience of submitting and retrieval of insurance information quick and easy. This system is designed to be used by insurance brokers and agents on behalf of their insurance clients for submittal of Certificates of Insurance ("COI") directly to the Fulton County Department of Purchasing. Instructions will be provided to the successful bidder.

10. RIGHT TO REJECT BIDS

The County reserves the right to reject any or all bids and to waive informalities. No bids will be received after the time set for opening bids. Any unauthorized conditions, limitations or provisions attached to the Bid, except as provided herein, will render it informal and may cause its rejection. Unbalanced bids will be subject to rejection. Any bidder may withdraw his/her bid, either personally or by telegraphic or written request, at any time prior to the scheduled closing time for receipt of bids. Telegraphic or written requests for withdrawal must be in the possession of the County prior to the closing time for receipt of bids.

11. APPLICABLE LAWS

All applicable laws and regulations of the State of Georgia and ordinances and regulations of Fulton County shall apply. Protestors shall seek resolution of their complaints in the manner provided in the Fulton County Purchasing Code §102-488 et. seq., which is incorporated by reference herein.

12. EXAMINATION OF CONTRACT DOCUMENTS

Prospective bidders shall examine the contract documents and before submitting a bid, shall make a written request to the County for an interpretation or correction of any ambiguity, in consistency or error therein which could be discovered by a bidder. At the bid opening each bidder shall be presumed to have read and be familiar with the contract documents.

13. BID EVALUATION

- a. Each Bid timely received and in the County's hands at the time set forth for the Bid opening shall constitute an offer to perform the Agreement on the terms and conditions thereof, in strict accordance with the Agreement documents, and all other requirements, all for the Bid total. For good cause and valuable consideration, the sufficiency of which is acknowledged by submittal of a Bid, each Bidder promises and agrees that its Bid shall be irrevocable for a period of **sixty calendar days** after the Bid opening and will not be withdrawn or modified during that time. The County may accept any Bid by giving the Bidder Written Notice of acceptance during that time. If necessary, the period of time specified may be extended by written agreement between the County and the Bidder or Bidders concerned.
- b. After the Bids have been opened and before any award is made, the County will evaluate the Bid process, the Bid total, the supplements to the Bid form, Bidder's experience, proposed Subcontractors and equipment manufacturers and other data relating to Bidders' responsibility and qualifications to perform the Agreement satisfactorily.
- c. All extension of the unit prices shown and the subsequent addition of extended amounts may be verified by the County. In the event of a discrepancy between the unit price bid and the extension, the unit price will be deemed intended by the Bidder and the extension shall be adjusted. In

the event of a discrepancy between the sum of the extended amounts and the bid total, the sum of the extended amounts shall govern.

- d. Bidder may be required to submit, in writing, the addresses of any proposed Subcontractors or Equipment manufacturers listed on the Bid, and to submit other material information relative to proposed Subcontractors or Equipment manufacturers. The County reserves the right to disapprove any proposed Subcontractor or Equipment manufacturers whose technical or financial ability or resources or whose experience are deemed inadequate.
- e. The County reserves the right to reject any Bid the prices of which appear to be unbalanced, and to reject any or all Bids, or parts thereof, if it determines, in its sole discretion, that such rejection is in the best interest of the County. Where only a single responsible and responsive Bid is received, the County may in its sole discretion, elect to conduct a price or cost analysis of the Bid. Such Bidder shall cooperate with such analysis and provide such supplemental information as may be required. The determination whether to enter into an Agreement with such sole Bidder shall be solely within the County's discretion and not dependent upon performance of a price or cost analysis.
- f. Bids will be evaluated on the basis of determining the lowest Bid total of a Bidder, not including alternates, whose Bid is responsive to the Invitation to Bid and who is determined to be technically, financially and otherwise responsible to perform the Agreement satisfactorily, and to meet all other requirements of the Bidding Documents relating thereto. Any Bid may be rejected if it is determined by the County to be non-responsive, provided, however, that the Commission reserves the right to waive any irregularities or technicalities which it determines, within its sole discretion, to be minor in nature and in the interest of the public. Furthermore, any Bid may be rejected if it is determined by the County, in its sole discretion, that the Bidder is not capable of performing the Agreement satisfactorily based upon review of its experience and technical and financial capabilities, or the failure of such bidder to provide information requested relating to such determination. Additionally, the County reserves the right to disqualify Bids, before and after the bid opening, upon evidence of collusion with intent to defraud or other illegal practices upon the part of any Bidder(s).
- g. The County intends to award the Agreement at the earliest practicable date to the lowest responsive, responsible Bidder(s), provided that the Bid is within the funds available for the project. In addition, the County reserves the right to reject all Bids if it determines, in its sole discretion, that the public interest will be best served by doing so.
- h. A Pre-award Conference may be conducted with the apparent low Bidder(s) to review general requirements of the Bidding Documents.

14. **AWARD CRITERIA**

Award will be made after evaluating the prices, responsiveness and responsibility of each Bidder.

- A. **Responsiveness:** The determination of responsiveness will be determined by the following:
- a. The completeness of all material, documents and/or information required by the County;
 - b. Whether the bidder has submitted a complete Bid form without irregularities, excisions, special conditions, or alternative bids for any item unless specifically requested in the Bid form.
- B. **Responsibility:** The determination of the bidder's responsibility will be determined by the following
- a. The ability, capacity and skill of the Bidder to perform and/or provide the Work required;
 - b. The County reserves the right to reject any bid if the evidence submitted by, or investigation of, the bidder fails to satisfy the County that he/she is properly qualified to carry out the obligations of the Contract;
 - c. The character, integrity, reputation, judgment, experience and efficiency of the Bidder;
 - d. The quality of performance of work on previous contracts or work; Maintains a permanent place of business individually or in conjunction with the prime contractor.
 - e. Has the appropriate and adequate technical experience necessary to perform the Work;
 - f. Has adequate personnel and equipment to do the Work expeditiously;
 - g. Has suitable financial means to meet obligations incidental to the work.

15. **DISQUALIFICATION OF BIDDERS**

Any of the following may be considered as sufficient for disqualification of a Bidder and the rejection of the Bid:

- a. Submission of more than one Bid for the same work by an individual, firm, partnership or Corporation under the same or different name(s);
- b. Evidence of collusion among Bidders;
- c. Previous participation in collusive bidding on Work for the County;
- d. Submission of an unbalanced Bid, in which the prices quoted for same items are out of proportion to the prices for other items;
- e. Lack of competency of Bidder. The Agreement will be awarded only to a Bidder(s) rated as capable of performing the Work.

16. BASIS OF AWARD

The Contract, if awarded, will be awarded to the lowest responsive and responsible bidder. No bid may be withdrawn for a period of sixty (60) days after the date of bid opening except as permitted by O.C.G.A., §36-91-41 et seq., as amended. Each Bid must be accompanied by a Bid Bond in accordance with the Bid Bond Requirements provided in the Contract Documents, on a Surety Company's Standard Bid Bond Form acceptable to the County in an amount no less than 5% of the amount bid. The successful bidder will be required to furnish a Performance Bond and Payment Bond, **on or before** the issuance of Notice to Proceed, each in the amount of 100% of the Contract Amount. All other required Contract Documents must be fully completed and executed by the Contractor and his/her Surety, and submitted to the Owner **on or before** the issuance of the Notice to Proceed.

17. PROFESSIONAL LICENSES (APPLICABLE)

The State of Georgia requires that the following professions are required by state law to be licensed:

1. Electricians
2. Plumbers
3. Conditioned Air Contractors
4. Low voltage Contractors

Bidders and any sub-contractors performing any of the above described work must provide a copy of their license for the work they will perform on this project. Bidders must complete Form C3: Georgia Professional License Certification in Section 6, Purchasing Forms Failure to provide the required license may deem your bid non-responsive.

18. WAGE CLAUSE

Pursuant to 102-413, Each Contractor shall agree that in the performance of the Contract he will comply with all lawful agreements, if any, which the Contractor had made with any association, union, or other entity, with respect to wages, salaries, and working conditions, so as not to cause inconvenience, picketing, or work stoppage.

19. NOTICE OF AWARD OF CONTRACT

As soon as possible, and within sixty (60) days after receipt of bids, the County shall notify the successful Bidder of the Award of Contract.

The award shall be made by the Board of Commissioners of Fulton County to the lowest responsive, responsible bidder(s) as soon as possible after receipt of bids, taking into consideration price and the responsiveness to the requirements set forth in the Invitation for Bid. In such case, no claim shall be made by the selected Contractor(s) for loss of profit if the contract is not awarded or awarded for less

work than is indicated and for less than the amount of his bid. The total of the awarded contract shall not exceed the available funds allocated for this project.

Should the County require additional time to award the contract, the time may be extended by mutual agreement between the County and the successful bidder. If an Award of Contract has not been made within sixty (60) days from the bid date or within the extension mutually agreed upon, the Bidder may withdraw the Bid without further liability on the part of either party.

Any award made by the Board of Commissioners as a result of this bid will begin from the date of the notice to proceed. The Bidder agrees hereby to commence work under this Contract, with adequate personnel and equipment, on a date to be specified in a written order from the user department. The contract shall become effective on the Contract Date and shall continue in effect until the end of the term of the contract or until the project has been closed-out unless earlier terminated pursuant to the termination provisions of the contract.

20. EXECUTION OF CONTRACT DOCUMENTS

Upon notification of Award of Contract, the County shall furnish the Contractor the conformed copies of Contract Documents for execution by the Contractor and Contractor's surety.

Within ten (10) days after receipt the Contractor shall return all the documents properly executed by the Contractor and the Contractor's surety. Attached to each document shall be an original power-of-attorney for the person executing the bonds for the surety and certificates of insurance for the required insurance coverage.

After receipt of the documents executed by the Contractor and his surety with the power-of-attorney and certificates of insurance, the County shall complete the execution of the documents. Distribution of the completed documents will be made upon completion.

Should the contractor and/or surety fail to execute the documents within the time specified, the County shall have the right to proceed on the Bid Bond accompanying the bid.

If the County fails to execute the documents within the time limit specified, the Contractor shall have the right to withdraw the Contractor's bid without penalty.

Should an extension of any of the time limits stated above be required, this shall be done only by mutual agreement between both parties.

Any agreement or contract resulting from the acceptance of a bid shall be on a County approved document form. The County reserves the right to reject any agreement that does not conform to the Invitation for Bid and any County requirements for agreements and contracts. The County reserves the right to modify the agreement resulting from this bid upon the recommendation of the County Attorney.

21. INVOICES AND PAYMENT TERMS

Invoices are to be mailed to the County department specified on the resulting purchase order or master agreement. All invoices must include the purchase order number or master agreement number. Failure to comply may result in delayed payments. The County payment terms are Net 30 days unless a cash discount is allowed for payment within not less than twenty (20) days. The payment term shall begin on the date the merchandise is inspected, delivered and accepted by the County.

Submittal of Invoices: Invoices shall be submitted as follows:

Via Mail:

Fulton County Government
141 Pryor Street, SW
Suite 7001
Atlanta, Georgia 30303
Attn: Finance Department – Accounts Payable

OR

Via Email:

Email: Accounts.Payable@fultoncountyga.gov

At minimum, original invoices must reference all of the following information:

- 1) Vendor Information
 - a. Vendor Name
 - b. Vendor Address
 - c. Vendor Code
 - d. Vendor Contact Information
 - e. Remittance Address
- 2) Invoice Details
 - a. Invoice Date
 - b. Invoice Number (uniquely numbered, no duplicates)
 - c. Purchase Order Reference Number
 - d. Date(s) of Services Performed
 - e. Itemization of Services Provided/Commodity Units
- 3) Fulton County Department Information (needed for invoice approval)
 - a. Department Name
 - b. Department Representative Name

22. EQUAL EMPLOYMENT OPPORTUNITY (“EEO”) IN PURCHASING AND CONTRACTING

To be eligible for award of this Agreement, the Bidder must certify and fully comply with the requirements, terms, and conditions of the County’s Non Discrimination in Contracting and Procurement.

23. JOINT VENTURE

Any Bidder intending to respond to this solicitation as a joint venture must submit an executed joint venture agreement with its offer. The agreement must designate those persons or entities authorized to execute documents or otherwise bind the joint venture in all transactions with Fulton County, or be accompanied by a document, binding upon the joint venture and its constituent members, making such designation. Offers from joint ventures that do not include these documents will be rejected as being non-responsive.

24. NON-COLLUSION

By submitting a signed Bid, Bidder certifies and attests that there has been no collusion with any other Bidder. Reasonable grounds for believing Bidder has an interest in more than one Bid will result in rejection of all Bids in which the Bidder has an interest. Any party to collusion may not be considered in future Bids for the same or similar work.

25. GEORGIA SECURITY AND IMMIGRATION COMPLIANCE ACT

This Invitation to Bid is subject to the Georgia Security & Immigration Compliance Act. Effective July 1, 2013, bidders and proposers are notified that all bids/proposals for services that are to be physically performed within the State of Georgia must be accompanied by proof of their registration with and continuing and future participation in the E-Verify program established by the United States Department of Homeland Security. Physical performance of services means any performance of labor or services for a public employer using a bidding process or by contract wherein the labor or services exceed \$2,499.99 99 (except for services performed by an individual who is licensed pursuant to Title 26, Title 43, or the State Bar of Georgia).

A completed affidavit must be submitted on the top of the bid/proposal at the time of submission, prior to the time for opening bids/proposals. Under state law, the County cannot consider any bid/proposal which does not include a completed affidavit. It is not the intent of this notice to provide detailed information or legal advice concerning the Georgia Security & Immigration Compliance Act. All bidders/proposers intending to do business with the County are responsible for independently apprising themselves and complying with the requirements of that law and its effect on County procurements and their participation in those procurements. For additional information on the E-Verify program or to enroll in the program, go to: <https://e-verify.uscis.gov/enroll>.

The Director of Purchasing & Contract Compliance is authorized to conduct random audits of a contractor's or subcontractors' compliance with the Illegal Immigration Reform and Enforcement Act and the rules and regulations of the Georgia Department of Labor.

See Section 00420, Purchasing Forms & Instructions for declarations and affidavits.

26. SUBCONTRACTING OPPORTUNITIES

Potential prime contractors submitting a bid on this project for Fulton County and are seeking subcontractors and/or suppliers can advertise those subcontracting opportunities on the County's website, <http://www.fultoncountyga.gov> under "Subcontracting Bid Opportunities".

27. TERM OF CONTRACT

The term of the Agreement shall be for a period of two hundred and seventy (270) calendar days, or as may be amended under the Agreement to comprise the Agreement Time. Contractor shall commence the Work within ten calendar days after receipt of Notice to Proceed and shall substantially complete the Work within two hundred and seventy (270) calendar days from issuance of the Notice to Proceed.

28. NO CONTACT PROVISION

It is the policy of Fulton County that the evaluation and award process for County contracts shall be free from both actual and perceived impropriety, and that contacts between potential vendors and County officials, elected officials and staff regarding pending awards of County contracts shall be prohibited.

- A. No person, firm, or business entity, however situated or composed, obtaining a copy of or responding to this solicitation, shall initiate or continue any verbal or written communication regarding this solicitation with any County officer, elected official, employee, or designated County representative, between the date of the issuance of this solicitation and the date of the County Manager's recommendation to the Board of Commissioners for award of the subject contract, except as may otherwise be specifically authorized and permitted by the terms and conditions of this solicitation.
- B. All verbal and written communications initiated by such person, firm, or entity regarding this solicitation, if same are authorized and permitted by the terms and conditions of this solicitation, shall be directed to the Purchasing Agent.
- C. Any violation of this prohibition of the initiation or continuation of verbal or written communications with County officers, elected officials, employees, or designated County representatives shall result in a written finding by the Purchasing Agent that the submitted Bid or proposal of the person, firm, or entity in violation is "non-responsive", and same shall not be considered for award.

29. AUTHORIZATION TO TRANSACT BUSINESS

If the Contractor is a corporation or corporations combined to form a joint venture, the corporation or members of the joint venture team, prior to Agreement execution, must submit documentary evidence from the Secretary of State that the corporation

is in good standing and that the corporation is authorized to transact business in the State of Georgia.

30. PRE-CONSTRUCTION CONFERENCE

A pre-construction conference may be held with the successful Bidder and all known Subcontractors at a time and place set by the County.

31. SUBSTITUTIONS

See Special Conditions Article.

32. RIGHT TO PROTEST

Any actual bidder or offeror that has submitted a bid/proposal for a particular procurement and is aggrieved in connection with the solicitation or award of the contract shall protest in writing to the purchasing agent after the date that the specific bid or proposal is submitted. No protest will be accepted or considered prior to the date the specific bid or proposal is submitted; it will be considered untimely. All protests shall set forth in full detail the factual and legal bases for the protest and specific relief sought by the protestor. Protests arising from factual or legal bases that the protestor knew or should have known prior to the submission of the bid/proposal must be submitted within three business days of the submission of the bid/proposal. Protests arising from factual or legal bases that the protestor knew or should have known subsequent to the date the bid/proposal was submitted must be submitted within ten business days after the protestor knew or should have known of such bases, but in no event shall any protest be submitted more than ten business days after the award of the contract. Untimely protests will not be considered by the purchasing agent and will be simply denied as untimely. Decisions on timeliness by the purchasing agent are not appealable. An oral protest or a protest to an official, employee, User Department, or other person apart from the Director of Purchasing & Contract Compliance does not comply.

33. CERTIFICATE OF ACCEPTANCE

By responding to this Bid, Bidder acknowledges that he/she has read this solicitation document, including any addenda, exhibits, attachments, and/or appendices in its entirety, and agrees that no pages or parts of the document have been omitted, that he/she understands, accepts and agrees to fully comply with the requirements therein.

Bidder also certifies and attests that the Bidder has reviewed the form Fulton County contract included in this solicitation and agrees to be bound by its terms, or that the Bidder certifies that it is submitting any proposed modification(s) to the contract terms with its proposal in accordance with Section 2.26, Exceptions to the County's Contract. The Bidder further certifies that the failure to submit proposed modifications with the Bid waives the Bidder's right to submit proposed modifications later. The Bidder also acknowledges that the indemnification and insurance provisions of Fulton County's contract included in this solicitation

document are non-negotiable and that proposed modifications to said terms may be reason to declare the Bidder's Bid as non-responsive.

34. EXCEPTIONS TO THE COUNTY'S CONTRACT

If Bidder takes exception to any term or condition set forth in the Owner-Contractor Agreement, and any of its exhibits, appendices or attachments, said exceptions must be clearly identified in the response to this Bid. Exceptions or modifications to any of the terms and conditions must be submitted as a separate document accompanying the Bidder's Bid clearly marked as "Exceptions."

The County shall be the sole determiner of the acceptability of any exception(s).

35. CERTIFICATION REGARDING DEBARMENT

By responding to this Bid, Bidder certifies that neither it or its subcontractors is presently debarred, suspended, proposed for debarment, declared ineligible, or otherwise excluded from doing business with any government agency. Any such exclusion may cause prohibition of your firm from participating in any procurement by the County. Section 102-449 of the Fulton County Code of Laws, which is incorporated as if fully set forth herein, establishes the procedure for the debarment of contractors.

36. BID GENERAL CONDITIONS

1. A Bid may be withdrawn upon receipt of a written request prior to the stated due date and time. If a firm seeks to withdraw a bid after the due date and time, the firm must present a notarized statement indicating that an error was made, with an explanation of how it occurred. The withdrawal request must be accompanied by documentation supporting the claim. Prior to approving or disapproving the request, an opinion will be obtained from the County Attorney's Office indicating whether the firm is bound by its Bid.

Bids for projects that are solicited pursuant to the Georgia Local Government Public Works Construction Law (O.C.G.A. § 36-91-1 et seq.) may be withdrawn as follows:

The County must advise Bidders in the solicitation of the number of days that Offerors will be required to honor their Bid. If an Bidder is not selected within 60 days of opening the Bids, any Bidder that is determined by the governmental entity to be unlikely of being selected for contract award will be released from the Bid.

2. Fulton County shall be the sole judge of the quality and the applicability of all Bids. Design, features, overall quality, local facilities, terms and other pertinent considerations will be taken into account in determining acceptability.
3. The successful Bidder must assume full responsibility for delivery of all goods and services proposed.

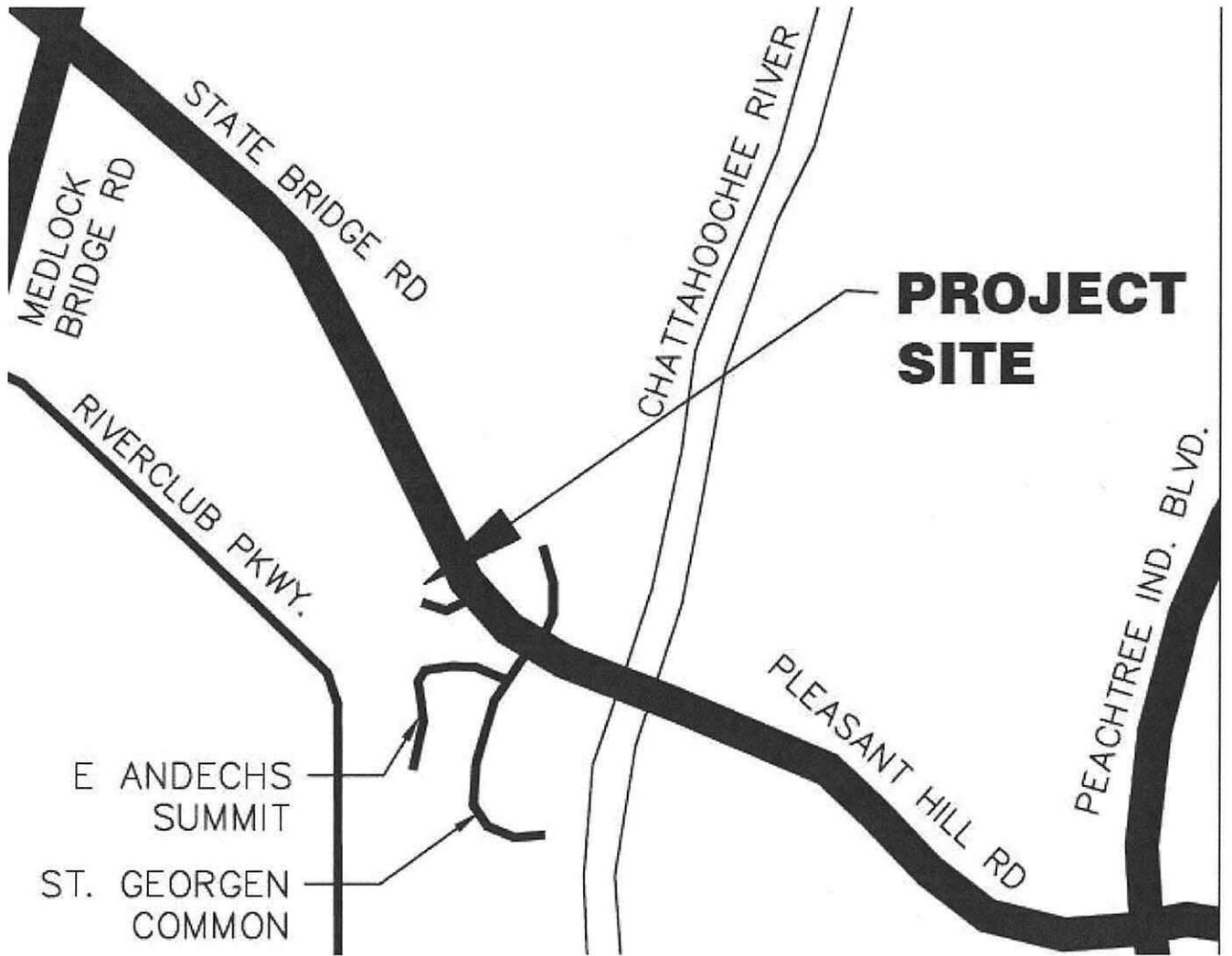
4. The successful Bidder must assume full responsibility for replacement of all defective or damaged goods and/or performance of contracted services within thirty (30) days' notice by the County of such defect, damage or deficiency.
5. The successful Bidder must assume full responsibility for providing warranty service on all goods, materials, or equipment provided to the County with warranty coverage. Should a vendor be other than the manufacturer, the vendor and not the County is responsible for contacting the manufacturer. The Offeror is solely responsible for arranging for the service to be performed.
6. The successful Bidder shall be responsible for the proper training and certification of personnel used in the performance of the services proposed.
7. The successful Bidder shall not assign, transfer, convey, sublet, or otherwise dispose of any contract resulting from the Bid or of any of its rights, title or interest therein without prior written consent of the Fulton County Board of Commissioners.
8. In case of default by the successful Bidder, Fulton County may procure the articles or services from another source and hold the successful Bidder responsible for any resultant excess cost.
9. All proposals and Bids submitted to Fulton County are subject to the Georgia "Open Records Act", Official Code of Georgia, Annotated (O.C.G.A.) § 50-18-70 et seq.
10. All proposals and Bids submitted to Fulton County involving Utility Contracting are subject to the Georgia law governing licensing of Utility Contractors, O.C.G.A. §43-14-8.2(h).

37. SUBMITTALS

The following submittals must be completed and submitted with the Bid Submittal. This checklist is provided to ensure that the Bidder submits certain required information with its Bid.

	Bid Submittal Check Sheet	Check (√)
1.	Georgia Security and Immigration Contractor Affidavit(s) and Agreements	
2.	Georgia Security and Immigration Subcontractor Affidavit(s)	
3.	Bid Form	
4.	Acknowledgment of Addenda	
5.	Bid Bond	
6.	Georgia Utility Contractor's License (applicable)	
7.	Georgia General Contractors License (applicable)	
8.	Georgia Professional License (applicable)	
9.	Office of Contract Compliance Requirements (submitted in a separate envelope)	
10.	Proof of Insurance Coverage	
11.	Statement of Bidder's Qualifications and Safety Record Form	

END OF SECTION



LOCATION SKETCH

Not to Scale

DIRECTIONS: The Chattahoochee III Pump Station is approximately three quarters of a mile east of the intersection of Medlock Bridge Road and State Bridge Road and will be on the south side of State Bridge Road west of the Chattahoochee River.

BID FORM

Submitted To: Fulton County Government

Submitted By: _____

For: **#16ITB091416K-JD - Chattahoochee III Pump Station Upgrades**

Submitted on _____, 20__.

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

The Bidder further declares that he has examined the site of the work and informed himself fully in regard to all conditions pertaining to the place where the work is to be done; that he has examined the Drawings and Specifications for the work and contractual documents relative thereto, and has read all instructions to Bidders and General Conditions furnished prior to the openings of bids; that he has satisfied himself relative to the work to be performed.

The Bidder proposes and agrees, if this Bid is accepted, to contract with the Board of Commissioners of Fulton County, Atlanta, Georgia, in the form of contract specified, to furnish all necessary materials, equipment, machinery, tools, apparatus, means of transportation and labor necessary, and to complete the construction of the work in full and complete accordance with the shown, noted, and reasonably intended requirements of the Specifications and Contract Documents to the full and entire satisfaction of the Board of Commissioners of Fulton County, Atlanta, Georgia, with a definite understanding that no money will be allowed for extra work except as set forth in the attached General Conditions and Contract Documents for the following prices.

THE BASE BID IS THE AMOUNT UPON WHICH THE BIDDER WILL BE FORMALLY EVALUATED AND WHICH WILL BE USED TO DETERMINE THE LOWEST RESPONSIBLE BIDDER.

The base bid may not be withdrawn or modified for a period of sixty (60) days following the receipt of bids.

BASE BID AMOUNT (Do not include any Bid Alternates)

\$ _____
(Dollar Amount In Numbers)

(Dollar Amount in Words)

The Bidder agrees hereby to commence work under this Contract, with adequate personnel and equipment, on a date to be specified in a written "Notice to Proceed" from the County.

The Bidder declares that he understands that the quantities shown for the unit prices items are subject to either increase or decrease, and that should the quantities of any of the items of work be increased, the Bidder proposes to do the additional work at the unit prices stated herein; and should the quantities be decreased, the Bidder also understands that payment will be made on the basis of actual quantities at the unit price bid and will make no claim for anticipated profits for any decrease in quantities; and that actual quantities will be determined upon completion of work, at which time adjustments will be made to the contract amount by direct increase or decrease.

BID FORM

Submitted To: Fulton County Government

Submitted By: _____

For: **#16ITB091416K-JD - Chattahoochee III Pump Station Upgrades**

Submitted on _____, 20__.

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

The Bidder further declares that he has examined the site of the work and informed himself fully in regard to all conditions pertaining to the place where the work is to be done; that he has examined the Drawings and Specifications for the work and contractual documents relative thereto, and has read all instructions to Bidders and General Conditions furnished prior to the openings of bids; that he has satisfied himself relative to the work to be performed.

The Bidder proposes and agrees, if this Bid is accepted, to contract with the Board of Commissioners of Fulton County, Atlanta, Georgia, in the form of contract specified, to furnish all necessary materials, equipment, machinery, tools, apparatus, means of transportation and labor necessary, and to complete the construction of the work in full and complete accordance with the shown, noted, and reasonably intended requirements of the Specifications and Contract Documents to the full and entire satisfaction of the Board of Commissioners of Fulton County, Atlanta, Georgia, with a definite understanding that no money will be allowed for extra work except as set forth in the attached General Conditions and Contract Documents for the following prices.

THE BASE BID IS THE AMOUNT UPON WHICH THE BIDDER WILL BE FORMALLY EVALUATED AND WHICH WILL BE USED TO DETERMINE THE LOWEST RESPONSIBLE BIDDER.

The base bid may not be withdrawn or modified for a period of sixty (60) days following the receipt of bids.

BASE BID AMOUNT (Do not include any Bid Alternates)

\$ _____
(Dollar Amount In Numbers)

(Dollar Amount in Words)

The Bidder agrees hereby to commence work under this Contract, with adequate personnel and equipment, on a date to be specified in a written "Notice to Proceed" from the County.

The Bidder declares that he understands that the quantities shown for the unit prices items are subject to either increase or decrease, and that should the quantities of any of the items of work be increased, the Bidder proposes to do the additional work at the unit prices stated herein; and should the quantities be decreased, the Bidder also understands that payment will be made on the basis of actual quantities at the unit price bid and will make no claim for anticipated profits for any decrease in quantities; and that actual quantities will be determined upon completion of work, at which time adjustments will be made to the contract amount by direct increase or decrease.

BASE BID AMOUNT

ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT COST	TOTAL PRICE
1.	PUMP STATION UPGRADE Include all equipment, materials, labor, demolition, debris removal and appurtenances to complete the work as outlined in the Scope of Work, construction drawings, bid documents and specifications. Include all costs here which are not specifically allowed for elsewhere.	1	LS		
2.	Pressure wash and paint all exterior and interior walls, doors, floors, etc. as outlined in the construction Drawings and Specifications. All surfaces are to be pressure washed, painting is only required for surfaces already painted	1	LS		
3.	Installation as outlined in the drawings and Specifications. This does not include the Grasscrete Pavers listed in the Alternate Bid Item.	1	LS		
4.	Per the Drawings, Specifications, and Contract Documents.	1	LS		
5.	Wet Well Grit Removal and Cleaning.	10	TONS		
6.	By-Pass Pumping	1	LS		
7.	24-inch Flare, Complete Install	1	LS		
8.	Owner Controlled Contingency Includes: inspection and testing , miscellaneous concrete repair, landscaping/grassing and Grasscrete paver system				\$190,000.00
	TOTAL BASE BID AMOUNT (lines 1-8)				

The Bidder furthermore agrees that, in the case of a failure on his part to execute the Contract Agreement and Bonds within ten days after receipt of conformed contract documents for execution, the Bid Bond accompanying his bid and the monies payable thereon shall be paid into the funds of the Owner as liquidated damages for such failure.

Enclosed is a Bid Bond in the approved form, in the sum of:

_____ Dollars

(\$ _____) according to the conditions of "Instructions to Bidders" and provisions

thereof.

The undersigned acknowledges receipt of the following addenda (list by the number and date appearing on each addendum) and thereby affirms that its Bid considers and incorporates any modifications to the originally issued Bidding Documents included therein.

ADDENDUM #	_____	DATED	_____
ADDENDUM #	_____	DATED	_____
ADDENDUM #	_____	DATED	_____
ADDENDUM #	_____	DATED	_____

BIDDER: _____

Signed by: _____
[Type or Print Name]

Title: _____

Business Address: _____

Business Phone: _____

Note: If the Bidder is a corporation, the Bid shall be signed by an officer of the corporation; if a partnership, it shall be signed by a partner. If signed by others, authority for signature shall be attached.

The full name and addresses of persons or parties interested in the foregoing Bid, as principals, are as follows:

Name	Address
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

END OF SECTION

BID BOND

No bid for a contract in Fulton County for work to be done shall be valid for any purpose unless the Contractor shall give a Bid Bond with good and sufficient surety payable to, in favor of, and for the protection of Fulton County. The Bid Bond shall not be less than 5% of the total amount payable by the terms of the Contract. No bid shall be read aloud or considered if a proper bid bond has not been submitted.

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 of Georgia.

Attestation for the corporation must be by the corporate officer; for a partnership by another partner; for an individual by a notary with the corporate seal.

BID BOND
#16ITB091416K-JD
Chattahoochee III Pump Station Upgrades
FULTON COUNTY GOVERNMENT

KNOW ALL MEN BY THESE PRESENTS, THAT WE _____

hereinafter called the PRINCIPAL, and _____

hereinafter call the SURETY, a corporation chartered and existing under the laws of the State of _____ and duly authorized to transact Surety business in the State of Georgia, are held and firmly bound unto the Fulton County Government (COUNTY), in the penal sum of _____ Dollars and Cents (\$ _____) good and lawful money of the United States of America, to be paid upon demand of the COUNTY, to which payment well and truly to be made we bind ourselves, our heirs, executors, and administrators and assigns, jointly and severally and firmly by these presents.

WHEREAS the PRINCIPAL has submitted to the COUNTY, for **#16ITB091416K-JD Chattahoochee III Pump Station Upgrades**, a Bid;

WHEREAS the PRINCIPAL desires to file this Bond in accordance with law:

NOW THEREFORE: The conditions of this obligation are such that if the Bid be accepted, the PRINCIPAL shall within ten (10) calendar days after receipt of written notification from the COUNTY of the award of the Contract execute the Contract in accordance with the Bid and upon the terms, conditions and prices set forth therein, in the form and manner required by the COUNTY, and execute sufficient and satisfactory Performance and Payments Bonds payable to the COUNTY, each in the amount of one hundred percent (100%) of the total contract price, in form and with security satisfactory to said COUNTY, then this obligation to be void; otherwise, to be and remain in full force and virtue in law; and the SURETY shall upon failure of the PRINCIPAL to comply with any or all of the foregoing requirements within the time specified above immediately pay to the COUNTY, upon demand the amount hereof in good and lawful money of the United States of America, not as a penalty, but as liquidated damages.

In the event suit is brought upon this Bond by the COUNTY and judgment is recovered, the SURETY shall pay all costs incurred by the COUNTY in such suit, including attorney's fees to be fixed by the Court.

Enclosed is a Bid Bond in the approved form, in the amount of _____
_____ Dollars

(\$ _____) being in the amount of five percent (5%) of the Contract Sum.
The money payable on this bond shall be paid to the COUNTY, for the failure of the Bidder to
execute a Contract within ten (10) days after receipt of the Contract and at the same time furnish
a Payment Bond and Performance Bond.

(SIGNATURES ON NEXT PAGE)

IN TESTIMONY THEREOF, the PRINCIPAL and SURETY have caused these presents to be duly signed and sealed this _____ day of _____, 20__

ATTEST:

PRINCIPAL

BY _____

(SEAL)

CERTIFICATE AS TO CORPORATE PRINCIPAL

I, _____, certify that I am the Secretary of the Corporation named as principal in the within bond; that _____, who signed the said bond of said corporation; that I know this signature, and his/her signature thereto is genuine; and that said bond was duly signed, sealed and attested for in behalf of said Corporation by authority of its governing body.

SECRETARY

(CORPORATE SEAL)

SURETY

BY _____

(SEAL)

END OF SECTION

PAYMENT BOND

No Contract with Fulton County for work to be done shall be valid for any purpose unless the Contractor provides a Payment Bond with good and sufficient surety payable to Fulton County for the use and protection of all sub-contractors and all persons supplying labor, materials, machinery, and equipment in the prosecution of the work provided for in the Contract. The Payment Bond shall be in the amount of 100% of the total contract amount, payable by the terms of the Contract, and shall be written on the following form.

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 of Georgia.

Attestation for the corporation must be by the corporate officer; for a partnership by another partner; for an individual by a notary with the corporate seal.

PAYMENT BOND

KNOW ALL MEN BY THESE PRESENTS that *insert name of contractor* (hereinafter called the "Principal") and *insert name of surety* (hereinafter called the "Surety"), are held and firmly bound unto **FULTON COUNTY**, a political subdivision of the State of Georgia (hereinafter called the "Owner"), its successors and assigns as obligee, in the penal sum of [100% of contract amount], lawful money of the United States of America, for the payment of which the Principal and the Surety bind themselves, their administrators, executors, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Principal has entered, or is about to enter, into a certain written contract with the Owner, dated [insert date of contract], which is incorporated herein by reference in its entirety (hereinafter called the "Contract"), for construction-type services of a project known as **#16ITB091416K-JD Chattahoochee III Pump Station Upgrades**, as more particularly described in the Contract (hereinafter called the "Project");

NOW, THEREFORE, the condition of this obligation is such that if the Principal shall promptly make payment to all persons working on or supplying labor or materials under the Contract, and any amendments thereto, with regard to labor or materials furnished and used in the Project, and with regard to labor or materials furnished but not so used, then this obligation shall be void; but otherwise it shall remain in full force and effect.

1. A "Claimant" shall be defined herein as any subcontractor, person, party, partnership, corporation or the entity furnishing labor, services or materials used, or reasonably required for use, in the performance of the Contract, without regard to whether such labor, services or materials were sold, leased or rented, and without regard to whether such Claimant is or is not in privity of contract with the Principal or any subcontractor performing work on the Project, including, but not limited to, the following labor, services, or materials: water, gas, power, light, heat, oil, gasoline, telephone service or rental of equipment directly applicable to the Contract.

2. In the event a Claimant files a lien against the property of the Owner, and the Principal fails or refuses to satisfy or remove it promptly, the Surety shall satisfy or remove the lien promptly upon written notice from the Owner, either by bond or as otherwise provided in the Contract.

3. The Surety hereby waives notice of any and all modifications, omissions, additions, changes, alterations, extensions of time, changes in the payment terms, and any other amendments in or about the Contract and agrees that the obligations undertaken by this Bond shall not be impaired in any manner by reason of any such modifications, omissions, additions, changes, alterations, extensions of time, changes in payment terms, and amendments.

4. The Surety hereby agrees that this Bond shall be deemed amended automatically and immediately, without formal or separate amendments hereto, upon any amendment or modifications to the Contract, so as to bind the Principal and Surety, jointly and severally, to the full payment of any Claimant under the Contract, as amended or modified, provided only that the Surety shall not be liable for more than the penal sum of the Bond, as specified in the first paragraph hereof.

5. This Bond is made for the use and benefit of all persons, firms, and corporations who or which may furnish any materials or perform any labor for or on account of the construction-type services to be performed or supplied under the Contract, and any amendments thereto, and they and each of them may sue hereon.

6. No action may be maintained on this Bond after one (1) year from the date the last services, labor, or materials were provided under the Contract by the Claimant prosecuting said action.

7. This Bond is intended to comply with O.C.G.A. Section 13-10-1, and shall be interpreted so as to comply with the minimum requirements thereof. However, in the event the express language of this Bond extends protection to the Owner beyond that contemplated by O.C.G.A. Section 13-10-1, or any other statutory law applicable to this Project, then the additional protection shall be enforced in favor of the Owner, whether or not such protection is found in the applicable statutes. **IN WITNESS WHEREOF**, the Principal and Surety have hereunto affixed their corporate seals and caused this obligations to be signed by their duly authorized representatives this _____ of _____, _____.

_____(SEAL)
(Principal)

By: _____

Attest:

Secretary

_____(SEAL)
(Surety)

By: _____

Attest:

Secretary

(Address of Surety's Home Office)

(Resident Agent of Surety)

PERFORMANCE BOND

No contract with Fulton County for work to be done shall be valid for any purpose unless the Contractor provides a Performance Bond with good and sufficient surety payable to, in favor of, and for the protection of Fulton County. The Performance Bond shall be in the amount of 100% of the total contract amount, payable by the terms of the Contract, and shall be written on the following form.

Surety companies executing Bonds must appear on the Treasury Department's most current list (Circular 570 as amended) and be authorized to transact business as a surety in Georgia.

Attestation for the corporation must be by the corporate officer; for a partnership by another partner; for an individual by a notary with the corporate seal.

PERFORMANCE BOND

KNOW ALL MEN BY THESE PRESENTS that _____
(hereinafter called the "Principal") and _____
(hereinafter called the "Surety"), are held and firmly bound unto **FULTON COUNTY**, a political subdivision of the State of Georgia (hereinafter called the "Owner"), its successors and assigns, in the penal sum of _____
[100% of Contract amount], lawful money of the United States of America, for the payment of which the Principal and the Surety bind themselves, their administrators, executors, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Principal has entered, or is about to enter, into a certain written contract with the Owner, dated _____, which is incorporated herein by reference in its entirety (hereinafter called the "Contract"), for construction-type services of a project known as **#16ITB091416K-JD Chattahoochee III Pump Station Upgrades** as more particularly described in the Contract (hereinafter called the "Project");

NOW, THEREFORE, the conditions of this obligation are as follows, that if the Principal shall fully and completely perform all the undertakings, covenants, terms, conditions, warranties, and guarantees contained in the Contract, including all modifications, amendments, changes, deletions, additions, and alterations thereto that may hereafter be made, then this obligation shall be void; otherwise it shall remain in full force and effect.

Whenever the Principal shall be, and declared by the Owner to be, in default under the Construction-Type Contract, the Surety shall promptly remedy the default as follows:

1. Complete the Contract in accordance with its terms and conditions; or, at the sole option of the Owner,
2. Obtain a bid or bids for completing the Contract in accordance with its terms and conditions, and upon determination by the Surety and the Owner of the lowest responsible bidder, arrange for a contract between such bidder and Owner and make available as the work progresses (even though there should be a default or succession of defaults under the Contract or contracts of completion arranged under this paragraph) sufficient funds to pay the cost of completion less the balance of the contract price; but not exceeding, including other costs and damages for which the Surety may be liable hereunder, the penal sum set forth in the first paragraph hereof, as may be adjusted, and the Surety shall make available and pay to the Owner the funds required by this Paragraph prior to the payment of the Owner of the balance of the contract price, or any portion thereof. The term "balance of the contract price," as used in this paragraph, shall mean the total amount payable by the Owner to the Contractor under the Contract, and any amendments thereto, less the amount paid by the Owner to the Contractor; or, at the sole option of the Owner,
3. Allow Owner to complete the work and reimburse the Owner for all reasonable costs incurred in completing the work.

In addition to performing as required in the above paragraphs, the Surety shall indemnify and hold harmless the Owner from any and all losses, liability and damages, claims, judgments, liens, costs and fees of every description, including reasonable attorney's fees, litigation costs and expert witness fees, which the Owner may incur, sustain or suffer by reason of the failure or default on the part of the Principal in the performance of any or all of the terms, provisions, and requirements of the Contract, including any and all amendments and modifications thereto, or

incurred by the Owner in making good any such failure of performance on the part of the Principal.

The Surety shall commence performance of its obligations and undertakings under this Bond promptly and without delay, after written notice from the Owner to the Surety.

The Surety hereby waives notice of any and all modifications, omissions, additions, changes, alterations, extensions of time, changes in payment terms, and any other amendments in or about the Contract, and agrees that the obligations undertaken by this Bond shall not be impaired in any manner by reason of any such modifications, omissions, additions, changes, alterations, extensions of time, change in payment terms, and amendments.

The Surety hereby agrees that this Bond shall be deemed amended automatically and immediately, without formal or separate amendments hereto, upon any amendment to the Contract, so as to bind the Principal and the Surety to the full and faithful performance of the Contract as so amended or modified, and so as to increase the penal sum to the adjusted Contract Price of the Contract.

No right of action shall accrue on this Bond to or for the use of any person, entity or corporation other than the Owner and any other obligee named herein, or their executors, administrators, successors or assigns.

This Bond is intended to comply with O.C.G.A. Section 36-91-1 et seq., and shall be interpreted so; as to comply with; the minimum requirements thereof. However, in the event the express language of this Bond extends protection to; the Owner beyond that contemplated by O.C.G.A. Section 36-91-1 et seq. and O.C.G.A. Section 13-10-1, as amended, or any other statutory law applicable to this Project, then the additional protection shall be enforced in favor of the Owner, whether or not such protection is found in the applicable statutes.

IN WITNESS WHEREOF the undersigned have caused this instrument to be executed and their respective corporate seals to be affixed and attested by their duly authorized representatives this _____ day of _____, _____.

_____(SEAL)
(Principal)

By _____

Attest:

Secretary

_____(SEAL)
(Surety)

By: _____

Attest:

Secretary

(Address of Surety's Home Office)

(Resident Agent of Surety)

END OF SECTION

SECTION 4
INSURANCE AND RISK MANAGEMENT PROVISIONS

Insurance and Risk Management Provisions Chattahoochee III Pump Station Upgrades

The following is the minimum insurance and limits that the Contractor/Vendor must maintain. If the Contractor/Vendor maintains higher limits than the minimum shown below, Fulton County Government requires and shall be entitled to coverage for the higher limits maintained by the Contractor/Vendor.

It is Fulton County Government's practice to obtain Certificates of Insurance from our Contractors and Vendors. Insurance must be written by a licensed agent in a company licensed to write insurance in the State of Georgia. Respondents shall submit with the bid/proposal evidence of insurability satisfactory to Fulton County Government as to form and content. Either of the following forms of evidence is acceptable:

- A letter from an insurance carrier stating that upon your firm/company being the successful Bidder/Respondent that a Certificate of Insurance shall be issued in compliance with the Insurance and Risk Management Provisions outlined below.
- A Certificate of Insurance complying with the Insurance and Risk Management Provisions outlined below (Request for Bid/Proposal number and Project Description must appear on the Certificate of Insurance).
- A combination of a specific policy written with an umbrella policy covering liabilities in excess of the required limits is acceptable to achieve the applicable insurance coverage levels.

Any and all Insurance Coverage(s) and Bonds required under the terms and conditions of the contract shall be maintained during the entire length of the contract, including any extensions or renewals thereto, and until all work has been completed to the satisfaction of Fulton County Government.

Accordingly the Respondent shall provide a certificate evidencing the following:

**1. WORKERS COMPENSATION/EMPLOYER'S LIABILITY INSURANCE – STATUTORY
(In compliance with the Georgia Workers Compensation Acts and any other State or Federal Acts or Provisions in which jurisdiction may be granted)**

Employer's Liability Insurance	BY ACCIDENT - EACH ACCIDENT	\$500,000
Employer's Liability Insurance	BY DISEASE - POLICY LIMIT	\$500,000
Employer's Liability Insurance	BY DISEASE - EACH EMPLOYEE	\$500,000

2. COMMERCIAL GENERAL LIABILITY INSURANCE (Including contractual Liability Insurance)

Bodily Injury and Property Damage Liability (Other than Products/Completed Operations)	Each Occurrence	-	\$1,000,000
	General Aggregate	-	\$2,000,000
Products\Completed Operations	Aggregate Limit	-	\$2,000,000
Personal and Advertising Injury	Limits	-	\$1,000,000
Damage to Rented Premises	Limits	-	\$100,000

3. BUSINESS AUTOMOBILE LIABILITY INSURANCE

Property Damage and Bodily Injury	Per Accident	-	\$1,000,000
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(Including operations of non-owned, owned and hired automobiles)

Chattahoochee III Pump Station Upgrades

4. **UMBRELLA LIABILITY** Each Occurrence - \$2,000,000
(In excess of Auto, General Liability and Employers Liability)

Certificates

Contractor shall provide written notice to Fulton County Government immediately if it becomes aware of or receives notice from any insurance company that coverage afforded under such policy or policies shall expire, be cancelled or altered. Certificates of Insurance are to list Fulton County Government, Its Officials, Officers, Employees, and Agents as an Additional Insured (except for Workers' Compensation), using ISO Additional Insured Endorsement form CG 20 10 (11/85) version, its' equivalent or on a blanket basis.

The insurance shall apply as Primary Insurance before any other insurance or self-insurance, including any deductible, non-contributory, and Waiver of Subrogation provided in favor of Fulton County.

Additional Insured under the General Liability, Auto Liability, Umbrella Policies (with exception of Workers Compensation), with no Cross Suits exclusion.

If Fulton County Government shall so request, the Respondent, Contractor or Vendor will furnish the County for its inspection and approval such policies of insurance with all endorsements, or confirmed specimens thereof certified by the insurance company to be true and correct copies.

Such certificates and notices shall be sent to:

Fulton County Government – Purchasing Department
130 Peachtree Street, S.W.
Suite 1168
Atlanta, Georgia 30303-3459

Important:

It is understood that neither failure to comply nor full compliance with the foregoing insurance requirements shall limit or relieve the Contractor/Vendor from liability incurred as a result of their activities/operations in conjunction with the Contract and/or Scope of Work.

USE OF PREMISES

Contractor/Vendor shall confine its apparatus, the storage of materials and the operations of its workers to limits/requirements indicated by law, ordinance, permits and any restrictions of Fulton County Government and shall not unreasonably encumber the premises with its materials (Where applicable).

PROTECTION OF PROPERTY

Contractor/Vendor will adequately protect its own work from damage, will protect Fulton County Government's property from damage or loss and will take all necessary precautions during the progress of the work to protect all persons and the property of others from damage or loss.

Chattahoochee III Pump Station Upgrades

Contractor/Vendor shall take all necessary precautions for the safety of employees of the work and shall comply with all applicable provisions of the Federal, State and local safety laws and building codes to prevent accidents or injury to persons on, about, or adjacent to the premises where work is being performed.

Contractor/Vendor shall erect and properly maintain at all times as required by the conditions and progress of the work, all necessary safeguards for the protection of its employees, Fulton County Government employees and the public and shall post all applicable signage and other warning devices to protect against potential hazards for the work being performed (Where applicable).

THE RESPONDENT ACKNOWLEDGES HAVING READ, UNDERSTANDING, AND AGREES TO COMPLY WITH THE ABOVE STATEMENTS, AND IS AUTHORIZED TO SIGN CONTRACTS ON BEHALF OF THE RESPONDING COMPANY.

COMPANY: _____ SIGNATURE: _____

NAME: _____ TITLE: _____

DATE: _____

PURCHASING FORMS & INSTRUCTIONS

This section contains the procurement forms that are required to be executed and submitted with the bid package. This section does not contain all forms required to be included with the bid package submittal.

To be deemed responsive to this ITB, Bidders must provide the information requested and complete in detail all Purchasing Forms. The appropriate individual(s) authorized to commit the Bidder to the Project must sign the Purchasing Forms. Bidders should reproduce each Purchasing Form, as required, and complete the appropriate portions of the forms provided in this section.

- Form A: Non-Collusion Affidavit of Prime Bidder/Offeror
- Form B: Certificate of Acceptance of Request for Bid/Proposal Requirements
- Form C: Professional License Certifications (***applicable***)
 - Form C1 – Georgia Utility License Contractor License
 - Form C2 – Georgia General Contractors License
 - Form C3 – Georgia Professional License
- Form D: Certification Regarding Debarment
- Form E: Disclosure Form and Questionnaire
- Form F: Georgia Security and Immigration Contractor Affidavit and Agreement
- Form G: Georgia Security and Immigration Subcontractor Affidavit

FORM A: NON-COLLUSION AFFIDAVIT OF BIDDER/OFFEROR

STATE OF GEORGIA

COUNTY OF FULTON

I, _____ certify that pursuant to Fulton County Code Section 102-397, this bid or proposal is made without prior understanding, agreement or connection with any corporation, firm or person submitting a bid for the same work, labor or service to be done or the supplies, materials or equipment to be furnished and is in all respects fair and without collusion or fraud. I understand collusive bidding is a violation of state and federal law and can result in fines, prison sentences and civil damages awards. I agree to abide by all conditions of this bid or proposal and certify that I am authorized to sign this bid or proposal for the bidder.

Affiant further states that pursuant to O.C.G.A. Section 36-91-21 (d) and (e), _____ has not, by itself or with others, directly or indirectly, prevented or attempted to prevent competition in such bidding or proposals by any means whatsoever. Affiant further states that (s)he has not prevented or endeavored to prevent anyone from making a bid or offer on the project by any means whatever, nor has Affiant caused or induced another to withdraw a bid or offer for the work.

Affiant further states that the said offer of _____ is bona fide, and that no one has gone to any supplier and attempted to get such person or company to furnish the materials to the bidder only, or if furnished to any other bidder, that the material shall be at a higher price.

(COMPANY NAME)

(PRESIDENT/VICE PRESIDENT)

Sworn to and subscribed before me this _____ day of _____, 20__.

(SECRETARY/ASSISTANT SECRETARY)

(Affix corporate seal here, if a corporation)

Notary Public: _____

County: _____

Commission Expires: _____

NOTE:

IF THE OFFEROR IS A PARTNERSHIP, ALL OF THE PARTNERS AND ANY OFFICER, AGENT, OR OTHER PERSON WHO MAY HAVE REPRESENTED OR ACTED FOR THEM IN BIDDING FOR OR PROCURING THE CONTRACT SHALL ALSO MAKE THIS OATH.

IF THE OFFEROR IS A CORPORATION, ALL OFFICERS, AGENTS, OR OTHER PERSONS WHO MAY HAVE ACTED FOR OR REPRESENTED THE CORPORATION IN BIDDING FOR OR PROCURING THE CONTRACT SHALL MAKE THE OATH.

**FORM B: FULTON COUNTY CERTIFICATE OF ACCEPTANCE OF BID/PROPOSAL
REQUIREMENTS**

This is to certify that on this day, offeror acknowledges that he/she has read this solicitation document, pages # _____ to # _____ inclusive, including any addenda # _____ to # _____ exhibit(s) # _____ to # _____, attachment(s) # _____, and/or appendices # _____ to # _____ in its entirety, and agrees that no pages or parts of the document have been omitted, that he/she understands, accepts and agrees to fully comply with the requirements therein, and that the undersigned is authorized by the offeror to submit the proposal herein and to legally obligate the offeror thereto.

This is also to certify that the offeror has reviewed the form Fulton County contract included in the solicitation documents and agrees to be bound by its terms, or that the offeror certifies that it is submitting any proposed modification to the contract terms with its proposal. The offeror further certifies that the failure to submit proposed modifications with the proposal waives the offeror's right to submit proposed modifications later. The offeror also acknowledges that the indemnification and insurance provisions of Fulton County's contract included in the solicitation documents are non-negotiable and that proposed modifications to said terms may be reason to declare the offeror's proposal as non-responsive.

Company: _____

Signature: _____

Name: _____

Title: _____

Date: _____

(Corporate Seal)

FORM C1: CONTRACTOR'S GEORGIA UTILITY LICENSE CERTIFICATION

Contractor's Name: _____

Utility Contractor's Name: _____

Expiration Date of License: _____

I certify that the above information is true and correct and that the classification noted is applicable to the Bid for this Project.

Signed: _____

Date: _____

(ATTACH COPY OF LICENSE)

**FORM C2: CONTRACTOR'S GEORGIA GENERAL CONTRACTOR'S LICENSE
CERTIFICATION**

Contractor's Name: _____

General Contractor's License Number: _____

Expiration Date of License: _____

I certify that the above information is true and correct and that the classification noted is applicable to the Bid for this Project.

Signed: _____

Date: _____

(ATTACH COPY OF LICENSE)

FORM C3: GEORGIA PROFESSIONAL LICENSE CERTIFICATION

NOTE: Please complete this form for the work your firm will perform on this project.

Contractor's Name: _____

Performing work as: Prime Contractor ____ Sub-Contractor ____

Professional License Type: _____

Professional License Number: _____

Expiration Date of License: _____

I certify that the above information is true and correct and that the classification noted is applicable to the Bid for this Project.

Signed:

Date:

(ATTACH COPY OF LICENSE)

FORM D: CERTIFICATION REGARDING DEBARMENT

- (1) The Offeror certifies that neither it or its subcontractors is presently debarred, suspended, proposed for debarment, declared ineligible, or otherwise excluded from doing business with any government agency. Any such exclusion may cause prohibition of your firm from participating in any procurement by the Fulton County Government.
- (2) If the Offeror is unable to certify to any of the statements in this certification, such Offeror or subcontractor shall attach an explanation to this bid or proposal.

INSTRUCTIONS FOR CERTIFICATION

By signing and submitting this certification, the Offeror is providing the certification set out below:

- (1) The certification in this clause is a material representation of fact upon which reliance will be placed. If it is later determined that the prospective vendor knowingly rendered a false certification, the Purchasing Agent may pursue all available remedies, including suspension and/or debarment, for withdrawal of award or termination of a contract.
- (2) The prospective Offeror shall provide immediate written notice to the Purchasing Agent if at anytime the Offeror learns that its certification was erroneous when submitted or has become erroneous by reason of changed circumstances.
- (3) Offeror shall be under a continuing duty to immediately inform the Purchasing Agent in writing of any changes, if as a result of such changes, the Offeror certification regarding debarment is affected.

DEBARMENT ORDINANCE

The following Section 102-449 of Fulton County Code of Laws establishes the procedure for the debarment of contractors.

(a) Authority to suspend.

After reasonable notice to the entity involved and reasonable opportunity for that entity to be heard, the Purchasing Agent, after consultation with user department, the County Manager and the County Attorney shall have the authority to suspend an entity for cause from consideration for award of county contracts. As used in this section, the term entity means any business entity, individual, firm, contractor, subcontractor or business corporation, partnership, limited liability corporation, firm, contractor, subcontractor or business structured; provided, further, that any such entity shall also be subject to suspension under this section if any of its constituents, members, subcontractors at any tier of such entity's and the entity, or any constituent or member, knew or should have known of the commission of the act. The suspension shall be for a period not to exceed three (3) years unless cause is based on a felony conviction for an offense related or associated with fraudulent contracting or misappropriation of funds wherein the suspension shall not exceed seven (7) years.

(b) Causes for Suspension. The causes for suspension include:

- (1) Conviction for commission of a criminal offense as an incident to obtain or attempting to obtain a public or private contract or subcontract, or in performance of such contract or subcontract;

- (2) Conviction of state or federal statutes of embezzlement, theft, forgery, bribery, falsification or destruction of records, receiving stolen property or other offense indicating a lack of business integrity or business honesty which currently, seriously and directly affects responsibility as a county contractor.
- (3) Conviction of state or federal anti-trust statutes arising out of the solicitation and submission of bids and proposals;
- (4) Violation of contract provisions, as set forth below, of a character which is regarded by the Purchasing Agent to be so serious as to justify suspension action:
 - a. Failure to perform in accordance with the specifications within a time limit provided in a county contract;
 - b. A recent record of failure to perform or unsatisfactory performance in accordance with the terms of one or more contracts; provided, that failure to perform or unsatisfactory performance caused by acts beyond the control of the contractor shall not be considered to be a basis for suspension;
 - c. Material representation of the composition of the ownership or workforce or business entity certified to the county as a minority business enterprise; or
 - d. Falsification of any documents.
- (5) For violation of the ethical standards set forth in Fulton County Code Chapter 9, Code of Ethics.
- (6) Knowing misrepresentation to the county, of the use which a majority owned contractor intends to make a minority business enterprise (a business entity at least 51 percent of which is owned and controlled by minority persons, as defined in Fulton County Code Section 102-431) as a subcontractor or a joint venture partner, in performing work under contract with the County.

Failure to fully and truthfully provide the information required, may result in the disqualification of your bid/proposal from consideration or termination of the Contract, once awarded. This document must be completed and included as a part of the bid/proposal package along with other required documents.

[SIGNATURES ON NEXT PAGE]

Under penalty of perjury, I declare that I have examined this certification and all attachments hereto, if applicable, to the best of my knowledge and belief, and all statements contained hereto are true, correct, and complete.

On this _____ day of _____, 20____

(Legal Name of Offeror) (Date)

(Signature of Authorized Representative) (Date)

(Title)

FORM E: DISCLOSURE FORM AND QUESTIONNAIRE

1. Please provide the names and business addresses of each of the Offeror's firm's officers and directors.

For the purposes of this form, the term "Offeror" means an entity that responds to a solicitation for a County contract by either submitting a proposal in response to a Request for Proposal or a Request for Qualification or a Bid in response to an Invitation to Bid. Describe accurately, fully and completely, their respective relationships with said Offeror, including their ownership interests and their anticipated role in the management and operations of said Offeror.

2. Please describe the general development of said Offeror's business during the past five (5) years, or such shorter period of time that said Offeror has been in business.

3. Please state whether any employee, agent or representative of said Offeror who is or will be directly involved in the subject project has or has ever: (i) directly or indirectly had a business relationship with Fulton County; (ii) directly or indirectly received revenues from Fulton County; or (iii) directly or indirectly receives revenues from the result of conducting business on Fulton County property or pursuant to any contract with Fulton County. Please describe in detail any such relationship.

LITIGATION DISCLOSURE:

Failure to fully and truthfully disclose the information required, may result in the disqualification of your bid or proposal from consideration or termination of the Contract, once awarded.

1. Please state whether any of the following events have occurred in the last five (5) years with respect to said Offeror. If any answer is yes, explain fully the following:

(a) whether a petition under the federal bankruptcy laws or state insolvency laws was filed by or against said Offeror, or a receiver fiscal agent or similar officer was appointed by a court for the business or property of said Offeror;

Circle One: YES NO

(b) whether Offeror was subject of any order, judgment, or decree not subsequently reversed, suspended or vacated by any court of competent jurisdiction, permanently enjoining said Offeror from engaging in any type of business practice, or otherwise eliminating any type of business practice; and

Circle One: YES NO

(c) whether said Offeror's business was the subject of any civil or criminal proceeding in which there was a final adjudication adverse to said Offeror, which directly arose from activities conducted by the business unit or corporate division of said Offeror which submitted a bid or proposal for the subject project. If so please explain.

Circle One: YES NO

2. Have you or any member of your firm or team to be assigned to this engagement ever been indicted or convicted of a criminal offense within the last five (5) years?

Circle One: YES NO

3. Have you or any member of your firm or team been terminated (for cause or otherwise) from any work being performed for Fulton County or any other Federal, State or Local Government?

Circle One: YES NO

4. Have you or any member of your firm or team been involved in any claim or litigation adverse to Fulton County or any other federal, state or local government, or private entity during the last three (3) years?

Circle One: YES NO

5. Has any offeror, member of offeror's team, or officer of any of them (with respect to any matter involving the business practices or activities of his or her employer), been notified within the five (5) years preceding the date of this offer that any of them are the target of a criminal investigation, grand jury investigation, or civil enforcement proceeding?

Circle One: YES NO

If you have answered "YES" to any of the above questions, please indicate the name(s) of the person(s), the nature, and the status and/or outcome of the information, indictment, conviction, termination, claim or litigation, the name of the court and the file or reference number of the case, as applicable. Any such information should be provided on a separate page, attached to this form and submitted with your proposal.

NOTE: If any response to any question set forth in this questionnaire has been disclosed in any other document, a response may be made by attaching a copy of such disclosure. (For example, said Offeror's most recent filings with the Securities and Exchange Commission ("SEC") may be provided if they are responsive to certain items within the questionnaire.) However, for purposes of clarity, Offeror should correlate its responses with the exhibits by identifying the exhibit and its relevant text.

Disclosures must specifically address, completely respond and comply with all information requested and fully answer all questions requested by Fulton County. Such disclosure must be submitted at the time of the bid or proposal submission and included as a part of the bid/proposal submitted for this project. Disclosure is required for Offerors, joint venture partners and first-tier subcontractors.

Failure to provide required disclosure, submit officially signed and notarized documents or respond to any and all information requested/required by Fulton County can result in the bid/proposal declared as non-responsive. This document must be completed and included as a part of the bid/proposal package along with other required documents.

[SIGNATURES ON NEXT PAGE]

Under penalty of perjury, I declare that I have examined this questionnaire and all attachments hereto, if applicable, to the best of my knowledge and belief, and all statements contained hereto are true, correct, and complete.

On this _____ day of _____, 20__

(Legal Name of Proponent) (Date)

(Signature of Authorized Representative) (Date)

(Title)

Sworn to and subscribed before me,

This _____ day of _____, 20__

(Notary Public) (Seal)

Commission Expires _____
(Date)

**FORM F: GEORGIA SECURITY AND IMMIGRATION CONTRACTOR AFFIDAVIT
AND AGREEMENT**

Instructions:

Contractors must attest to compliance with the requirements of O.C.G.A 13-10-91 and the Georgia Department of Labor Rule 300-10-01-.02 by executing the Contractor Affidavit provided.

STATE OF GEORGIA

COUNTY OF FULTON

**FORM F: GEORGIA SECURITY AND IMMIGRATION CONTRACTOR AFFIDAVIT
AND AGREEMENT**

By executing this affidavit, the undersigned contractor verifies its compliance with O.C.G.A. 13-10-91, stating affirmatively that the individual, firm or corporation which is engaged in the physical performance of services¹ under a contract with **[insert name of prime contractor]** _____ on behalf of **Fulton County Government** has registered with and is participating in a federal work authorization program*,² in accordance with the applicability provisions and deadlines established in O.C.G.A. 13-10-91.

The undersigned further agrees that, should it employ or contract with any subcontractor(s) in connection with the physical performance of services to this contract with **Fulton County Government**, contractor will secure from such subcontractor(s) similar verification of compliance with O.C.G.A. 13-10-91 on the Subcontractor Affidavit provided in Rule 300-10-01-.08 or a substantially similar form. Contractor further agrees to maintain records of such compliance and provide a copy of each such verification to the **Fulton County Government** at the time the subcontractor(s) is retained to perform such service.

EEV/Basic Pilot Program* User Identification Number

BY: Authorized Officer of Agent
(Insert Contractor Name)

Title of Authorized Officer or Agent of Contractor

Printed Name of Authorized Officer or Agent

Sworn to and subscribed before me this _____ day of _____, 20__.

Notary Public: _____

County: _____

Commission Expires: _____

¹O.C.G.A. § 13-10-90(4), as amended by Senate Bill 160, provides that "physical performance of services" means any performance of labor or services for a public employer (e.g., Fulton County) using a bidding process (e.g., ITB, RFQ, RFP, etc.) or contract wherein the labor or services exceed \$2,499.99, except for those individuals licensed pursuant to title 26 or Title 43 or by the State Bar of Georgia and is in good standing when such contract is for service to be rendered by such individual.

²*[Any of the electronic verification of work authorization programs operated by the United States Department of Homeland Security or any equivalent federal work authorization program operated by the United States Department of Homeland Security to verify information of newly hired employees, pursuant to the Immigration Reform and Control Act of 1986 (IRCA), P.L. 99-603].

**FORM G: GEORGIA SECURITY AND IMMIGRATION SUBCONTRACTOR
AFFIDAVIT**

Instructions:

In the event that your company is awarded the contract for this project, and will be utilizing the services of any subcontractor(s) in connection with the physical performance of services pursuant to this contract, the following affidavit must be completed by such subcontractor(s). Your company must provide a copy of each such affidavit to Fulton County Government, Department of Purchasing & Contract Compliance with the proposal submittal.

All subcontractor affidavit(s) shall become a part of the contract and all subcontractor(s) affidavits shall be maintained by your company and available for inspection by Fulton County Government at any time during the term of the contract. All subcontractor(s) affidavit(s) shall become a part of any contractor/subcontractor agreement(s) entered into by your company.

STATE OF GEORGIA

COUNTY OF FULTON

**FORM G: GEORGIA SECURITY AND IMMIGRATION SUBCONTRACTOR
AFFIDAVIT**

By executing this affidavit, the undersigned subcontractor verifies its compliance with O.C.G.A. 13-10-91, stating affirmatively that the individual, firm or corporation which is engaged in the physical performance of services³ under a contract with **[insert name of prime contractor]** _____ behalf of **Fulton County Government** has registered with and is participating in a federal work authorization program*,⁴ in accordance with the applicability provisions and deadlines established in O.C.G.A. 13-10-91.

EEV/Basic Pilot Program* User Identification Number

BY: Authorized Officer of Agent
(Insert Subcontractor Name)

Title of Authorized Officer or Agent of Subcontractor

Printed Name of Authorized Officer or Agent

Sworn to and subscribed before me this _____ day of _____, 20__.

Notary Public: _____

County: _____

Commission Expires: _____

³O.C.G.A. § 13-10-90(4), as amended by Senate Bill 160, provides that "physical performance of services" means any performance of labor or services for a public employer (e.g., Fulton County) using a bidding process (e.g., ITB, RFQ, RFP, etc.) or contract wherein the labor or services exceed \$2,499.99, except for those individuals licensed pursuant to title 26 or Title 43 or by the State Bar of Georgia and is in good standing when such contract is for service to be rendered by such individual.

⁴*[Any of the electronic verification of work authorization programs operated by the United States Department of Homeland Security or any equivalent federal work authorization program operated by the United States Department of Homeland Security to verify information of newly hired employees, pursuant to the Immigration Reform and Control Act of 1986 (IRCA), P.L. 99-603].

SECTION 6

CONTRACT COMPLIANCE REQUIREMENTS

NON-DISCRIMINATION IN PURCHASING AND CONTRACTING

It is the policy of Fulton County Government that discrimination against businesses by reason of the race, color, gender or national origin of the ownership of any such business is prohibited. Furthermore, it is the policy of the Board of Commissioners ("Board") that Fulton County and all vendors and contractors doing business with Fulton County shall provide to all businesses the opportunity to participate in contracting and procurement paid, in whole or in part, with monetary appropriations of the Board without regard to the race, color, gender or national origin of the ownership of any such business. Similarly, it is the policy of the Board that the contracting and procurement practices of Fulton County should not implicate Fulton County as either an active or passive participant in the discriminatory practices engaged in by private contractors or vendors seeking to obtain contracts with Fulton County.

Implementation of Equal Employment Opportunity (EEO) Policy

Pursuant to Fulton County Code section §102-391, Equal Opportunity Clause, the County effectuates Equal Employment Opportunity. This policy considers racial and gender workforce availability. The availability of each workgroup is derived from the work force demographics set forth in the 2010 Census EEO file prepared by the United States Department of Commerce for the applicable labor pool normally utilized for the contract.

Monitoring of EEO Policy

Upon award of a contract with Fulton County, the successful bidder/proposer must complete Exhibit B, Equal Employment Opportunity Report ("EEOR"), describing the racial and gender make-up of the firm's work force. If the EEOR indicates that the firm's demographic composition indicates underutilization of employee's of a particular ethnic group for each job category, the EEOR will be submitted to the Division of Diversity and Civil Rights Compliance for further action.

EQUAL BUSINESS OPPORTUNITY PLAN (EBO PLAN)

In addition to the proposal submission requirements, each vendor **must** submit an Equal Business Opportunity Plan (EBO Plan) with their bid/proposal. The EBO Plan is designed to enhance the utilization of a particular racial, gender or ethnic group by a bidder/proposer, contractor, or vendor or by Fulton County. The respondent **must** outline a plan of action to encourage and achieve diversity and equality in the available procurement and contracting opportunities with *this solicitation*.

The EBO Plan **must** identify and include:

1. Potential opportunities within the scope of work of *this solicitation* that will allow for participation of racial, gender or ethnic groups.
2. Efforts that will be made by the bidder/proposer to encourage and solicit minority and female business utilization in *this solicitation*.

DETERMINATION OF GOOD FAITH EFFORTS

In accordance with Fulton County Code Section §102-426, the Prime Contractor **must** demonstrate that they have made all efforts reasonably possible to ensure that Minority and Female Business Enterprises (MFBE) have had a full and fair opportunity to compete and win subcontracts on this project. The Prime Contractor is required to include all outreach attempts that would demonstrate a "Good Faith Effort" in the solicitation of sub-consultants/subcontractors.

Written documentation demonstrating the Prime Contractor's outreach efforts to identify, contact, contract with or utilize Minority or Female owned businesses shall include holding pre-bid conferences, publishing advertisements in general circulation media, trade association publications, minority-focused media, and the County's bid board, as well as other efforts.

Include a list of publications where the advertisement was placed as well as a copy of the advertisement. Advertisement shall include at a minimum, scope of work, project location, location(s) of where plans and specifications may be viewed or obtained and trade or scopes of work for which subcontracts are being solicited.

PROMPT PAYMENT

The prime contractor must certify in writing and must document that all subcontractors, sub-consultants and suppliers have been promptly paid for work and materials, (less any retainage by the prime contractor prior to receipt of any further progress payments). In the event the prime contractor is unable to pay subcontractors, sub-consultants or suppliers until it has received a progress payment from Fulton County, the prime contractor shall pay all subcontractors, sub-consultants or suppliers funds due from said progress payment within ten days (10) of receipt of payment from Fulton County. In no event shall a subcontractor, sub-consultant or supplier be paid later than ten (10) days as provided for by state

REQUIRED FORMS (To be submitted with Technical Proposal)

In order to be compliant with the intent and provisions of the Fulton County Non-Discrimination in Purchasing and Contracting Policy, bidders/proposers **must** submit the following completed documents with the Technical Proposal.

- Exhibit A – Promise of Non-Discrimination
- Exhibit C – Schedule of Intended Subcontractor Utilization

The following documents must be completed as instructed if awarded the project:

- Exhibit B – Equal Employment Opportunity Report (EEOR)
- Exhibit D – Letter of Intent to Perform as a Subcontractor or Provide Materials or Services **(To be submitted only by subcontractor/sub-consultant/suppliers of winning Prime prior to contract execution)**
- Exhibit E – Prime Contractor's Subcontractor Utilization Report **(To be submitted monthly with pay applications)**

All Contract Compliance documents (Exhibits A, C and the EBO Plan) are to be placed in a **separate sealed envelope** clearly marked "**CONTRACT COMPLIANCE**". These documents are considered part of and must be submitted with the Technical Proposal.

EXHIBIT A – PROMISE OF NON-DISCRIMINATION

“Know all persons by these presents, that I/We (_____),
Name

_____ Title Firm Name

Hereinafter “Company”, in consideration of the privilege to bid on or obtain contracts funded, in whole or in part, by Fulton County, hereby consent, covenant and agree as follows:

- 1) No person shall be excluded from participation in, denied the benefit of, or otherwise discriminated against on the basis of race, color, national origin or gender in connection with any bid submitted to Fulton County for the performance of any resulting there from,
- 2) That it is and shall be the policy of this Company to provide equal opportunity to all businesses seeking to contract or otherwise interested in contracting with this Company without regard to the race, color, gender or national origin of the ownership of this business,
- 3) That the promises of non-discrimination as made and set forth herein shall be continuing in nature and shall remain in full force and effect without interruption,
- 4) That the promise of non-discrimination as made and set forth herein shall be made a part of, and incorporated by reference into, any contract or portion thereof which this Company may hereafter obtain,
- 5) That the failure of this Company to satisfactorily discharge any of the promises of non-discrimination as made and set forth herein shall constitute a material breach of contract entitling the Board to declare the contract in default and to exercise any and all applicable rights and remedies, including but not limited to cancellation of the contract, termination of the contract, suspension and debarment from future contracting opportunities, and withholding and/or forfeiture of compensation due and owing on a contract; and
- 6) That the bidder shall provide such information as may be required by the Director of Purchasing & Contract Compliance pursuant to Section 102.436 of the Fulton County Non-Discrimination in Purchasing and Contracting Policy.

NAME: _____ **TITLE:** _____

SIGNATURE: _____

ADDRESS: _____

PHONE NUMBER: _____ **EMAIL:** _____

EXHIBIT B – EMPLOYMENT REPORT

The demographic employment make-up for the bidder and all subcontractors performing work on this project must be submitted prior to the execution of the contract.

JOB CATEGORIES	TOTAL EMPLOYED		TOTAL MINORITIES		WHITE (Not Hispanic Origin)		BLACK or AFRICAN AMERICAN (Not of Hispanic Origin)		HISPANIC or LATINO		AMERICAN INDIAN or ALASKAN NATIVE (AIAN)		ASIAN		NATIVE HAWAIIAN or OTHER PACIFIC ISLANDER (NHOP)		TWO or MORE RACES		
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	
	EXECUTIVE/SENIOR LEVEL OFFICIALS and MANAGERS																		
FIRST/MID LEVEL OFFICIALS and MANAGERS																			
PROFESSIONALS																			
TECHNICIANS																			
SALES WORKERS																			
ADMINISTRATIVE SUPPORT WORKERS																			
CRAFT WORKERS																			
OPERATIVES																			
LABORERS & HELPERS																			
SERVICE WORKERS																			
TOTAL																			

FIRM'S NAME: _____

ADDRESS: _____

CONTACT NAME: _____

EMAIL: _____ PHONE NUMBER: _____

SUBMITTED BY: _____

EXHIBIT C - SCHEDULE OF INTENDED SUBCONTRACTOR UTILIZATION

If the bidder/proposer intends to subcontract any portion of this scope of work/service(s), this form **must be** completed and **submitted with the bid/proposal**. All prime bidders/proposers **must** submit Letter(s) of Intent (Exhibit D) for all subcontractors who will be utilized under the scope of work/services prior to contract execution.

Prime Bidder/Proposer Company Name _____

ITB/RFP Name & Number: _____

1. My firm, as Prime Bidder/Proposer on this scope of work/service(s) is , is not a minority or female owned and controlled business enterprise. (Please indicate below the portion of work, including, percentage of bid/proposal amount that your firm will carry out directly):
 \$ _____ or _____ %
2. This highlighted information below must be completed and submitted with the bid/proposal if a **joint venture (JV)** approach is to be undertaken. Please provide JV breakdown information below and attach a copy of the executed Joint Venture Agreement.

JV Partner(s) information:

Business Name	Business Name	Business Name
% of JV _____	% of JV _____	% of JV _____
Ethnicity _____	Ethnicity _____	Ethnicity _____
Gender _____	Gender _____	Gender _____
Phone# _____	Phone# _____	Phone# _____

3. Sub-Contractors (including suppliers) to be utilized in the performance of this scope of work/service(s), if awarded, are:

SUBCONTRACTOR NAME: _____

ADDRESS: _____

PHONE: _____

CONTACT PERSON: _____

ETHNIC GROUP*: _____ COUNTY CERTIFIED** _____

WORK TO BE PERFORMED: _____

DOLLAR VALUE OF WORK: \$ _____ PERCENTAGE VALUE: _____ %

***Ethnic Groups: African American (AABE); Asian American (ABE); Hispanic American (HBE); Native American (NABE); White Female American (WFBE); **If yes, please attach copy of recent certification.**

SUBCONTRACTOR NAME: _____
ADDRESS: _____

PHONE: _____
CONTACT PERSON: _____
ETHNIC GROUP*: _____ COUNTY CERTIFIED** _____
WORK TO BE PERFORMED: _____

DOLLAR VALUE OF WORK: \$ _____ PERCENTAGE VALUE: _____ %

SUBCONTRACTOR NAME: _____
ADDRESS: _____

PHONE: _____
CONTACT PERSON: _____
ETHNIC GROUP*: _____ COUNTY CERTIFIED** _____
WORK TO BE PERFORMED: _____

DOLLAR VALUE OF WORK: \$ _____ PERCENTAGE VALUE: _____ %

SUBCONTRACTOR NAME: _____
ADDRESS: _____

PHONE: _____
CONTACT PERSON: _____
ETHNIC GROUP*: _____ COUNTY CERTIFIED** _____
WORK TO BE PERFORMED: _____

DOLLAR VALUE OF WORK: \$ _____ PERCENTAGE VALUE: _____ %

SUBCONTRACTOR NAME: _____
ADDRESS: _____

PHONE: _____
CONTACT PERSON: _____
ETHNIC GROUP*: _____ COUNTY CERTIFIED** _____
WORK TO BE PERFORMED: _____

DOLLAR VALUE OF WORK: \$ _____ PERCENTAGE VALUE: _____ %

***Ethnic Groups: African American (AABE); Asian American (ABE); Hispanic American (HBE); Native American (NABE); White Female American (WFBE); **If yes, please attach copy of recent certification.**

Total Dollar Value of Subcontractor Agreements: (\$)

Total Percentage of Subcontractor Value: (%)

CERTIFICATION: The undersigned certifies that he/she has read, understands and agrees to be bound by the Bid/Proposer provisions, including the accompanying Exhibits and other terms and conditions regarding sub-contractor utilization. The undersigned further certifies that he/she is legally authorized by the Bidder/Proposer to make the statement and representation in this Exhibit and that said statements and representations are true and correct to the best of his/her knowledge and belief. The undersigned understands and agrees that if any of the statements and representations are made by the Bidder/Proposer knowing them to be false, or if there is a failure of the intentions, objectives and commitments set forth herein without prior approval of the County, then in any such event the Contractor's acts or failure to act, as the case may be, shall constitute a material breach of the contract, entitling the County to terminate the Contract for default. The right to so terminate shall be in addition to, and in lieu of, any other rights and remedies the County may have for other defaults under the contract.

Signature: _____ **Title:** _____

Business or Corporate Name: _____

Address: _____

Telephone: () _____

Fax Number: () _____

Email Address: _____

EXHIBIT D

**LETTER OF INTENT TO PERFORM AS A SUBCONTRACTOR
OR
PROVIDE MATERIALS OR SERVICES**

This form **must** be completed by **ALL** known subcontractors and submitted only by subs of awarded Prime prior to contract execution.

To: _____
(Name of Prime Contractor Firm)

From: _____
(Name of Subcontractor Firm)

ITB/RFP Number: _____

Project Name: _____

The undersigned is prepared to perform the following described work or provide materials or services in connection with the above project (specify in detail particular work items, materials, or services to be performed or provided):

Description of Work	Project Commence Date	Project Completion Date	Estimated Dollar Amount

(Prime Bidder)

(Subcontractor)

Signature _____

Signature _____

Title _____

Title _____

Date _____

Date _____

EXHIBIT E - PRIME CONTRACTOR/SUB-CONTRACTOR UTILIZATION REPORT

This report must be submitted by the tenth day of each month, along with a copy of your monthly invoice (schedule of values/payment application) to Contract Compliance. Failure to comply shall result in the County commencing proceedings to impose sanctions to the prime contractor, in addition to pursuing any other available legal remedy. Sanctions may include the suspending of any payment or part thereof, termination or cancellation of the contract, and the denial of participation in any future contracts awarded by Fulton County.

REPORTING PERIOD	PROJECT NAME:
FROM:	PROJECT NUMBER:
TO:	PROJECT LOCATION:

PRIME CONTRACTOR	Contract Award Date	Contract Award Amount	Change Order Amount	Contract Period	% Complete to Date
Name:					
Address:					
Phone #:					
Email:					

AMOUNT OF PAY APPLICATION THIS PERIOD: \$
 TOTAL PAYMENT(S) RECEIVED FROM COUNTY THIS PERIOD): \$
 TOTAL AMOUNT PAID YEAR TO DATE: \$

SUBCONTRACTOR UTILIZATION (add additional rows as necessary)					
Name of Sub-Contractor	Description of Work	Contract Amount	Amount Paid To Date	Amount of Pay Application This Period	Contract Period Starting Date Ending Date
TOTALS					

Executed By: _____ (Signature) _____ (Printed Name)
 Notary: _____ Date: _____

My Commission Expires: _____

Should you have questions regarding any of the documents contained in Section 6, please feel free to contact the Office of Contract Compliance at (404) 612-6300, for further assistance.

SECTION 7 GENERAL CONDITIONS

00700-1 FAMILIARITY WITH SITE

Execution of this agreement by the Contractor is a representation that the Contractor has visited the site, has become familiar with the local conditions under which the work is to be performed, and has correlated personal observations with the requirements of this agreement.

00700-2 CONTRACT DOCUMENTS

This agreement consists of Owner's invitation for bid, instructions to bidders, bid form, performance bond, payment bond, acknowledgments, the contract, general conditions, special conditions, specifications, plans, drawings, exhibits, addenda, and written change orders.

- A. Notice of Award of Contract:
- B. Execution of Contract Documents

Upon notification of Award of Contract, the Owner shall furnish the Contractor the conformed copies of Contract Documents for execution by the Contractor and the Contractor's surety.

Within ten (10) days after receipt the Contractor shall return all the documents properly executed by the Contractor and the Contractor's surety. Attached to each document shall be an original power-of-attorney for the person executing the bonds for the surety and certificates of insurance for the required insurance coverage.

After receipt of the documents executed by the Contractor and his surety with the power-of-attorney and certificates of insurance, the Owner shall complete the execution of the documents. Distribution of the completed documents will be made upon completion.

Should the Contractor and/or Surety fail to execute the documents within the time specified; the Owner shall have the right to proceed on the Bid Bond accompanying the bid.

If the Owner fails to execute the documents within the time limit specified, the Contractor shall have the right to withdraw the Contractor's bid without penalty.

Drawings and Specifications:

The Drawings, Specifications, Contract Documents, and all supplemental documents, are considered essential parts of the Contract, and requirements occurring in one are as binding as though occurring in all. They are intended to define, describe and provide for all Work necessary to complete the Project in an acceptable manner, ready for use, occupancy, or operation by the Owner.

In case of conflict between the Drawings and Specifications, the Specifications shall govern. Figure dimensions on Drawings shall govern over scale dimensions, and detailed Drawings shall govern over general Drawings.

In cases where products or quantities are omitted from the Specifications, the description and quantities shown on the Drawings shall govern.

Any ambiguities or need for clarification of the Drawings or Specifications shall be immediately reported to the Construction Manager in writing. Any such ambiguity or need for clarification shall be handled by the Construction Manager in writing. No clarification of the Drawings and Specifications hereunder by the Construction Manager shall entitle the Contractor to any additional monies unless a Change Order has been processed as provided by "Changes in the Contract" hereof.

Any work done by the Contractor following a discovery of such differing site condition or ambiguity or need for clarification in the Contract Drawings and Specifications prior to a written report to the Construction Manager shall not entitle the Contractor to additional monies and shall be done at the Contractor's risk.

The Construction Manager will furnish the Contractor five (5) copies of the Contract Drawings and the Specifications, one copy of which the Contractor shall have available at all times on the Project site.

00700-3 DEFINITIONS

The following terms as used in this agreement are defined as follows to the extent the definitions herein differ or conflict with those in the Instructions for Bidders, Section 00100, the definitions herein shall control.

Alternate bids – the amount stated in the bid or proposal to be added to or deducted from the amount of the base bid or base proposal if the corresponding change in project scope or alternate materials or methods of construction is accepted.

Base bid – the amount of money stated in the bid or proposal as the sum for which the bidder or proposer offers to perform the work.

Change Order - an alteration, addition, or deduction from the original scope of work as defined by the contract documents to address changes or unforeseen conditions necessary for project completion. A written order to the Contractor issued by the County pursuant to Fulton County Policy and Procedures 800-6 for changes in the work within the general scope of the contract documents, adjustment of the contract price, extension of the contract time, or reservation of determination of a time extension.

Construction Manager shall mean the individual designated in writing, by the Director of the Facilities and Transportation Services Department as the Construction Manager.

Contractor shall mean the party of the second part to the Contract Agreement or the authorized and legal representative of such party.

Contract Documents include the Contract Agreement, Contractor's Bid (including all documentation accompanying the Bid and any post-Bid documentation required by the County prior to the Notice of Award), Bonds, all Special Conditions, General Conditions, Supplementary Conditions, Specifications, Drawings and addenda, together with written amendments, change orders, field orders and the Construction Manager's written interpretations and clarifications issued in accordance with the General Conditions on or after the date of the Contract Agreement.

Shop drawing submittals reviewed in accordance with the General Conditions, geotechnical investigations and soils report and drawings of physical conditions in or relating to existing surface structures at or contiguous to the site are not Contract Documents.

Contract Price - The sum specified in the Agreement to be paid to the Contractor in consideration of the Work.

Contract Time shall mean the number of consecutive calendar days as provided in the Contract Agreement for completion of the Work, to be computed from the date of Notice to Proceed.

Owner or County shall mean Fulton County Government, party of the first part to the Contract Agreement, or its authorized and legal representatives.

Day - A calendar day of twenty-four hours lasting from midnight of one day to midnight the next day.

Detention Equipment Contractor ("DEC") – Any legally chartered business entity whose primary activity is the supply and/or installation of detention hardware equipment and related systems.

Director - Director of the Facilities and Transportation Services Department of Fulton County, Georgia or the designee thereof.

Engineer of Record – Prime Engineering, Incorporated developed the specifications and drawings referred to herein.

Final Completion shall mean the completion of all work as required in accordance with the terms and conditions of the contract documents.

Liquidated Damages shall mean the amount, stated in the Contract Agreement, which the Contractor agrees to pay to the Owner for each consecutive calendar day beyond the Contract time required to complete the Project or for failing to comply with associated milestones. Liquidated Damages will end upon written notification from the Owner of Final Acceptance of the Project or upon written notification of from the Owner of completion of the milestone.

Notice to Proceed - A written communication issued by the County to the Contractor authorizing it to proceed with the work, establishing the date of commencement and completion of the work, and providing other direction to the Contractor.

Products shall mean materials or equipment permanently incorporated into the work.

Program Manager - Not used in this contract. Delete all references.

Project Manual - The Contract Documents.

Provide shall mean to furnish and install.

Substantial Completion - The date certified by the Construction Manager when all or a part of the work, as established pursuant to General Condition 0700-81, is sufficiently completed in accordance with the requirements of the contract documents so that the identified portion of the work can be utilized for the purposes for which it is intended.

Work or Project - All of the services specified, indicated, shown or contemplated by the contract documents, and furnishing by the Contractor of all materials, equipment, labor, methods, processes, construction and manufacturing materials and equipment, tools, plans, supplies, power, water, transportation and other things necessary to complete such services in accordance with the contract documents to insure a functional and complete facility.

00700-4 CODES

All codes, specifications, and standards referenced in the contract documents shall be the latest editions, amendments and revisions of such referenced standards in effect as of the date of the request for proposals for this contract.

00700-5 REVIEW OF CONTRACT DOCUMENTS

Before making its proposal to the County, and continuously after the execution of the agreement, the Contractor shall carefully study and compare the contract documents and shall at once report to the Construction Manager any error, ambiguity, inconsistency or omission that may be discovered, including any requirement which may be contrary to any law, ordinance, rule, or regulation of any public authority bearing on the performance of the work. By submitting its proposal, the Contractor agrees that the contract documents, along with any supplementary written instructions issued by or through the Construction Manager that have become a part of the contract documents, appear accurate, consistent and complete insofar as can be reasonably determined. If the Contractor has timely reported in writing any error, inconsistency, or omission to the Construction Manager, has properly stopped the affected work until instructed to proceed, and has otherwise followed the instructions of the Construction Manager, the Contractor shall not be liable to the County for any damage resulting from any such error, inconsistency, or omission in the contract documents. The Contractor shall not perform any portion of the work without the contract documents, approved plans, specifications, products and data, or samples for such portion of the work. For purposes of this section "timely" is defined as the time period in which the contractor discovers, or should have discovered, the error, inconsistency, or omission, with the exercise of reasonable diligence.

00700-6 STRICT COMPLIANCE

No observation, inspection, test or approval of the County or Construction Manager shall relieve the Contractor from its obligation to perform the work in strict conformity with the contract documents except as provided in General Condition 00700-48.

00700-7 APPLICABLE LAW

All applicable State laws, County ordinances, codes, and rules and regulations of all authorities having jurisdiction over the construction of the project shall apply to this agreement. The Contractor shall comply with the requirements of any Fulton County program concerning non-discrimination in contracting. All work performed within the right of way of the Georgia Department of Transportation and any railroad crossing shall be in accordance with Georgia Department of Transportation regulations, policies and procedures and, where applicable, those of any affected railroad. The Contractor shall comply with all laws, ordinances, codes, rules and regulations bearing on the conduct of the work as specified and the Contractor agrees to indemnify and hold harmless the County, its officers, agents and employees, as well as the Construction Manager and the Program Manager against any claim or liability arising from or based on the violation of any law, ordinance, regulation, order or decree affecting the conduct of the work, whether occasioned by the Contractor, his agents or employees.

00700-8 PERMITS, LICENSES AND BONDS

All permits and licenses necessary for the work shall be secured and paid for by the Contractor. If any permit, license or certificate expires or is revoked, terminated, or suspended as a result of any action on the part of the Contractor, the Contractor shall

not be entitled to additional compensation or time. The Contractor shall obtain and keep in force at all times performance and payment bonds payable to Fulton County in penal amounts equal to 100% of the Contract price.

00700-9 TAXES

- A. The Contractor shall pay all sales, retail, occupational, service, excise, old age benefit and unemployment compensation taxes, consumer, use and other similar taxes, as well as any other taxes or duties on the materials, equipment, and labor for the work provided by the Contractor which are legally enacted by any municipal, county, state or federal authority, department or agency at the time bids are received, whether or not yet effective. The Contractor shall maintain records pertaining to such taxes and levies as well as payment thereof and shall make the same available to the County at all reasonable times for inspection and copying. The Contractor shall apply for any and all tax exemptions which may be applicable and shall timely request from the County such documents and information as may be necessary to obtain such tax exemptions. The County shall have no liability to the Contractor for payment of any tax from which it is exempt.
- B. The Contractor is obligated to comply with all local and State Sales and Use Tax laws. The Contractor shall provide the Owner with documentation to assist the Owner in obtaining sales and/or use tax refunds for eligible machinery and equipment used for the primary purpose of reducing or eliminating air or water pollution as provided for in Chapter 48-8-3 (36) and (37) of the Official Code of Georgia. All taxes shall be paid by the Contractor. All refunds will accrue to the Owner.

Acceptance of the project as complete and final payment will not be made by the Owner until the Contractor has fully complied with this requirement.

00700-10 DELINQUENT CONTRACTORS

The County shall not pay any claim, debt, demand or account whatsoever to any person firm or corporation who is in arrears to the County for taxes. The County shall be entitled to a counterclaim, backcharge, and offset for any such debt in the amount of taxes in arrears, and no assignment or transfer of such debt after the taxes become due shall affect the right of the County to offset any taxes owed against said debt.

00700-11 LIEN WAIVERS

The Contractor shall furnish the County with evidence that all persons who have performed work or furnished materials pursuant to this agreement have been paid in full prior to submitting its demand for final payment pursuant to this agreement. A final affidavit, Exhibit A, must be completed, and submitted to comply with requirements of 00700-11. In the event that such evidence is not furnished, the County may retain sufficient sums necessary to meet all lawful claims of such laborers and materialmen. The County assumes no obligation nor in any way undertakes to pay such lawful claims from any funds due or that may become due to the Contractor.

00700-12 MEASUREMENT

All items of work to be paid for per unit of measurement shall be subject to inspection, measurement, and confirmation by the Construction Manager.

00700-13 ASSIGNMENT

The Contractor shall not assign any portion of this agreement or moneys due there from (include factoring of receivables) without the prior written consent of the County. The Contractor shall retain personal control and shall provide personal attention to the fulfillment of its obligations pursuant to this agreement. Any assignment without the express written consent of the County shall render this contract voidable at the sole option of the County.

00700-14 FOREIGN CONTRACTORS

In the event that the Contractor is a foreign corporation, partnership, or sole proprietorship, the Contractor hereby irrevocably appoints the Secretary of State of Georgia as its agent for service of all legal process for the purpose of this contract only.

00700-15 INDEMNIFICATION

The Contractor hereby assumes the entire responsibility and liability for any and all injury to or death of any and all persons, including the Contractor's agents, servants, and employees, and in addition thereto, for any and all damages to property caused by or resulting from or arising out of any act or omission in connection with this contract or the prosecution of work hereunder, whether caused by the Contractor or the Contractor's agents, Servants, or employees, or by any of the Contractor's subcontractors or suppliers, and the Contractor shall indemnify and hold harmless the County, the Construction Manager, County's Commissioners, officers, employees, successors, assigns and agents, or any of their subcontractors from and against any and all loss and/or expense which they or any of them may suffer or pay as a result of claims or suits due to, because of, or arising out of any and all such injuries, deaths and/or damage, irrespective of County or Construction Manager negligence (except that no party shall be indemnified for their own sole negligence). The Contractor, if requested, shall assume and defend at the Contractor's own expense, any suit, action or other legal proceedings arising there from, and the Contractor hereby agrees to satisfy, pay, and cause to be discharged of record any judgment which may be rendered against the County and the Construction Manager arising there from.

In the event of any such loss, expense, damage, or injury, or if any claim or demand for damages as heretofore set forth is made against the County or the Construction Manager, the County may withhold from any payment due or thereafter to become due to the Contractor under the terms of this Contract, an amount sufficient in its judgment to protect and indemnify it and the Construction Manager, County's Commissioners, officers, employees, successors, assigns and agents from any and all claims, expense, loss, damages, or injury; and the County, in its discretion, may require the Contractor to furnish a surety bond satisfactory to the County providing for such protection and indemnity, which bond shall be furnished by the Contractor within five (5) days after written demand has been made therefore. The expense of said Bond shall be borne by the Contractor.

00700-16 SUPERVISION OF WORK AND COORDINATION WITH OTHERS

The Contractor shall supervise and direct the work using the Contractor's best skill and attention. The Contractor shall be solely responsible for all construction methods and procedures and shall coordinate all portions of the work pursuant to the contract subject to the overall coordination of the Construction Manager. All work pursuant to this agreement shall be performed in a skillful and workmanlike manner.

The County reserves the right to perform work related to the Project with the County's own forces and to award separate contracts in connection with other portions of the project, other work on the site under these or similar conditions of the contract, or work which has been extracted from the Contractor's work by the County.

When separate contracts are awarded for different portions of the project or other work on the site, the term "separate contractor" in the Contract Documents in each case shall mean the contractor who executes each separate County Agreement.

The Contractor shall cooperate with the County and separate contractors in arranging the introduction and storage of materials and equipment and execution of their work, and shall cooperate in coordinating connection of its work with theirs as required by the Contract Documents.

If any part of the Contractor's Work depends for proper execution or results upon the work of the County or any separate contractor, the Contractor shall, prior to proceeding with that portion of the Work, promptly report to the Construction Manager any apparent discrepancies or defects in such other work that render it unsuitable for such proper execution and results **within fourteen (14) days** of discovery of such discrepancy or defect. Failure of the Contractor to so report in writing shall constitute an acceptance of the County's or separate contractor's work as fit and proper to receive the Work, except as to any defects which may subsequently become apparent in such work by others.

Any costs caused by defective or untimely work shall be borne by the party responsible therefore.

Should the Contractor wrongfully cause damage to the work or property of the County or to other work or property on the site, including the work of separate contractors, the Contractor shall promptly remedy such damage at the Contractor's expense.

Should the Contractor be caused damage by any other contractor on the Project, by reason of such other contractor's failure to perform properly his contract with the County, no action shall lie against the County or the Construction Manager inasmuch as the parties to this agreement are the only beneficiaries hereof and there are no third party beneficiaries and neither the County nor the Construction Manager shall have liabilities therefore, but the Contractor may assert his claim for damages solely against such other contractor. The Contractor shall not be excused from performance of the contract by reason of any dispute as to damages with any other contractor or third party.

Where the Work of this Contract shall be performed concurrently in the same areas as other construction work, the Contractor shall coordinate with the Construction Manager and the separate contractors in establishing mutually acceptable schedules and procedures that shall permit all jobs to proceed with minimum interference.

If a dispute arises between the Contractor and separate contractors as to their responsibility for cleaning up, the County may clean up and charge the cost thereof to the Contractor or contractors responsible therefore as the County shall determine to be just.

00700-17 ADMINISTRATION OF CONTRACT

The Program Manager and the Construction Manager shall provide administration services as hereinafter described.

For the administration of this Contract, the Construction Manager shall serve as the County's primary representative during design and construction and until final payment to the Contractor is due. The Construction Manager shall advise and consult with the

County and the Program Manager. The primary point of contact for the Contractor shall be the Construction Manager. All correspondence from the Contractor to the County shall be forwarded through the Construction Manager. Likewise, all correspondence and instructions to the Contractor shall be forwarded through the Construction Manager.

The Construction Manager will determine in general that the construction is being performed in accordance with design and engineering requirements, and will endeavor to guard the County against defects and deficiencies in the Work.

The Construction Manager will not be responsible for or have control or charge of construction means, methods, techniques, sequences, or procedures, or for safety precautions and programs in connection with the Work, nor will it be responsible for the Contractor's failure to carry out the Work in accordance with the Contract Documents. The Construction Manager will not be responsible for or have control or charge over the acts or omissions of the Contractor, its engineers, consultants, subcontractors, or any of their agents or employees, or any other persons performing the Work.

Based on the Construction Manager's observations regarding the Contractor's Applications for Payment, the Construction Manager shall determine the amounts owing to the Contractor, in accordance with the payment terms of the Contract, and shall issue Certificates for Payment in such amount to the County.

The Construction Manager shall render interpretations necessary for the proper execution or progress of the Work. Either party to the Contract may make written requests to the Construction Manager for such interpretations.

Claims, disputes and other matters in question between the Contractor and the County relating to the progress of the Work or the interpretation of the Contract Documents shall be referred to the Construction Manager for interpretation.

All interpretations of the Construction Manager shall be consistent with the intent of and reasonably inferable from the Contract Documents and shall be in writing or in graphic form.

Except as otherwise provided in this Contract, the Construction Manager shall issue a decision on any disagreement concerning a question of fact arising under this Contract. The Construction Manager shall reduce the decision to writing and mail or otherwise furnish a copy thereof to the Contractor. The decision of the Construction Manager shall be final and conclusive unless, within thirty (30) days from the date of receipt of such copy, the Contractor files a written appeal with the Director of Public Works and mails or otherwise furnishes the Construction Manager a copy of such appeal. The decision of the Director of Public Works or the Director's duly authorized representative for the determination of such appeals shall be final and conclusive. Such final decision shall not be pleaded in any suit involving a question of fact arising under this Contract, provided such is not fraudulent, capricious, arbitrary, so grossly erroneous as necessarily implying bad faith, or is not supported by substantial evidence. In connection with any appeal proceeding under this Article, the Contractor shall be afforded an opportunity to be heard and to offer evidence in support of Contractor's appeal. Pending any final decision of a dispute hereunder, the Contractor shall proceed diligently with the performance of the Contract as directed by the Construction Manager.

The Construction Manager shall have authority to reject Work which does not conform to the Contract Documents. Whenever, in the Construction Manager's opinion, it is considered necessary or advisable for the implementation of the intent of the Contract Documents, the County shall have authority to require special inspection or testing of the

Work whether or not such Work be then fabricated, installed or completed. The Contractor shall pay for such special inspection or testing if the Work so inspected or tested is found not to comply with the requirements of the contract; the County shall pay for special inspection and testing if the Work is found to comply with the contract. Neither the Construction Manager's authority to act under this Subparagraph, nor any decision made by the Construction Manager in good faith either to exercise or not to exercise such authority, shall give rise to any duty or responsibility of the Construction Manager to the Contractor, any subcontractor, any of their agents or employees, or any other person performing any of the Work.

The Contractor shall provide such shop drawings, product data, and samples as may be required by the Construction Manager and/or as required by these Contract Documents.

The Construction Manager shall conduct inspections to determine Substantial Completion and Final Completion, and shall receive and forward to the County for review written warranties and related documents required by the Contract Documents and assembled by the Contractor. The Construction Manager shall approve and issue Certificates for Payment upon compliance with Substantial and Final Completion requirements indicated in General Conditions 00700-81, 00700-82, 00700-84 and 00700-85 of this Agreement.

Except as provided in General Condition 00700-48, the Contractor shall not be relieved from the Contractor's obligations to perform the work in accordance with the contract documents by the activities or duties of the County or any of its officers, employees, or agents, including inspections, tests or approvals, required or performed pursuant to this agreement.

00700-18 RESPONSIBILITY FOR ACTS OF EMPLOYEES

The Contractor shall employ only competent and skilled personnel. The Contractor shall, upon demand from the Construction Manager, immediately remove any superintendent, foreman or workman whom the Construction Manager may consider incompetent or undesirable.

The Contractor shall be responsible to the County for the acts and omissions of the Contractor's employees, subcontractors, and agents as well as any other persons performing work pursuant to this agreement for the Contractor.

00700-19 LABOR, MATERIALS, SUPPLIES, AND EQUIPMENT

Unless otherwise provided in this agreement, the Contractor shall make all arrangements with necessary support agencies and utility companies provide and pay for all labor, materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other facilities and services necessary for the execution and completion of the work.

00700-20 DISCIPLINE ON WORK SITE

The Contractor shall enforce strict discipline and good order among its employees and subcontractors at all times during the performance of the work, to include compliance with the Fulton County Drug Free Work Place Policy. The Contractor shall not employ any subcontractor who is not skilled in the task assigned to it. The Construction Manager may, by written notice, require the Contractor to remove from the work any subcontractor or employee deemed by the Construction Manager to be incompetent.

00700-21 HOURS OF OPERATION

All work at the construction site shall be performed during regular business hours of the Fulton County government, except upon the Construction Manager's prior written consent to other work hours. It is further understood that the Contractor's construction schedule is based on a normal 40 hours, five day work week, less Fulton County-recognized holidays. Contractors work schedule shall not violate Fulton County Noise Ordinance by working hours inconsistent with the Fulton County Noise Ordinance. The County's current noise ordinance or other applicable ordinance shall govern. If the Contractor desires to work in excess of this limit, the Contractor shall submit a written request to the Construction Manager, a minimum of five days prior to the desired work date. The Contractor shall be responsible for any additional expenses incurred by the Owner as a result of the extended work hours, including resident inspection overtime. The cost associated with resident inspector overtime shall be deducted from the Contractor monthly payment request.

00700-22 FAMILIARITY WITH WORK CONDITIONS

The Contractor shall take all steps necessary to ascertain the nature and location of the work and the general and local conditions which may affect the work or the cost thereof. The Contractor's failure to fully acquaint itself with the conditions which may affect the work, including, but not limited to conditions relating to transportation, handling, storage of materials, availability of utilities, labor, water, roads, weather, topographic and subsurface conditions, other separate contracts to be entered into by the County relating to the project which may affect the work of the Contractor, applicable provisions of law, and the character and availability of equipment and facilities necessary prior to and during the performance of the work shall not relieve the Contractor of its responsibilities pursuant to this agreement and shall not constitute a basis for an equitable adjustment of the contract terms. The County reserves the right to perform with its own forces or to contract with other entities for other portions of the project work, in which case the Contractor's responsibility to assure its familiarity with work conditions hereunder shall include all coordination with such other contractors and the County necessary to insure that there is no interference between contractors as will delay or hinder any contractor in its prosecution of work on the project. The County assumes no responsibility for any understandings or representations concerning conditions of the work made by any of its officers, agents, or employees prior to the execution of this agreement.

00700-23 RIGHT OF ENTRY

The County reserves the right to enter the site of the work by such agent, including the Construction Manager, as it may elect for the purpose of inspecting the work or installing such collateral work as the County may desire. The Contractor shall provide safe facilities for such access so that the County and its agents may perform their functions.

00700-24 NOTICES

Any notice, order, instruction, claim or other written communication required pursuant to this agreement shall be deemed to have been delivered or received as follows:

Upon personal delivery to the Contractor, its authorized representative, or the Construction Manager on behalf of the County. Personal delivery may be accomplished by in-person hand delivery or bona fide overnight express service.

Three days after depositing in the United States mail a certified letter addressed to the Contractor or the Construction Manager for the County. For purposes of mailed notices,

the County's mailing address shall be 141 Pryor Street, 6th Floor, Atlanta, Georgia 30303, or as the County shall have otherwise notified the Contractor. The Contractor's mailing address shall be the address stated in its proposal or as it shall have most recently notified the Construction Manager in writing.

00700-25 SAFETY

A. SAFETY, HEALTH AND LOSS PREVENTION

The Contractor shall be responsible for implementing a comprehensive project-specific safety, health and loss prevention program and employee substance abuse program for this project. All Sub-Contractors must either implement their own program or follow the Contractor's safety, health and loss prevention program and employee substance abuse program.

The Contractor's safety, health and loss prevention program and employee substance abuse program must meet or exceed all governmental regulations (OSHA, EPA, DOT, State, local), and any other specific Fulton County requirements

B. COUNTY'S SAFETY, HEALTH, AND LOSS PREVENTION PROCESS GUIDELINES AND REQUIREMENTS

The County and its agents reserve the right, but assume no duty, to establish and enforce safety, health, and loss prevention guidelines and to make the appropriate changes in the guidelines, for the protection of persons and property and to review the efficiency of all protective measures taken by the Contractor. The Contractor shall comply with all safety, health, and loss prevention process guidelines and requirements and changes made by the County or its agent(s). The issuance of any such guidelines or changes by the County or its agent(s) shall not relieve the Contractor of its duties and responsibilities under this Agreement, and the County or its agent(s) shall not thereby assume, nor be deemed to have assumed, any such duties or responsibilities of the Contractor.

C. COMPLIANCE OF WORK, EQUIPMENT, AND PROCEDURES WITH ALL APPLICABLE LAWS and REGULATIONS

All Work, whether performed by the Contractor or its Sub-Contractors of any tier, or anyone directly or indirectly employed by any of them, and all equipment, appliances, machinery, materials, tools and like items incorporated or used in the Work, shall be in compliance with and conform to:

1. All applicable laws, ordinances, rules, regulations and orders of any public, quasi-public or other governmental authority relating to the safety of persons and their protection against injury, specifically including, but in no event limited to, the Federal Occupational Safety and Health Act of 1970, as amended, and all rules and regulations now or hereafter in effect pursuant to said Act.
2. All rules, regulations, and requirements of the County or its agent(s) and its insurance carriers relating there to. In the event of a conflict or differing requirements the more stringent shall govern.

D. PROTECTION OF THE WORK

1. The Contractor shall, throughout the performance of the Work, maintain adequate and continuous protection of all Work and temporary facilities

against loss or damage from whatever cause, shall protect the property of the County and third parties from loss or damage from whatever cause arising out of the performance of the Work, and shall comply with the requirements of the County or its agent(s) and its insurance carriers, and with all applicable laws, codes, rules and regulations, (as same may be amended) with respect to the prevention of loss or damage to property as a result of fire or other hazards.

2. The County or its agent(s) may, but shall not be required to, make periodic inspections of the Project work area. In such event, however, the Contractor shall not be relieved of its aforesaid responsibilities and the County or its agent(s) shall not assume, nor shall it be deemed to have assumed, any responsibility otherwise imposed upon the assurance of Contractor by this Agreement.

E. SAFETY EQUIPMENT

1. The Contractor shall provide to each worker on the Project work area the proper safety equipment for the duties being performed by that worker and will not permit any worker on the Project work area who fails or refuses to use the same. The County or its agent shall have the right, but not the obligation, to order the removal of a worker from the Project work site for his/her failure to comply with safe practices or substance abuse policies.

F. EMERGENCIES

1. In any emergency affecting the safety of persons or property, or in the event of a claimed violation of any federal or state safety or health law or regulation, arising out of or in any way connected with the Work or its performance, the Contractor shall act immediately to prevent threatened damage, injury or loss and to remedy said violation. Failing such action the County or its agent(s) may immediately take whatever steps it deems necessary including, but not limited to, suspending the Work as provided in this Agreement.
2. The County or its agent(s) may offset any and all costs or expenses of whatever nature, including attorneys' fees, paid or incurred by the County or its agent(s) (whether such fees are for in-house counsel or counsel retained by the County or its agent), in taking the steps authorized by Section 00700-25(G) (1) above against any sums then or thereafter due to the Contractor. The Contractor shall defend, indemnify and hold the County, its officers, agents, and employees harmless against any and all costs or expenses caused by or arising from the exercise by the County of its authority to act in an emergency as set out herein. If the Contractor shall be entitled to any additional compensation or extension of time change order on account of emergency work not due to the fault or neglect of the Contractor or its Sub-Contractors, such additional compensation or extension of time shall be determined in accordance with General Condition 00700-52 and General Condition 00700-87 of this Agreement.

G. SUSPENSION OF THE WORK

1. Should, in the judgment of the County or its agent(s), the Contractor or any Sub-Contractor fail to provide a safe and healthy work place, the County or its agent shall have the right, but not the obligation, to suspend work in the unsafe areas until deficiencies are corrected. All costs of any nature (including, without limitation, overtime pay, liquidated damages or other costs arising out of delays) resulting from the suspension, by whomsoever incurred, shall be borne by the Contractor.
2. Should the Contractor or any Sub-Contractor fail to provide a safe and healthy work place after being formally notified in writing by the County or its agents of such non-compliance, the contract may be terminated following the termination provision of the contract.

H. CONTRACTOR'S INDEMNITY OF THE COUNTY FOR CONTRACTOR'S NON-COMPLIANCE WITH SAFETY PROGRAM

1. The Contractor recognizes that it has sole responsibility to assure its Safety Program is implemented and to assure its construction services are safely provided. The Contractor shall indemnify, defend and hold the County and its agents harmless, from and against any and all liability (whether public or private), penalties (contractual or otherwise), losses, damages, costs, attorneys' fees, expenses, causes of action, claims or judgments resulting, either in whole or in part, from any failure of the Contractor, its Sub-Contractors of any tier or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, to comply with the safety requirements of the contract. The Contractor shall not be relieved of its responsibilities under the safety requirements of the Contract should the County or its agent(s) act or fail to act pursuant to its rights hereunder.
2. The Contractor shall not raise as a defense to its obligation to indemnify under this Subparagraph I any failure of those indemnified hereunder to assure Contractor operates safely, it being understood and agreed that no such failure shall relieve the Contractor from its obligation to assure safe operations or from its obligation to so indemnify. The Contractor also hereby waives any rights it may have to seek contribution, either directly or indirectly, from those indemnified hereunder.
3. In any and all claims against those indemnified hereunder by any employee of the Contractor, any Sub-Contractor of any tier or anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable, the indemnification obligation under this Subparagraph I shall not be limited in any way as to the amount or type of damages, compensation or benefits payable by or for the Contractor or any Sub-Contractor of any tier under any workers' compensation act, disability benefit or other employee benefit acts.

00700-26 BLASTING AND EXCAVATION

The Contractor acknowledges that it is fully aware of the contents and requirements of O.C.G.A. § 25-9-1 through 25-9-12 concerning blasting and excavation near underground gas pipes and facilities and shall fully comply therewith.

00700-27 HIGH VOLTAGE LINES

The Contractor acknowledges that it is fully aware of the contents and requirements O.C.G.A. § 46-3-30 through 46-3-39 concerning safeguards against contact with high voltage lines, and the Contractor shall fully comply with said provisions.

00700-28 SCAFFOLDING AND STAGING

The Contractor acknowledges that it is the person responsible for employing and directing others to perform labor within the meaning of O.C.G.A. § 34-1-1 and agrees to comply with said provisions.

00700-29 CLEAN-UP

The Contractor shall clean up all refuse, rubbish, scrap materials, and debris caused by its operations to the end that the site of the work shall present a neat, orderly and workmanlike appearance at all times.

00700-30 PROTECTION OF WORK

The Contractor shall be responsible for maintenance and protection of the work, which shall include any County-furnished supplies, material, equipment, until final completion of this agreement and acceptance of the work as defined herein. Any portion of the work suffering injury, damage or loss shall be considered defective and shall be corrected or replaced by the Contractor without additional cost to the County.

00700-31 REJECTED WORK

The Contractor shall promptly remove from the project all work rejected by the Construction Manager for failure to comply with the contract documents and the Contractor shall promptly replace and re-execute the work in accordance with the contract documents and without expense to the County. The Contractor shall also bear the expense of making good all work of other Contractors destroyed or damaged by such removal or replacement.

00700-32 DEFECTIVE WORK

If the Contractor defaults or neglects to carry out any portion of the work in accordance with the contract documents, and fails within three days after receipt of written notice from the Construction Manager to commence and continue correction of such default or neglect with diligence and promptness, the County may, after three days following receipt by the Contractor of an additional written notice and without prejudice to any other remedy the County may have, make good such deficiencies and complete all or any portion of any work through such means as the County may select, including the use of a separate Contractor. In such case, an appropriate change order shall be issued deducting from the payments then or thereafter due the Contractor the cost of correcting such deficiencies. In the event the payments then or thereafter due the Contractor are not sufficient to cover such amount, the Contractor shall pay the difference to the County on demand.

The County may, at its option, accept defective or nonconforming work instead of requiring its removal or correction. In such case, a change order shall be issued reducing the price due the contractor to the extent appropriate and equitable. Such contract price adjustment shall be effected whether or not final payment has been made.

00700-33 WARRANTY OF NEW MATERIALS

The Contractor warrants to the County that all materials and equipment furnished under this contract will be new unless otherwise specified, and the Contractor further warrants that all work will be of good quality, free from faults and defects, and in conformance with the contract documents. The warranty set forth in this paragraph shall survive final acceptance of the work.

00700-34 CONTRACTOR'S WARRANTY OF THE WORK

If within one year after the date of issuance of the certificate of final payment pursuant to General Condition 84, or within such longer period of time as may be prescribed by law or by the term of any applicable special warranty required by the contract documents, any of the work is found to be defective or not in accordance with the contract documents, the Contractor shall correct such work promptly after receipt of written notice from the Construction Manager to do so. This obligation shall survive both final payment for the work and termination of the contract.

00700-35 ASSIGNMENT OF MANUFACTURERS' WARRANTIES

Without limiting the responsibility or liability of the Contractor pursuant to this agreement, all warranties given by manufacturers on materials or equipment incorporated in the work are hereby assigned by the Contractor to the County. If requested, the Contractor shall execute formal assignments of said manufacturer's warranties to the County. All such warranties shall be directly enforceable by the County.

00700-36 WARRANTIES IMPLIED BY LAW

The warranties contained in this agreement, as well as those warranties implied by law, shall be deemed cumulative and shall not be deemed alternative or exclusive. No one or more of the warranties contained herein shall be deemed to alter or limit any other.

00700-37 STOP WORK ORDERS

In the event that the Contractor fails to correct defective work as required by the contract documents or fails to carry out the work in accordance with contract documents, the Construction Manager, in writing, may order the Contractor to stop work until the cause for such order has been eliminated. This right of the County to stop work shall not give rise to any duty on the part of the County or the Construction Manager to execute this right for the benefit of the Contractor or for any other person or entity.

00700-38 TERMINATION FOR CAUSE

If the Contractor is adjudged bankrupt, makes a general assignment for the benefit of creditors, suffers the appointment of a receiver on account of its insolvency, fails to supply sufficient properly skilled workers or materials, fails to make prompt payment to subcontractors or materialmen, disregards laws, ordinances, rules, regulations, or orders of any public authority having jurisdiction, fails to diligently prosecute the work, or is otherwise guilty of a material violation of this agreement and fails within seven days after receipt of written notice to commence and continue correction of such default, neglect, or violation with diligence and promptness, the County may, after seven days following receipt by the Contractor of an additional written notice and without prejudice to any other remedy the County may have, terminate the employment of the Contractor and take possession of the site as well as all materials, equipment, tools, construction equipment and machinery thereon. The County may finish the work by whatever methods the County deems expedient. In such case, the Contractor shall not be entitled to receive any further payment until the work is completed. If the unpaid balance of the

contract price exceeds the cost of completing the work, such excess shall be paid to the Contractor. If such costs exceed the unpaid balance, the Contractor shall pay the difference to the County on demand. This obligation for payment shall survive the termination of the contract. Termination of this agreement pursuant to this paragraph may result in disqualification of the Contractor from bidding on future County contracts.

00700-39 TERMINATION FOR CONVENIENCE

The County may, at any time upon written notice to the Contractor, terminate the whole or any portion of the work for the convenience of the County. The effective date of the terminations shall be provided in the written notice. Said termination shall be without prejudice to any right or remedy of the County provided herein. In addition, in the event this agreement has been terminated due to the default of the Contractor, and if it is later determined that the Contractor was not in default pursuant to the provisions of this agreement at the time of termination, then such termination shall be considered a termination for convenience pursuant to this paragraph.

00700-40 TERMINATION FOR CONVENIENCE - PAYMENT

If the Contract is terminated for convenience by the Owner as provided in this article, Contractor will be paid compensation for those services actually performed as approved by the Owner or his representative. Partially completed tasks will be compensated for based on a signed statement of completion prepared by the Project Manager and submitted to the Contractor which shall itemize each task element and briefly state what work has been completed and what work remains to be done. Contractor shall also be paid for reasonable costs for the orderly filing and closing of the project.

00700-41 TERMINATION FOR CONVENIENCE - PAYMENT LIMITATIONS

Except for normal spoilage, and except to the extent that the County shall have otherwise expressly assumed the risk of loss, there shall be excluded from the amounts payable to the Contractor the fair value, as determined by the Construction Manager, of property which is destroyed, lost, stolen or damaged so as to become undeliverable to the County or to another buyer.

00700-42 COST TO CURE

If the County terminates for cause the whole or any part of the work pursuant to this agreement, then the County may procure upon such terms and in such manner as the Construction Manager may deem appropriate, supplies or services similar to those so terminated, and the Contractor shall be liable to the County for any excess costs for such similar supplies or services. The Contractor shall continue the performance of this agreement to the extent not terminated hereunder.

00700-43 ATTORNEY'S FEES

Should the Contractor default pursuant to any of the provisions of this agreement, the Contractor and its surety shall pay to the County such reasonable attorney's fees as the County may expend as a result thereof and all costs, expenses, and filing fees incidental thereto.

00700-44 CONTRACTOR'S RESPONSIBILITIES UPON TERMINATION

After receipt of a notice of termination from the County, and except as otherwise directed by the Construction Manager, the Contractor shall:

1. Stop work under the contract on the date and to the extent specified in the notice of termination;

2. Place no further orders or subcontracts for materials, services or facilities, except as may be necessary for completion of such portion of the work under the agreement as is not terminated;
3. Terminate all orders and subcontracts to the extent that they relate to the performance of work terminated by the notice of termination;
4. Assign to the County in the manner, at the times, and to the extent directed by the Construction Manager, all of the rights, title and interest of the Contractor under the orders and subcontracts so terminated, in which case the County shall have the right, at its discretion, to settle or pay any and all claims arising out of the termination of such orders or subcontracts;
5. Settle all outstanding liabilities and all claims arising out of such termination of orders and subcontracts with the approval or ratification of the Construction Manager, to the extent the Construction Manager may require, which approval or ratification shall be final for all purposes;
6. Transfer title and deliver to the entity or entities designated by the Construction Manager, in the manner, at the times, and to the extent, if any, directed by the Construction Manager, and to the extent specifically produced or specifically acquired by the Contractor for the performance of such portion of the work as has been terminated:
 - a. The fabricated or un-fabricated parts, work, and progress, partially completed supplies, and equipment, materials, parts, tools, dyes, jigs, and other fixtures, completed work, supplies, and other material produced as a part of or acquired in connection with the performance of the work terminated by the notice of termination; and
 - b. The completed or partially completed plans, drawings, information, and other property to the work.
7. Use its best efforts to sell in the manner, at the times, to the extent, and at the prices directed or authorized by the Construction Manager, any property described in Section 6 of this paragraph, provided, however, that the Contractor shall not be required to extend credit to any buyer and further provided that the proceeds of any such transfer or disposition shall be applied in reduction of any payments to be made by the County to the Contractor pursuant to this agreement.
8. Complete performance of such part of the work as shall not have been terminated by the notice of termination; and
9. Take such action as may be necessary, or as the Construction Manager may direct, for the protection and preservation of the property related to the agreement which is in the possession of the Contractor and in which the County has or may acquire an interest.

00700-45 RECORDS

The Contractor shall preserve and make available to the County all of its records, books, documents and other evidence bearing on the costs and expenses of the Contractor and any subcontractor pursuant to this agreement upon three days advance notice to the Contractor.

00700-46 DEDUCTIONS

In arriving at any amount due the Contractor pursuant to the terms of this agreement, there shall be deducted all liquidated damages, advance payments made to the Contractor applicable to the termination portion of the contract, the amount of any claim which the County may have against the Contractor, the amount determined

By the Construction Manager to be necessary to protect the County against loss due to outstanding potential liens or claims, and the agreed price of any materials acquired or sold by the Contractor and not otherwise recovered by or credited to the County.

00700-47 REIMBURSEMENT OF THE COUNTY

In the event of termination, the Contractor shall refund to the County any amount paid by the County to the Contractor in excess of the costs properly reimbursable to the Contractor.

00700-48 SUSPENSION, INTERRUPTION, DELAY, DAMAGES

The Contractor shall be entitled to only those damages and that relief from termination by the County as specifically set forth in this agreement. The Construction Manager may issue a written order requiring the Contractor to suspend, delay or interrupt all or any part of the work for such period of time as the County may determine to be appropriate for the convenience of the County. If the performance of the work is interrupted for an unreasonable period of time by an act of the County or any of its officers, agents, employees, contractors, or consultants in the administration of this agreement, an equitable adjustment shall be made for any increase in the Contractor's costs of performance and any increase in the time required for performance of the work necessarily caused by the unreasonable suspension, delay, or interruption. Any equitable adjustment shall be reduced to writing and shall constitute a modification to this agreement. In no event, however, shall an equitable adjustment be made to the extent that performance of this agreement would have been suspended, delayed or interrupted by any other cause, including the fault or negligence of the Contractor. No claim for an equitable adjustment pursuant to this paragraph shall be permitted before the Contractor shall have notified the Construction Manager in writing of the act or failure to act involved, and no claim shall be allowed unless asserted in writing to the Construction Manager within ten days after the termination of such suspension, delay or interruption.

00700-49 COMMENCEMENT AND DURATION OF WORK

The County may issue a Notice to Proceed at any time within 120 days following execution of the contract by the County. The Contractor shall commence work pursuant to this agreement within ten days of mailing or delivery of written notice to proceed. The Contractor shall diligently prosecute the work to completion within the time specified therefore in the Agreement. The capacity of the Contractor's construction and manufacturing equipment and plan, sequence and method of operation and forces employed, including management and supervisory personnel, shall be such as to insure completion of the work within the time specified in the Agreement. The Contractor and County hereby agree that the contract time for completion of the work is reasonable taking into consideration the average climatic conditions prevailing in the locality of the work and anticipated work schedules of other contractors whose activities are in conjunction with or may affect the work under this contract.

00700-50 TIME OF THE ESSENCE

All time limits stated in this agreement are of the essence of this contract.

00700-51 IMPACT DAMAGES

Except as specifically provided pursuant to a stop work order or change order, the Contractor shall not be entitled to payment or compensation of any kind from the County for direct or indirect or impact damages including, but not limited to, costs of acceleration arising because of delay, disruption, interference or hindrance from any cause whatsoever whether such delay, disruption, interference or hindrance is reasonable or unreasonable, foreseeable or unforeseeable, or avoidable, provided, however, that this provision shall not preclude the recovery of damages by the Contractor for hindrances or delays due solely to fraud or bad faith on the part of the County, its agents, or employees. The Contractor shall be entitled only to extensions in the time required for performance of the work as specifically provided in the contract.

00700-52 DELAY

The Contractor may be entitled to an extension of the contract time, but not an increase in the contract price or damages, for delays arising from unforeseeable causes beyond the control and without the fault or negligence of the Contractor or its subcontractors for labor strikes, acts of God, acts of the public enemy, acts of the state, federal or local government in its sovereign capacity, by acts of another separate contractor, or by an act or neglect of the County.

00700-53 INCLEMENT WEATHER

The Contractor shall not be entitled to an extension of the contract time due to normal inclement weather. Unless the Contractor can substantiate to the satisfaction of the Construction Manager that there was greater than normal inclement weather and that such greater than normal inclement weather actually delayed the work, the Contractor shall not be entitled to an extension of time therefore. The following shall be considered the normal inclement weather days for each month listed, and extensions of time shall be granted in increments of not less than one half day only for inclement weather in excess of the days set out.

January	10 days
February	10 days
March	7 days
April	6 days
May	4 days
June	3 days
July	4 days
August	2 days
September	2 days
October	3 days
November	6 days
December	9 days

00700-54 DELAY - NOTICE AND CLAIM

The Contractor shall not receive an extension of time unless a Notice of Delay is filed with the Construction Manager within ten days of the first instance of such delay, disruption, interference or hindrance and a written Statement of the Claim is filed with the Construction Manager within 20 days of the first such instance. In the event that the Contractor fails to comply with this provision, it waives any claim which it may have for an extension of time pursuant to this agreement.

00700-55 STATEMENT OF CLAIM - CONTENTS

The Statement of Claim referenced in Article 00700-54 shall include specific information concerning the nature of the delay, the date of commencement of the delay, the construction activities affected by the delay, the person or organization responsible for the delay, the anticipated extent of the delay, and any recommended action to avoid or minimize the delay.

00700-56 WORK BEHIND SCHEDULE, REMEDY BY CONTRACTOR

If the work actually in place falls behind the currently updated and approved schedule, and it becomes apparent from the current schedule that work will not be completed within the contract time, the Contractor agrees that it will, as necessary, or as directed by the Construction Manager, take action at no additional cost to the County to improve the progress of the work, including increasing manpower, increasing the number of working hours per shift or shifts per working day, increasing the amount of equipment at the site, and any other measure reasonably required to complete the work in a timely fashion.

00700-57 DILIGENCE

The Contractor's failure to substantially comply with the requirements of the preceding paragraph may be grounds for determination by the County that the Contractor is failing to prosecute the work with such diligence as will insure its completion within the time specified. In such event, the County shall have the right to furnish, from its own forces or by contract, such additional labor and materials as may be required to comply with the schedule after 48 hours written notice to the Contractor, and the Contractor shall be liable for such costs incurred by the County.

00700-58 SET-OFFS

Any monies due to the Contractor pursuant to the preceding paragraph of this agreement may be deducted by the County against monies due from the County to the Contractor.

00700-59 REMEDIES CUMULATIVE

The remedies of the County under Articles 00700-56, 00700-57, and 00700-58 are in addition to and without prejudice to all of the rights and remedies of the County at law, in equity, or contained in this agreement.

00700-60 TITLE TO MATERIALS

No materials or supplies shall be purchased by the Contractor or by any Subcontractor subject to any chattel mortgage or under a conditional sales contract or other agreement by which any interest is retained by the seller. The Contractor hereby warrants that it has good and marketable title to all materials and supplies used by it in the work, and

the Contractor further warrants that all materials and supplies shall be free from all liens, claims, or encumbrances at the time of incorporation in the work.

00700-61 INSPECTION OF MATERIALS

All materials and equipment used in the construction of the project shall be subject to adequate inspection and testing in accordance with accepted standards and in accordance with the requirements of the contract documents. Additional tests performed after the rejection of materials or equipment shall be at the Contractor's expense.

00700-62 CONSTRUCTION MANAGER'S PRESENCE DURING TESTING

All tests performed by the Contractor shall be witnessed by the Construction Manager unless the requirement therefore is waived in writing. The Construction Manager may perform additional tests on materials previously tested by the Contractor, and the Contractor shall furnish samples for this purpose as requested.

00700-63 MATERIALS INCORPORATED IN WORK

The Contractor shall furnish all materials and equipment to be incorporated in the work. All such materials or equipment shall be new and of the highest quality available. Manufactured materials and equipment shall be obtained from sources which are currently manufacturing such materials, except as otherwise specifically approved by the Construction Manager.

00700-64 STORAGE OF MATERIALS

Materials and equipment to be incorporated in the work shall be stored in such a manner as to preserve their quality and fitness for the work and to facilitate inspection.

00700-65 PAYROLL REPORTS

The Contractor may be required to furnish payroll reports to the Construction Manager as required by the Owner Controlled Insurance Program.

00700-66 CONTRACTORS' REPRESENTATIVE

Before beginning work, the Contractor shall notify the Construction Manager in writing of one person within its organization who shall have complete authority to supervise the work, receive orders from the Construction Manager, and represent the Contractor in all matters arising pursuant to this agreement. The Contractor shall not remove its representative without first designating in writing a new representative. The Contractor's representative shall normally be present at or about the site of work while the work is in progress. When neither the Contractor nor its representative is present at the work site, the superintendent, foreman, or other of the Contractor's employee in charge of the work shall be an authorized representative of the Contractor.

00700-67 SPECIALTY SUB-CONTRACTORS

The Contractor may utilize the services of specialty subcontractors on those parts of the project which, under normal contracting practices, are performed by specialty subcontractors. The Contractor shall not award more than seventy-five percent of the work to subcontractors.

00700-68 INSPECTION BY THE CONSTRUCTION MANAGER

All work pursuant to this agreement shall be subject to inspection by the Construction Manager for conformity with contract drawings and specifications. The Contractor shall

give the Construction Manager reasonable advance notice of operations requiring special inspection of a portion of the work.

00700-69 WORK COVERED PRIOR TO CONSTRUCTION MANAGER'S INSPECTION

In the event that work is covered or completed without the approval of the Construction Manager, and such approval is required by the specifications or required in advance by the Construction Manager, the Contractor shall bear all costs involved in inspection notwithstanding conformance of such portion of the work to the contract drawings and specifications.

00700-70 SCHEDULING OF THE WORK

The work of this contract shall be planned, scheduled, executed, and reported as required by the Contract Documents.

00700-71 PROGRESS ESTIMATES

The Contractor shall prepare a written report for the Construction Manager's approval, on County forms, of the total value of work performed and materials and equipment obtained to the date of submission. Such a report must accompany each request for a progress payment and is subject to review and approval by the Construction Manager. Approval of a progress estimate or tendering of a progress payment shall not be considered an approval or acceptance of any work performed, and all estimates and payments shall be subject to correction in subsequent estimates. Progress payments shall be made for all completed activities and for materials suitably stored on-site.

00700-72 PROGRESS PAYMENTS

Upon approval of each monthly estimate of work performed and materials furnished, the Construction Manager shall approve payment to the Contractor for the estimated value of such work, materials, and equipment, less the amount of all prior payments and any liquidated damages. The Contractor will be paid 100 percent, less retainage, of the cost of materials received and properly stored on-site but not incorporated into the work. Payments for materials or equipment stored on the site shall be conditioned upon submission by the Contractor of bills of sale to establish the County's title to such materials or equipment. The Contractor's request for payment shall provide sufficient detail as to the work completed or materials purchased for which payment is requested to permit meaningful review by the Construction Manager.

00700-73 TIME OF PAYMENT

The Contractor will be paid within 45 days following receipt of an approved Progress Estimate. The Contractor expressly agrees that the payment provisions within this Contract shall supersede the rates of interest, payment periods, and contract and subcontract terms provided for under the Georgia Prompt Pay Act, O.C.G.A. §13-11-1 et seq., and that the rates of interest, payment periods, and contract and subcontract terms provided for under the Prompt Pay Act shall have no application to this Contract. The County shall not be liable for any late payment interest or penalty.

Submittal of Invoices: Invoices shall be submitted as follows:

Via Mail:

Fulton County Government
141 Pryor Street, SW
Suite 7001
Atlanta, Georgia 30303

Attn: Finance Department – Accounts Payable

OR

Via Email:

Email: Accounts.Payable@fultoncountyga.gov

At minimum, original invoices must reference all of the following information:

- 1) Vendor Information
 - a. Vendor Name
 - b. Vendor Address
 - c. Vendor Code
 - d. Vendor Contact Information
 - e. Remittance Address

- 2) Invoice Details
 - a. Invoice Date
 - b. Invoice Number (uniquely numbered, no duplicates)
 - c. Purchase Order Reference Number
 - d. Date(s) of Services Performed
 - e. A written report of the total value of work performed and materials and equipment obtained to the date of submission

- 3) Fulton County Department Information (needed for invoice approval)
 - a. Department Name
 - b. Department Representative Name

00700-74 RETAINAGE

The County shall retain from each progress payment ten percent of the estimated value of the work performed until the progress payments, including retainage, total 50 percent of the contract price. If a contract includes two or more projects or assignments that have been separately priced and have separate budgets, and the performances of such projects or assignments are not related to or dependent upon the performance of any other, the 50 per cent limit shall be based upon the price for each individual project or assignment. Thereafter, no further retainage shall be withheld so long as the Contractor is making satisfactory progress to insure completion of the work within the time specified therefore. The County may reinstate the ten percent retainage in the event the Construction Manager determines that the Contractor is not making satisfactory progress to complete the work within the time specified in this agreement or in the event that the Construction Manager provides a specific cause for such withholding. The County may also withhold retainage upon substantial completion of the work as provided in O.C.G.A. §13-10-81(c). Interest may be paid upon the retainage in accordance with Georgia law.

00700-75 PAYMENT OF SUBCONTRACTORS

The Contractor shall promptly pay each subcontractor upon the receipt of payment from the County. Such payment shall be made from the amount paid to the Contractor pursuant to the subcontractor's work. The Contractor shall also maintain the records of the percentage retained from payments to the Contractor pursuant to such subcontractor's work. The Contractor shall procure agreements from each subcontractor

requiring each subcontractor to pay their subcontractors, agents and employees in a similar manner. The County reserves the right to inquire of any subcontractor, supplier, materialmen, or subconsultant, the status of any indebtedness of the Contractor. The County further reserves the right to require the Contractor to designate on each instrument of payment exceeding \$400.00 to subcontractors, suppliers, materialmen, and subconsultants that such payment is on account of the work under this Contract.

00700-76 COUNTY'S RESPONSIBILITIES TO SUBCONTRACTORS

Neither the County nor the Construction Manager shall have any obligation to pay any subcontractor except as otherwise required by law.

00700-77 PROGRESS PAYMENTS - ACCEPTANCE OF WORK

Certification of progress payments, as well as the actual payment thereof, shall not constitute the County's acceptance of work performed pursuant to this agreement.

00700-78 PAYMENTS IN TRUST

All sums paid to the Contractor pursuant to this agreement are hereby declared to constitute trust funds in the hands of the contractor to be applied first to the payment of claims of subcontractors, laborers, and suppliers arising out of the work, to claims for utilities furnished and taxes imposed, and to the payment of premiums on surety and other bonds and on insurance for any other application.

00700-79 JOINT PAYMENTS

The County reserves the right to issue any progress payment or final payment by check jointly to the Contractor and any subcontractor or supplier.

00700-80 RIGHT TO WITHHOLD PAYMENT

The Construction Manager may decline to approve payment and may withhold payment in whole or in part to the extent reasonable and necessary to protect the County against loss due to defective work, probable or actual third party claims, the Contractor's failure to pay subcontractors or materialmen, reasonable evidence that the work will not be completed within the contract time or contract price or damage to the County or any other contractor on the project.

00700-81 CERTIFICATE OF SUBSTANTIAL COMPLETION

Upon the Contractor's submission of a request for a certificate of Substantial Completion, the Construction Manager shall inspect the work and determine whether the work is Substantially Complete. If the work is Substantially Complete, the Construction Manager shall issue a certificate of Substantial Completion of the work which shall establish the date of Substantial Completion, shall state the responsibilities of the County and the Contractor for security, maintenance, heat, utilities, damage to the work and insurance, and shall fix the time within which the Contractor shall complete the items submitted by the Contractor as requiring correction or further work. The certificate of substantial completion of the work shall be submitted to the County and the Contractor for their written acceptance of the responsibilities assigned to them pursuant to such certificate.

If in the sole opinion of the Construction Manager, the work is not substantially complete, the Construction Manager shall notify the Contractor of such, in writing, and outline requirements to be met to achieve Substantial Completion.

00700-82 PAYMENT UPON SUBSTANTIAL COMPLETION

Upon Substantial Completion of the work and upon application by the Contractor and approval by the Construction Manager, the County shall make payment reflecting 100% work completed, less value of work remaining as determined by Construction Manager and any authorized retainage.

00700-83 COMMENCEMENT OF WARRANTIES

Warranties required by this agreement shall commence on the date of final completion of the project as determined under Article 00700-84 unless otherwise provided in the certificate of Substantial Completion.

00700-84 FINAL PAYMENT - WAIVER OF CLAIMS, DISPUTE OF FINAL PAYMENT

The acceptance of the Substantial Completion payment shall constitute a waiver of all claims by the Contractor except those previously made in writing and identified by the Contractor as unsettled at the time of application for payment at Substantial Completion and except for the retainage sums due at final acceptance. Following the Construction Manager's issuance of the certificate of Substantial Completion and the Contractor's completion of the work pursuant to this agreement, the Contractor shall forward to the Construction Manager a written notice that the work is ready for final inspection and acceptance. If after inspection the Construction Manager certifies that the work is complete and issues written notification of such to the Contractor, the Contractor shall forward to the Construction Manager a final application for payment. The Construction Manager shall issue a certificate for payment, which shall approve final payment to the Contractor and shall establish the date of final completion.

In the event the Contractor timely disputes the amount of the final payment, the amount due the Contractor shall be deemed by the Contractor and the County to be an unliquidated sum and no interest shall accrue or be payable on the sum finally determined to be due to the Contractor for any period prior to final determination of such sum, whether such determination be by agreement of the Contractor and the County or by final judgment of the proper court in the event of litigation between the County and the Contractor. The Contractor specifically waives and renounces any and all rights it may have under O.C.G.A. §13-6-13 and agrees that in the event suit is brought by the Contractor against the County for any sum claimed by the Contractor under the Contract or for any extra or additional work, no interest shall be awarded on any sum found to be due from the County to the Contractor in the final judgment entered in such suit. All final judgments shall draw interest at the legal rate, as specified by law.

00700-85 DOCUMENTATION OF COMPLETION OF WORK

Neither the final payment nor the remaining retainage shall become due until the Contractor submits the following documents to the Construction Manager:

- a. An affidavit that all payrolls, bills for materials and equipment, and other indebtedness connected with the work have been paid other otherwise satisfied;
- b. The surety's consent to final payment; and
- c. Any other data reasonably required by the County or Construction Manager establishing payment or satisfaction of all such obligations, including releases, waivers of liens, and documents of satisfaction of debts.

In the event that a subcontractor refuses to furnish a release or waiver as required by the County or Construction Manager, the Contractor may furnish a bond satisfactory to the County to indemnify the County against such loss. In the event that any lien or indebtedness remains unsatisfied after all payments are made, the contractor shall refund to the County all moneys that the County may become compelled to pay in discharging such lien or other indebtedness, including all costs and reasonable attorney's fees.

00700-86 GOVERNING LAW

Each and every provision of this agreement shall be construed in accordance with and governed by Georgia law. The parties acknowledge that this contract is executed in Fulton County, Georgia and that the contract is to be performed in Fulton County, Georgia. Each party hereby consents to the Fulton Superior Court's sole jurisdiction over any dispute which arises as a result of the execution or performance of this agreement, and each party hereby waives any and all objections to venue in the Fulton Superior Court.

00700-87 CHANGES IN THE WORK

A. CHANGE ORDERS

1. A Change Order is a written order to the Contractor signed to show the approval and the authorization of the County, issued after execution of the Contract, authorizing a change in the Work and/or an adjustment in the Contract Sum or the Contract Time. Change Orders shall be written using forms designated by the County with Contractor providing supporting documentation as required by the Construction Manager. The Contract Sum and the Contract Time may be changed only by approved Change Order pursuant to Fulton County Procedure 800-6. The amount payable by the Change Order is payment in full for all direct and indirect costs incurred and related to the work under said Change Order, including but not limited to delays, imports, acceleration, disruption and extended overhead. A Change Order signed by the Contractor indicates the Contractor's agreement therewith, including the adjustment in either or both of the Contract Sum or the Contract Time.
2. The County, without invalidating the Contract, may order changes in the Work within the general scope of the Contract as defined herein. The time allowed for performance of the work and the contract price to be paid to the Contractor may be adjusted accordingly.
3. The cost or credit to the County resulting from a change in the Work shall be determined in one or more of the following ways:
 - a. By mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;
 - b. By unit prices stated in the Contract Documents or subsequently agreed upon;
 - c. By cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee; or
 - d. By the method provided in Subparagraph A4 below.

4. If none of the methods set forth in Subparagraphs 3a, 3b, or 3c above is agreed upon, the Contractor, provided a written order signed by the Construction Manager is received, shall promptly proceed with the Work involved. The cost of such Work shall then be determined by the Construction Manager on basis of the reasonable expenditures and savings of those performing the Work attributable to the change. The cost of the change shall include only the items listed in Subparagraph 5a below, and in the case of either a decrease or an increase in the Contract Sum, an allowance for overhead and profit in accordance with the schedules set forth in Subparagraphs 5b and 6 below shall be applied to the cost or credit.
 - a. In such case, and also under Subparagraph 3a above, the Contractor shall keep and present, in such form as the Construction Manager may prescribe, an itemized accounting of all actual costs expended, together with appropriate supporting data for inclusion in a Change Order.
 - b. All hourly rate charges shall be submitted to the Construction Manager for prior review and approval. All hourly rate charges shall be properly supported as required by the Construction Manager with certified payrolls, or their acceptable equivalent. When authorized to proceed for a given change and actual expenditures have been made prior to execution of a Change Order for the entire change, such actual expenditures may be summarized monthly, and if approved, incorporated into a Change Order. When both additions and credits covering related Work or substitutions are involved in any one change, the allowance for overhead and profit shall be figured on the basis of the net increase or decrease, if any, with respect to that change.
5. In Subparagraphs 3 and 4 above, the items included in "Cost and "Overhead" shall be based on the following schedule:
 - a. Unless otherwise provided in the Contract Documents, "Cost" shall be limited to the following: cost of materials incorporated into the Work, including sales tax and cost of delivery; cost of direct labor (labor cost may include a pro rata share of foreman's account of the change) including social security, old age and unemployment insurance, and fringe benefits required by agreement or custom; workers' or workmen's compensation insurance; rental value of equipment and machinery; costs for preparing Shop Drawings.
 - b. Unless otherwise provided in the Contract Documents, "Overhead" shall include the following: bond and insurance premiums including increase and decreases from change in the Work, supervision, superintendence, construction parking, wages of timekeepers, watchmen and clerks, small tools, consumable supplies, expendables, incidentals, general office expense, the cost of additional reproduction for the Contractor's subcontractors beyond that agreed upon in the Contract Documents, construction parking, any additional costs of craft supervision by the

- Contractor's or subcontractors' superintendents, and overhead charges which would be customary and expended regardless of the change in the Work due to other overlapping activities which are included as part of the original Contract, and all other expenses not included in "Cost" above.
- c. In the event that a change is issued by the County which would require the expenditure of substantial amounts of special supervision (beyond the foreman level) by the Contractor, the Contractor may, at the sole direction of the Construction Manager, be allowed to incorporate these charges into the agreement cost for the change.
6. In Subparagraphs 3 and 4 above, the allowance for overhead and profit combined, included in the total cost or credit to the County, shall be based on the following schedule:
 - a. For the Contractor, for any work performed by the Contractor's own forces, ten (10) percent of the cost.
 - b. For the Contractor, for any work performed by a Contractor's subcontractor, five (5) percent of the amount due the subcontractor.
 - c. For each subcontractor or sub-subcontractor involved, for any work performed by that subcontractor's or sub-subcontractor's own forces, ten (10) percent of the cost.
 - d. For each subcontractor, for work performed by a sub-subcontractor, five (5) percent of the amount due to the sub-subcontractor.
 - e. Cost to which overhead and profit is to be applied shall be determined in accordance with Subparagraph 5 above unless modified otherwise.
 7. In order to facilitate checking of quotations for extras or credits, all proposals or bids, except those so minor that their propriety can be seen by inspection, shall be accompanied by a complete itemization of costs, including labor cost, materials and subcontracts. Labor and materials shall be itemized in the manner defined in Subparagraph 4 above. Where major cost items are subcontracts, they shall be itemized also. In no case shall a change be approved without such itemization.
 8. No payment shall be made for any changes to the contract that are not included in a fully executed Change Order.
- B. CONCEALED, UNKNOWN AND DIFFERING CONDITIONS
1. Should concealed conditions be encountered in the performance of the Work below the surface of the ground, or should concealed or unknown conditions in an existing structure be at variance with the conditions indicated by the Contract Documents, or should unknown physical conditions below the surface of the ground or concealed or unknown conditions in an existing structure of an unusual nature, differing materially from those ordinarily encountered and generally recognized as inherent in work of the character provided for in this Contract, be

encountered, the Contract Sum and Contract Time shall be equitably adjusted by Change Order upon request by either party made **within twenty (20) days after the first observance** of the conditions. No such request for equitable adjustment shall be valid unless the Contractor complies with this (20) days notice and Subparagraph C.1. below.

2. The Contractor shall promptly, and before such conditions are disturbed, notify the Construction Manager in writing of any claim of concealed, unknown or differing conditions pursuant to this paragraph. The Construction Manager shall authorize the Engineer to investigate the conditions, and if it is found that such conditions do materially so differ and cause an increase or decrease in the Contractor's cost of, or the time required for, performance of any part of the Work under this Contract, whether or not changed as a result of such conditions, an equitable adjustment shall be recommended to the Construction Manager.
3. No claim of the Contractor under this clause shall be allowed unless the Contractor has given the notice required in (a) above, prior to disturbing the condition.
4. No claim by the Contractor for an equitable adjustment shall be allowed if asserted after final payment under this Contract.
5. Any materially differing site condition as between what is shown on the Drawings and Specifications and actually found on site shall be immediately reported to the Construction Manager in writing prior to the commencement of Work at the site. Failure of the Contractor to notify the Construction Manager in writing of the differing site condition prior to performance of Work at the site shall constitute a waiver of any claim for additional monies. Any Change Order necessitated by the differing site condition shall be processed as provided under "Changes in the Contract".

C. REQUESTS FOR ADDITIONAL COST

1. If the Contractor wishes to request an increase in the Contract Sum, the Contractor shall give the Construction Manager written notice thereof within twenty (20) days after the occurrence of the event, or identification of the conditions, giving rise to such request. This notice shall be give by the Contractor before proceeding to execute the Work, except in an emergency endangering life or property in which case the Contractor shall proceed in accordance with Article 00700-25 and Subparagraph A.4 above. No such request shall be valid unless so made within the twenty (20) days specified above. If the County and the Contractor cannot agree on the amount of the adjustment in the Contract Sum, it shall be determined by the Construction Manager. Any change in the Contract Sum resulting from such claim shall be documented by Change Order.
2. If the Contractor claims that addition cost is involved because of, but not limited to (1) any written interpretation pursuant to General Condition 00700-17 of this Agreement, (2) any order by the County to stop the Work pursuant to Articles 00700-25 and 00700-37 of this Agreement where the Contractor was not at fault, or any such order by the Construction Manager as the County's agent, or (3) any written order for a minor

change in the Work issued pursuant to Paragraph D below, the Contractor shall submit a request for an increase in the Contract Sum as provided in Subparagraph C.1 above. No such claim shall be valid unless the Contractor complies with Subparagraph C.1 above and approved by the County pursuant to Change Order Policy 800-6.

D. MINOR CHANGES IN THE WORK

The Construction Manager may order minor changes in the Work not involving an adjustment in the Contract Price, extension of the time allowed for performance of the work and not inconsistent with the intent of the Contract Documents. Such changes shall be effected by a written Change Directive issued by the Construction Manager, and shall be binding on the County and the Contractor. The Contractor shall carry out such written orders promptly.

E. BONDS

If any change order results in an increase in the contract price, the contractor shall increase the penal sum of the performance and payment bonds to equal the increased price.

00700-88 DISAGREEMENT WITH ORDERS FOR CHANGE

Contractor's written acceptance of a Change Order or other order for changes shall constitute his final and binding agreement to the provisions thereof and a waiver of all claims in connection therewith, whether direct or consequential in nature. Should Contractor disagree with any order for changes, he may submit a notice of potential claim to the Construction Manager, at such time as the order is set forth in the form of a Change Order. Disagreement with the provisions of an order for changes shall not relieve Contractor of his obligation under Article 00700-87 of this Agreement.

00700-89 NO WAIVER OF REMEDIES

Exercise by the County of any remedy is not exclusive of any other remedy available to County and shall not constitute a waiver of any such other remedies. Failure of the County to exercise any remedy, including breach of contract remedies, shall not preclude the County from exercising such remedies in similar circumstances in the future.

00700-90 LAND AND RIGHTS-OF-WAY

The owner will provide, as indicated in the Contract Documents and prior to Notice to Proceed, the lands upon which the work is to be done, right-of-way for access thereto, and such other lands which are designated for the use of the Contractor. The Contractor shall confine the Contractor's work and all associated activities to the easements and other areas designated for the Contractor's use. The Contractor shall comply with any limits on construction methods and practices which may be required by easement agreements. If, due to some unforeseen reason, the necessary easements are not obtained, the Contractor shall receive an equitable extension of contract time dependent upon the effect on the critical path of the project schedule or the County may terminate the Contract for its convenience.

00700-91 COORDINATION WITH STATE DEPARTMENT OF TRANSPORTATION

No clearing or grading shall be completed by Contractor within the State Department of Transportation (DOT) area under construction. The Contractor must coordinate his construction scheduling with DOT.

If the Contractor begins work before DOT's completion date, he must obtain the approval of DOT before starting work in the area. The state DOT has the right to stop the Contractor's work the DOT area.

The Contractor shall receive no additional compensation or damages resulting from delay or work stoppage from DOT actions or scheduling.

Contractor shall obtain DOT drawings of the DOT, project area for verification of road geometry, storm drains, etc. from Georgia Department of Transportation or Fulton County. The Contractor is responsible for obtaining any pertinent DOT revisions.

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EXHIBIT A
FINAL AFFIDAVIT

TO FULTON COUNTY, GEORGIA

I, _____, hereby certify that all suppliers of materials, equipment and service, subcontractors, mechanic, and laborers employed by _____ or any of his subcontractors in connection with the design and/or construction of _____ at Fulton County have been paid and satisfied in full as of _____, 200____, and that there are no outstanding obligations or claims of any kind for the payment of which Fulton County on the above-named project might be liable, or subject to, in any lawful proceeding at law or in equity.

Signature

Title

Personally appeared before me this _____ day of _____, 20____. _____, who under Oath deposes and says that he is _____ of the firm of _____, that he has read the above statement and that to the best of his knowledge and belief same is an exact true statement.

Notary Public

My Commission expires

END OF SECTION

SECTION 8
SPECIAL CONDITIONS

STATEMENT OF BIDDER'S QUALIFICATIONS AND SAFETY RECORD FORM

STATEMENT OF BIDDER'S QUALIFICATIONS

This Statement of Bidder's Qualifications is to accompany bids submitted for the following project:

#16ITB091416K-JD Chattahoochee III Pump Station Modifications

1. NAME OF BIDDER: _____

2. BUSINESS ADDRESS: _____

3. TELEPHONE NUMBER: _____

4. OFFICIAL REPRESENTATIVE AND TITLE: _____

5. Using the form provided at the end of this Section, list previously completed projects which are similar in scope and complexity to this project which were completed or assigned to your firm or joint venture, including: Name of project, location of project, owner's name, address and phone number, description of work performed, initial contract amount, final contract amount, start date, scheduled completion date and actual completion date. (If a joint venture, list separately for each joint venture partner.) Limit to 5.

Contractors must have successfully completed at least two contracts involving construction or modification of water or wastewater pumping stations which included reinforced concrete, erection of structural steel, piping, installation of mechanical equipment, electrical and instrumentation systems with a capacity of not less than 2 MGD and a construction value of not less than \$500,000.

6. Provide the following information for the organization proposed for this project:

- a. Organizational chart.
- b. Indicate the participation by the various members in the organization, as shown on the organizational chart, in the management and in the division of work (If a joint venture, indicate percent of man hours and percent of project cost to be performed by each joint venture member).

7. Using the form provided at the end of this Section, provide information for the Project Manager and the Project Superintendent.

- a. Project Manager must have been project manager for duration of project and successfully completed at least two contracts involving

construction or modifications of water or wastewater pumping stations which included reinforced concrete, erection of structural steel, piping, installation of mechanical equipment, electrical and instrumentation systems with a capacity of not less than 2 MGD and a construction value of not less than \$500,000.

- b. Project Superintendent must have successfully completed at least two contracts involving construction or modifications of water or wastewater pumping stations which included reinforced concrete, erection of structural steel, piping, installation of mechanical equipment, electrical and instrumentation systems with a capacity of not less than 2 MGD and a construction value of not less than \$500,000.

8. The Contractor must have an established Safety Program. Complete the attached form entitled "CONTRACTOR SAFETY RECORD FORM".

9. The Contractor's Workman's Compensation Ratings (EMR-Experience Modification Rate)

Year	Experience Modification Rate (EMR)
Average:	

10. The Contractor's OSHA Incidence Rates. Note: the Industry Standard for Construction, published by the U.S. Department of Labor (2012) for Heavy and Civil Engineering Construction, all industries, list the Recordable Incidence Rate of 3.2 and the Days Away from Work Incidence Rate of 1.7, per OSHA definition and calculation, as the industry averages.

Year	Total Recordable Incidents	Total Hours Worked	OSHA Incidence Rate*
Average			

Year	Total Days Away from Work Incidents	Total Hours Worked	OSHA Incidence Rate*
Average			

* Use your OSHA Form No. 200 and the formula:

$$(\text{Total Incidents} \times 200,000 \text{ hours}) \div (\text{Number of hours worked}) = \text{Incidence Rate}$$

11. If there have been any fatalities during the last five (5) years on any projects performed by the Contractor or on any work performed under the direct supervision of a proposed Project Manager and the Contractor or proposed Project Manager was cited by OSHA for "Willful", in performing the work in which the fatality occurred, the Contractor may be disqualified based on the County's review. The Contractor may also be disqualified in the event that a Recordable Incident occurred due to the same condition that existed when a previous fatality occurred and resulted in an OSHA citation for failure to implement a corrective action plan.

- a. Fatalities during the last five years where Contractor was cited by OSHA for "Willful" Violation _____
- b. Fatalities during the last five years where the proposed Project Manager was cited by OSHA for "Willful" Violation. _____

12. If there have been any incidents during the last five (5) years on any wastewater or water pumping or treatment facility projects performed by the Contractor or on any work performed under the direct supervision of a proposed Project Manager that resulted in the wastewater or water treatment facility failing to meet NPDES Discharge Permit requirements or wastewater spills due to the actions of the Contractor or Project Manager or failure of the Contractor or Project Manager to perform work on schedule; the Contractor may be disqualified based on the County's review.

- a. NPDES Discharge Permit violations or wastewater spills during the last 5 years related to facility projects performed by the Contractor: _____
- b. NPDES Discharge Permit violations or wastewater spills during the last 5 years related to work under the direct supervision of the proposed Project Manager: _____

The previous statements and attachments are true, correct, and complete to the best of my knowledge.

Date: _____

Firm Name: _____

By: _____

Title: _____

Sworn to and subscribed before me

this ____ day of _____, 2016

Notary Public

CONTRACTOR SAFETY RECORD FORM

A. General Information

Name of Firm:	
Business Address:	
Telephone:	Fax:
Prepared by/Title:	Date prepared:

II. Experience Modification Rates

List your firm's Workers Compensation Experience Modification Rates (EMR) for the last three years.

Year	Experience Modification Rate (EMR)

III. OSHA Incidence Rates

A. List your firm's Occupational Safety Health Administration (OSHA) incidence rates for the last three years.

Year	Total Recordable Incidents	Total Hours Worked	OSHA Incidence Rate*

* Use your OSHA Form No. 200 and the formula:

(Total Incidents x 200,000 hours) ÷ (Number of hours worked) = Incidence Rate

B. Provide your incidence rates over the last three years for the following categories:

Category	Incidence Rate by Year*		
	Year _____	Year _____	Year _____
Fatalities			
Injuries and Illnesses with Lost Work Days			
Injuries and Illnesses with Restricted Work Days			

* Use your OSHA Form No. 200 and the formula:

(Total Incidents x 200,000 hours) ÷ (Number of hours worked) = Incidence Rate

C. Does your firm have any upheld OSHA citations in the past five years?

Yes No (If yes, attach explanation)

IV. Safety Program Information

A. Do you have a written safety program?

Yes No (If yes, attach outline)

B. Which of the following does your safety program contain:

1. Does your company require health and safety training of its subcontractors?

Yes No

2. Is documentation of health and safety training required?

Yes No

3. Do you have a Hazard Communication Program (29 CFR 1910.1200, CCR Title 8 Section 5194)?

Yes No

4. Do you have a Confined Space Entry and Rescue Program (29 CFR 1910.146, CCR Title 8 Section 5156-5159)?

Yes No (If yes, attach explanation)

5. Do you have a "Hot Work" permit program (29 CFR 1910.146, CCR Title 8 5156-5159)?

Yes No (If yes, attach explanation)

IV. Safety Program Information (cont'd)

B. Which of the following does your safety program contain (cont'd):

6. Do you have a "Lock-Out/Tag-Out" program (29 CFR 1910.417)?

Yes No (If yes, attach explanation)

C. Do you have an Equipment Maintenance Program for the following:

1. Miscellaneous construction tools and equipment? Yes No

2. Ladders? Yes No

3. Scaffolds? Yes No

4. Heavy Equipment? Yes No

5. Vehicles? Yes No

D. Do you have a new employee safety orientation program?

Yes No

1. If yes, does it include instruction in the following:

- (a) Company Safety Policy Yes No
- (b) Company Safety Rules Yes No
- (c) Safety Meeting Attendance Yes No
- (d) Company Safety Record Yes No
- (e) Hazard Recognition Yes No
- (f) Hazard Reporting Yes No
- (g) Injury Reporting Yes No
- (h) Non-Injury Accident Reporting Yes No
- (i) Personal Protective Equipment Yes No
- (j) Respiratory Protection Yes No
- (k) Fire Protection Yes No
- (l) Housekeeping Yes No
- (m) Toxic Substance Yes No
- (n) Electrical Safety Yes No
- (o) Fall Protection Yes No
- (p) First-Aid/CPR Yes No
- (q) Driving Safety Yes No
- (r) Hearing Conservation Yes No

- (s) Lock-Out/Tag-Out Yes No
- (t) Bloodborne Pathogens Yes No
- (u) Asbestos Yes No
- (v) Confined Spaces Yes No
- (w) Hazard Communication Yes No

IV. Safety Program Information (cont'd)

E. Do you conduct safety meetings for your employees? Yes No

1. If yes, how often:

Daily Weekly Bi-weekly Monthly As Needed

F. Do you conduct health and safety audits of work in progress?

Yes No

1. If yes, who conducts the audits?

2. How often are the audits conducted?

G. Do you notify all employees of accidents and precautions related to accidents and near misses?

Yes No

1. If yes, how is this notification accomplished?

(a) Safety meetings Yes No

(b) Post notification in office Yes No

(c) Post notification at the site where the incident occurred Yes No

(d) Other _____

H. Is safety a criteria in evaluating the performance of:

1. Employees Yes No

2. Supervisors Yes No

3. Management Yes No

I. Does your firm hold "tailgate" safety meetings? Yes No

1. If yes, how often:

Daily Weekly Bi-weekly Monthly As Needed

J. Does your company have a drug and alcohol testing policy?

Yes No

K. *Does your company require that subcontractors participate in a drug surveillance/testing program?*

Yes No

L. *Does your company have a method of disseminating safety information?*

Yes No

STATEMENT OF BIDDER'S QUALIFICATIONS
COMPANY PROJECT EXPERIENCE

(Complete Form Only For Projects That Meet Minimum Criteria)

Project Name	
Project Location	
Contractor's Project Manager	
Contractor's Project Superintendent	
Owners Representative & Phone Number	
Design Engineer Representative Name & Phone Number	
Treatment Facility Capacity (MGD)	
Initial Contract Amount	\$
Final Contract Amount	\$
Project Duration	Date Started: Date Completed: Time Extensions:
Was Project Completed on Time?	
List Any NPDES Permit Violations or wastewater spills Due to Contractors Failure to Complete Project on Schedule or Due to Contractor's Failure to Properly Coordinate its Work.	
Description of Major Project Components:	

STATEMENT OF BIDDER'S QUALIFICATIONS
PROJECT MANAGER'S EXPERIENCE

(Complete Form Only For Projects That Meet Minimum Criteria)

Project Name	
Project Location	
Contractor's Project Manager	
Owners Representative & Phone Number	
Design Engineer Representative Name & Phone Number	
Treatment Facility Capacity (MGD)	
Initial Contract Amount	\$
Final Contract Amount	\$
Project Duration	Date Started: Date Completed: Time Extensions:
Was Project Completed on Time?	
List Any NPDES Permit Violations or wastewater spills Due to Contractors Failure to Complete Project on Schedule or Due to Contractor's Failure to Properly Coordinate its Work.	
Description of Major Project Components:	

STATEMENT OF BIDDER'S QUALIFICATIONS
PROJECT SUPERINTENDENT'S EXPERIENCE

(Complete Form Only For Projects That Meet Minimum Criteria)

Project Name	
Project Location	
Contractor's Project Superintendent	
Owners Representative & Phone Number	
Design Engineer Representative Name & Phone Number	
Treatment Facility Capacity (MGD)	
Initial Contract Amount	\$
Final Contract Amount	\$
Project Duration	Date Started: Date Completed: Time Extensions:
Was Project Completed on Time?	
List Any NPDES Permit Violations or wastewater spills Due to Contractors Failure to Complete Project on Schedule or Due to Contractor's Failure to Properly Coordinate its Work.	
Description of Major Project Components:	

END OF SECTION



INVITATION TO BID #16ITB091416K-JD

CHATTACHOOCHEE III PUMP STATION UPGRADES

Volume II

FOR

DEPARTMENT OF PUBLIC WORKS

BID ISSUANCE DATE: September 26, 2016

BID DUE DATE AND TIME: Monday, November 7, 2016 at 11:00 A.M.

PRE-BID CONFERENCE DATE: October 13, 2016

PURCHASING CONTACT: Joyce Daniel, Assistant Purchasing Agent

E-MAIL: joyce.daniel@fultoncountyga.gov

**LOCATION: FULTON COUNTY DEPARTMENT OF PURCHASING
130 PEACHTREE STREET, S.W., SUITE 1168
ATLANTA, GA 30303**

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Non-Discrimination in Contracting and Procurement

Required Forms and EBO Plan:

- Exhibit A – Promise of Non-Discrimination
- Exhibit B – Employment Report
- Exhibit C – Schedule of Intended Subcontractor Utilization
- Exhibit D – Letter of Intent to Perform As a Subcontractor or Provide Materials or Services
- Exhibit E – Prime Contractor/Subcontractor Utilization Report
- Equal Business Opportunity Plan (EBO Plan)

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SCOPE OF WORK AND TECHNICAL SPECIFICATIONS

SECTION NO. 01010

SUMMARY OF WORK

PART 1 – GENERAL

1.01 PROJECT INFORMATION

- A. Project Identification: **Chattahoochee III Pump Station Upgrades.**
 - 1. Project Location: On States Bridge Road, north west of the intersection of States Bridge Road and Saint Georgen Common.
- B. Owner: Fulton County Department of Public Works, 141 Pryor Street, SW, Suite 6001, Atlanta, GA 30303

1.02 WORK COVERED BY CONTRACT DOCUMENTS

The Scope of Work of this contract includes the following major elements: To provide all labor, equipment, material and construction services for the replacement of three (3) existing vertical pumps (4MGD, 100HP each) and the addition of one (1) new pump; check valves and plug valves; replace Variable Frequency Drives (VFD); Install Programmable Logic Controls and Touch Screen Human Machine Interface Systems (HMI); construct new emergency by-pass pump connection; install new electrical upgrades; new odor control system, painting, landscaping, fence repair, wet well cleaning; by-pass pumping and other facility/site improvements as described in the drawings and specifications. The work described below shall include all work, labor, tools and materials required for the complete installation of:

- A. to install of four (4), 105 HP dry pit submersible pumps, motors and check valves. Valves are to be swing check valves and plug valves. Any by-pass pumping required to perform the work shall be the responsibility of the Contractor.
- B. to install of four (4) new Variable Frequency Drives, Programmable Logic Control systems, and Digital Human Machine Interface touch screens. The Contractor shall install a pressure transducer system as the primary and an Ultrasonic transducer system as the secondary system to monitor the wet well levels. Include all electrical and instrumentation upgrades required by the contract documents, manufacturer and local electrical codes and insure all components work in conjunction with each other. These systems shall be integrated with the monitoring system. The existing VFDs are to be removed, protected, and delivered to the Owner.
- C. to replace all discharge piping from the 24-inch flange at the wet well wall to the 30"x20" tee at the existing 30-inch header pipe.
- D. to install emergency bypass connection piping so the Owner will be able to bring in a mobile pump and completely bypass the station for repair or maintenance work in the future. This includes new bypass piping into each wet well.

- E. the installation and integration of a new odor control system and ductwork.
- F. to install handrails (and safety-net) on all access hatches inside and outside the pump station. Repair and relocate damaged handrail at the pump station.
- G. to install new lights inside and outside the pump station, and within the wet well and intake channels.
- H. install new electromagnetic flow meter and valves inside underground vaults on force main.
- I. to pressure wash the exterior and interior of the building. Repaint all interior and exterior walls, doors, floors, windows, etc. Only surfaces which are already painted are to be painted. Refer to Section 09900 for coating systems. Match existing colors.
- J. to relocate the controls for the dry well sump pumps upstairs into the electrical room.
- K. to drain and clean the existing wet well of any grease, dirt and debris before installing the new pumps. Any bypass pumping required shall be the responsibility of the Contractor.
- L. Replace the gates inside the wet well and influent channels.
- M. to coordinate installation, testing and training of equipment with the Manufacturer and Owner. The Contractor, Manufacturer and Owner shall be present during performance testing and all parties shall sign off that the equipment is installed and operating as intended and per Manufacturer's recommendation. Each pump shall run for one week without any issue to ensure no problems before disconnecting the second pump.
- N. to install new fiberglass stairwell enclosures and door and all appurtenances and new wiring.
- O. to complete the following site work improvements:
 - i. Remove the existing dumpster pad and drain, and raise grades to provide positive drainage away from the pump station.
 - ii. Remove and replace existing storm lines.
 - iii. Construct a new 2-foot maximum height cast-in-place retaining wall along the edge of the existing driveway.
 - iv. Relocate the existing metal stairs on the southwest corner of the intake channel to the southeast corner to allow for construction of the new odor control system slab.
 - v. Mill and repave the existing driveway from State Bridge Road to the pump station once the grading changes are complete at the loading dock.

- vi. Construct 15' wide grasscrete pavers for access to the new by-pass connections and meter and valve vaults (to be bid as an alternate item).
 - vii. Installation and maintenance of the erosion and sediment control and all associated requirements with those jurisdictions have authority.
-
- P. Installation of any electrical, instrumentation, controls, wiring, piping, valves, gates, supports, etc. which may not necessarily be listed here but are necessary to complete the work;
 - Q. Procure Permits and approvals as necessary and obtain rights-of-way and easements if necessary for Contractor's use;
 - R. Dispose of construction debris, trash, and waste in a legal manner as required;
 - S. All associated work which are not specifically mentioned in the contract documents but are required to complete the project;
 - T. All work is to be completed without undue delay, and in a workmanlike manner.

1.03 ACCESS TO SITE

- A. General: Contractor shall have limited use of Project site for construction operations as indicated on Drawings by the Contract limits and as indicated by requirements of this Section.
- B. Use of Site: Limit use of Project site to work in areas indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.
 - 1. Limits: Confine construction operations to areas of work shown in Plans.
 - 2. **The existing pump station must remain in operation during construction. The contractor shall be responsible for insuring the pump station remains in operation. The Contractor shall be responsible for any by-pass pumping required to keep the pump station in operation.**
 - 3. **WORKING HOURS: 7:30am to 7:30pm** Monday thru Friday, and **8:00am to 5:00pm** on Saturdays.
 - 4. Cutting, capping, and reconnecting utility systems outside limits of construction shall be performed by Contractor, unless otherwise noted.
 - 5. Conform to all laws, ordinances, permits and regulations affecting the Work on site.
 - 6. Owner Occupancy: Allow for Owner occupancy of Project site.
 - 7. Driveways, Walkways and Entrances: Keep driveways and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.
 - a. Schedule deliveries to minimize use of driveways and entrances by construction operations.
 - b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

8. Do not unreasonably encumber site with equipment, materials, or vehicles.
 9. Return all improvements on or about site and adjacent property which are not shown to be altered, removed or otherwise changed, to conditions which existed previous to starting performance under the Contract.
 10. Parking for construction personnel including the use of Owner's parking lot(s) shall be reviewed with Owner before construction start.
- C. Condition of Existing Building: Maintain portions of existing building affected by construction operations in a weather tight condition throughout construction period. Repair damage caused by construction operations.
1. Limit use and operation within existing facilities to areas indicated for construction work and as required to perform Work. Other areas within facility shall not be disturbed or disrupted.
 2. Perform Work so as not to interfere or inconvenience staff and Owner's operation.
 3. Maintain and keep clear all required fire exit ways throughout facility within and in vicinity of construction areas. Coordinate alternate temporary egress routes with Owner and local fire authority.
 4. Do not load structure with weights that will endanger structure.
 5. Audio devices and radios are prohibited; except that two-way radios and their use within occupied facilities shall be limited so not to disrupt occupants.
 6. T-shirts or other clothing with derogatory depictions, language, and/or slogans regarding alcohol, drugs, race or sexual in nature, shall not be worn on premises.
 7. Derogatory language regarding race, sexual or religious in nature, shall not be used on premises.
 8. Coordinate construction operations to assure that operations are carried out with consideration given to conservation of energy, water, and materials.
 9. Make every effort to keep noise to a minimum in construction operation. Jackhammers shall not be permitted for use within the existing building without the Owner's consent.
 10. Smoking shall not be allowed within 25 feet of any part of the pump station structure or within the pump station itself.
- 1.04 COORDINATION WITH OPERATIONS STAFF AND CONTRACTOR
- A. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's day-to-day operations. Maintain existing exits unless otherwise indicated.
1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and approval of authorities having jurisdiction.
 2. Notify Owner not less than 48 hours in advance of activities that will affect Owner's operations.

3. Contractor and his forces shall exercise special care during all aspects of construction activity including material deliveries, hoisting and installation activities.
4. Control of traffic, dust, dirt, and construction related noise shall be maintained at all times.
5. Schedule work at such time and in such a manner so as to minimize interference and inconvenience to staff and Owner's operations.
6. Each Contractor must obtain authorization of General Contractor as approved by Owner, before starting any work within an existing area of building.
7. Area immediately surrounding all areas of Work shall be protected from danger of materials being dropped or dislodged.
8. Work shall be performed in a manner that will not impose avoidable hardship, danger, or inconvenience to staff.

1.05 WORK RESTRICTIONS

- A. Work Restrictions, General: Comply with restrictions on construction operations.
 1. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.
- B. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after providing temporary utility services according to requirements indicated:
 1. Notify Engineer and Owner not less than two days in advance of proposed utility interruptions.
 2. Obtain Owner's written permission before proceeding with utility interruptions.
- C. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to Owner occupancy with Owner.
 1. Notify Engineer and Owner not less than two days in advance of proposed disruptive operations.
 2. Obtain Owner's written permission before proceeding with disruptive operations.
- D. Employee Identification: Provide identification tags and Federal I-9 forms for Contractor personnel working on Project site.
- E. Employee Screening: Comply with Owner's requirements for drug and background screening of Contractor personnel working on Project site.
 1. Maintain list of approved screened personnel with Owner's representative.
 2. Provide onsite copies of Employee's I-9 Forms for periodical inspections. All employees shall be legal to work in the United States and have valid I-9 forms. The Contractor shall Provide e-verify certification upon request.

1.06 APPLICABLE CODES

All references to codes, specifications, and standards referred to in the Specification Sections and on the Drawings shall mean, and are intended to be, the latest edition, amendment, and/or revision of such reference standard in effect as of the date of these Contract Documents.

1.07 ABBREVIATIONS & SYMBOLS

A. Reference to technical society, institution, association, or governmental authority is made in the Specifications in accordance with the following abbreviations:

AA	Aluminum Association
AAMA	Architectural Aluminum Manufacturers Association
AASHTO	American Association of State Highway & Transportation Officials
ABMA	American Boiler Manufacturers Association
ACI	American Concrete Institute
ACRI	Air Conditioning and Refrigeration Institute
ADC	Air Diffusion Council
AFI	Air Filter Institute
AGA	American Gas Association
AGCA	Associated General Contractors of America, Inc.
AGMA	American Gear Manufacturers Association
AIA	American Institute of Architects
AIA	American Insurance Association
AIMA	Acoustical and Insulating Materials Association
AISI	American Institute of Steel Construction
AITC	American Institute of Timber Construction
ALS	American Lumber Standards
AMCA	Air Moving and Conditioning Association
ANSI	American National Standards Institute, Inc.
APA	American Plywood Association
ARI	Air Conditioning and Refrigeration Institute
ASAHC	American Society of Architectural Hardware Consultants
ASCE	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society of Testing Materials
AWI	Architectural Woodwork Institute
AWPA	American Wood Preservers Association
AWPI	American Wood Preservers Institute
AWS	American Welding Society
AWWA	American Waterworks Association
BHMA	Builders Hardware Manufacturers Association
BIA	Brick Institute of America
BRI	Building Research Institute

CABRA	Copper and Brass Research Association
CAGI	Compressed Air and Gas Institute
CE	Corps of Engineers (Army)
CRSI	Concrete Reinforcing Steel Institute
CS	U.S. Commercial Standard
CSI	Construction Specifications Institute
ETL	Electrical Testing Laboratories
FGMA	Flat Glass Marketing Association
FIA	Factory Insurance Association
FM	Factory Mutual Engineering Division Association of Factory Mutual Fire Insurance Companies
FPL	Forest Products Laboratories
FS	Federal Specifications
FSIWA	Federation of Sewage and Industrial Waste Association
HPMA	Hardwood Plywood Manufacturers Association
IEEE	Institute of Electrical and Electronics Engineering
IES	Illuminating Engineering Society
IPCEA	Insulated Power Cable Engineers Association
JAN	Joint Army-Navy Specifications
MAC	Masonry Advisory Council
MLMA	Metal Lath Manufacturers Association
MS	Military Specifications
MSS	Manufacturers Standardization Society of the Valves and Fittings Industries
MSTD	Military Standard
NAAMM	National Association of Architectural Metal Manufacturers
NAFM	National Association of Fan Manufacturers
NAPM	National Association of Plastic Manufacturers
NBHA	National Builders Hardware Association
NBS	National Bureau of Standards
NCMA	National Concrete Masonry Association
NEC	National Electric Code (NFPA Pamphlet No. 70)
NELMA	Northeastern Lumber Manufacturers Association, Inc.
NEMA	National Electric Manufacturers Association
NEMI	National Elevator Manufacturing Industry, Inc.
NFC	National Fire Code
NFPA	National Fire Protection Association
NHLA	National Hardwood Lumber Association
NHPMA	National Hardwood and Pine Manufacturers Association
NPA	National Particle board Association
NPCA	National Paint and Coatings Association
NRMCA	National Ready Mixed Concrete Association
NSF	National Sanitation Foundation
OSHA	Occupational Safety and Health Administration
PCA	Portland Cement Association
PCI	Prestressed Concrete Institute
PS	Product Standard, U.S. Department of Commerce
SDI	Steel Deck Institute

SDI	Steel Door Institute
SJI	Steel Joint Institute
SMACNA	Sheet Metal and Air Conditioning Contractors National Association
SMFMA	Sprayed Mineral Fiber Manufacturers Association, Inc.
SPIB	Southern Pine Inspection Bureau
SPR	Simplified Practice Recommendations, U.S. Department of Commerce
SSPC	Steel Structures Painting Council
SWFPA	Structural Wood Fiber Products Association
TEMA	Tubular Exchange Manufacturing Association
TIMA	Thermal Insulation Manufacturers Association
TPI	Truss Plate Institute
UL	Underwriter's Laboratories, Inc.
UPC	Uniform Plumbing Code
USCGS	U.S. Coast and Geodetic Survey
WCLIB	West Coast Lumber Inspection Bureau
WRI	Wire Reinforcement Institute
WWPA	Western Wood Products Association

PART 2 - PRODUCTS

(Not Used)

PART 3 - EXECUTION

3.01 PROTECTION

- A. Make such explorations and probes as are necessary to ascertain any required protective measures before proceeding with demolition and removal. Give particular attention to shoring and bracing requirements so as to prevent any damage to existing construction.
- B. Provide, erect, and maintain barriers, warning signs, and other items as required for proper protection of the workmen engaged in demolition operations, occupants of the building and the general public.
- C. Provide and maintain temporary protection of the existing structure designated to remain where demolition, removal, and new work are being done, connections made, materials handled, or equipment moved.
- D. Take necessary precautions to prevent dust and dirt from rising by wetting demolished masonry, concrete, plaster, and similar debris.
- E. Provide adequate fire protection in accordance with local Fire Department requirements and OSHA and other safety requirements.

- F. Do not close or obstruct walkways, passageways, or stairways. Do not store or place materials in passageways, stairs, or other means of egress. Conduct operations with minimum traffic interference.
- G. Be responsible for any damage to the existing structure or contents by reason of the insufficiency of protection provided.

3.02 WORKMANSHIP

- A. Cut, remove, alter, temporarily remove and replace, or relocate existing work as required for performance of the work. Perform such work required with due care, including shoring and bracing.
- B. Coordinate patching involving the various trades whether or not specifically mentioned in the respective Specification sections.
- C. Restore finish work of floors, walls, and ceilings remaining in place but damaged or defaced because of demolition or alteration work to condition equal that which existed at beginning of work under this Contract.
- D. Where alteration or removals expose damaged or unfinished surfaces or materials, refinish such surfaces or materials, or remove them and provide new or salvaged materials to make continuous surface uniform.
- E. Perform new work and restore and refinish existing work in conformance with applicable requirements of the Specifications, except as follows:
 - 1. Materials for use in repair of existing surfaces, but not otherwise specified, shall conform to the highest standards of the trade involved, and be in accordance with approved industry standards, and shall be as required to match existing surfaces.
 - 2. Workmanship for repair of existing materials shall, unless otherwise specified, be equal to similar workmanship existing in or adjacent to the space where the work is being done.
 - 3. Reinstallation of salvaged items where no similar items exist shall be done in accordance with the highest standards of the trade involved in accordance with approved Shop Drawings.
- F. Materials or items demolished shall become the property of the Contractor and shall be removed from the Owner's property.
- G. In general, demolish masonry in small sections. Where necessary to prevent collapse of any construction, install temporary shores, struts, or bracing.
- H. Cut out embedded anchorage and attachment items as required to properly provide for patching and repair of the respective finishes.
- I. Where utilities are removed, or abandoned, cap, valve, plug, or by-pass to make complete and working installation.

- J. Properly close and patch holes and openings in existing floor, walls and ceiling surfaces resulting from alteration work.
- K. Upon completion of contract, deliver work complete and undamaged. Damage that may be caused by Contractor or Contractor's workmen to existing structures, grounds, and utilities shall be repaired by Contractor and left in as good condition as existed prior to damaging.
- L. Finish new and adjacent existing surfaces as specified for new work. Clean existing surfaces of dirt, grease and loose paint before refinishing.

3.03 CLEANING UP

Remove debris as the work progresses. Maintain the premises in a neat and clean condition. Any trash which may cause an odor, attract rodents, or otherwise be a nuisance shall be removed from site daily.

END OF SECTION

SECTION NO. 01015

CONTROL OF WORK

PART 1- GENERAL

1.01 MANPOWER

The Contractor shall furnish manpower and equipment which will be efficient, appropriate and large enough to secure a satisfactory quality of work and a rate of progress which will insure the completion of the work within the time stipulated. If at any time the progress of work appears to the Owner to be inefficient, inappropriate, or insufficient for securing the quality of work required or for producing the rate of progress aforesaid, he may order the Contractor to submit a corrective action plan. Failure of the Owner to give such order shall in no way relieve the Contractor of his obligations to secure the quality of the work and rate of progress required.

1.02 PRIVATE LAND

The Contractor shall not enter or occupy private land outside of easements, except by permission of the Owner.

1.03 PIPE LOCATIONS

Pipelines shall be located as indicated on the Drawings, but the Owner reserves the right to make such modifications in locations as may be found desirable to avoid interference with existing structures or for other reasons. Where fittings are noted on the Drawings, such notation is for the Contractor's convenience and does not relieve him from laying and jointing different or additional items where required.

1.04 OPEN EXCAVATIONS

- A. All open excavations shall be adequately safeguarded by providing temporary barricades, caution signs, lights and other means to prevent accidents to persons, and damage to property. The Contractor shall, at his own expense, provide suitable and safe bridges and other crossings for accommodating travel by Owner's personnel, pedestrians and workmen. Bridges provided for access to private property during construction shall be removed when no longer required. The length of open trench will be controlled by the particular surrounding conditions, but shall always be confined to limits which minimize interference with plant operating personnel and does not endanger existing facilities. If the excavation becomes a hazard, or if it excessively restricts traffic construction procedures such as limiting the length of open trench, prohibiting stacking excavated material in the street, and requiring that the trench shall not remain open overnight shall be engaged.
- B. The Contractor shall take precautions to prevent injury to the public due to open trenches. All trenches, excavated material, equipment, or other obstacles which could be dangerous to the public shall be well lit at night.

1.05 TEST PITS

Test pits for the purpose of locating underground pipeline or structures in advance of the construction shall be excavated and backfilled by the Contractor so as not to create a hazardous area. Test pits shall be backfilled immediately after their purpose has been satisfied and the surface restored and maintained in a manner satisfactory to the Owner.

1.06 CARE AND PROTECTION OF PROPERTY

- A. The Contractor shall be responsible for the preservation of all public and private property, and shall use every precaution necessary to prevent damage thereto. If any direct or indirect damage is done to public or private property by or on account of any act, omission, neglect, misconduct in the execution of the work on the part of the Contractor, such property shall be restored by the Contractor, at his expense, to a condition similar or equal to that existing before the damage was done.
- B. Within the limits of this work all fences, walks, bushes, trees, shrubbery, and other physical features shall be protected and restored in a thoroughly workmanlike manner. Fences and other features removed by the Contractor shall be replaced in the original location as soon as conditions permit. All grass areas beyond the limits of construction which have been damaged by the Contractor shall be regraded and seeded.
- C. The protection, removal, and replacement of existing physical features within the limits of work shall be a part of the work under the Contract, and all costs in connection therewith shall be included in the unit and/or lump sum prices established under the items in the Bid Form.

1.08 PROTECTION AND RELOCATION OF EXISTING STRUCTURES AND UTILITIES

- A. The Contractor shall assume full responsibility for the protection of all buildings, structures, and utilities, public or private, including poles, signs, services to buildings, utilities in the street, such as pipes, water pipes, hydrants, sewers, drains, and electric and telephone cables, whether or not they are shown on the Drawings. The Contractor shall carefully support and protect all such structures and utilities from injury of any kind. Any damage resulting from the Contractor's operations shall be repaired by him at his expense.
- B. Protection and temporary removal and replacement of existing utilities and structures as described in this Section shall be considered as extra work and all costs in connection therewith shall be as outlined in the General Conditions.
- C. If, in the opinion of the Owner, permanent relocation of a utility is required, he may direct the Contractor, in writing, to perform the work. Work so ordered will be paid for at the Contract unit prices, if applicable, or as extra work under the General Conditions. If relocation of a privately owned utility is required, the Owner will notify the Utility to perform the work as expeditiously as possible. The Contractor shall fully cooperate

with the Owner and Utility, and shall have no claim for delay due to such relocation. The Contractor shall notify public utility companies in writing at least 48 hours (excluding Saturdays, Sundays, and legal holidays) before excavating in any public way.

1.09 WATER FOR CONSTRUCTION PURPOSES

The express approval of the Owner shall be obtained before water is used. Hydrants shall only be operated under the supervision of the Owner.

1.10 MAINTENANCE OF FLOW

The Contractor shall at his own cost, provide for the flow of sewers, drains, and water courses interrupted during the progress of the work, and shall immediately cart away and remove all offensive matter. The entire procedure of maintaining existing flow shall be fully discussed with the Owner well in advance of the interruption of any flow.

1.11 COOPERATION WITHIN THIS CONTRACT

A. All firms or persons authorized to perform any work under this Contract shall cooperate with the General Contractor and his subcontractors or trades, and shall assist in incorporating the work of other trades where necessary or required.

B. Cutting and patching, drilling and fitting shall be carried out where required by the trade or subcontractor having jurisdiction, unless otherwise indicated herein or directed by the Owner.

1.12 CLEANUP

During the course of the work, the Contractor shall keep the site of his operations in as clean and neat a condition as is possible. He shall dispose of all residue resulting from the construction work and, at the conclusion of the work, he shall remove and haul away any surplus excavation, broken pavement, lumber, equipment, temporary structures, and any other refuse remaining from the construction operation, and shall leave the entire site of the work in a neat and orderly condition.

PART 2 - PRODUCTS

(Not Used)

PART 3 - EXECUTION

(Not Used)

END OF SECTION

SECTION NO. 01016

CONTROL OF MATERIALS

PART 1 - GENERAL

1.01 APPROVAL OF MATERIALS

A. Only new materials and equipment shall be incorporated in the work. All materials and equipment furnished by the Contractor shall be subject to the inspection and approval of the Owner. No material shall be delivered to the work without prior approval of the Owner.

B. As soon as possible after the Contract has been executed, the Contractor shall submit to the Engineer, data relating to materials and equipment he proposes to furnish for the work. Such data shall be in sufficient detail to enable the Owner to identify the particular project and to form an opinion as to its conformity to the Specifications.

C. Facilities and labor for handling and inspection of all materials and equipment shall be furnished by the Contractor. If the Owner required, either prior to beginning or during the progress of the work, the Contractor shall submit samples of materials for such special tests as may be necessary to demonstrate that they conform to the specifications. Such samples shall be furnished, stored, packed, and shipped as directed at the Contractor's expense. Except as otherwise noted, the Owner will make arrangements for and pay for the tests.

D. The Contractor shall submit data and samples sufficiently early to permit consideration and approval before materials are necessary for incorporation in the work. Any delay of approval resulting from the Contractor's failure to submit samples or data promptly shall not be used as a basis of a claim against the Owner.

E. The materials and equipment used on the work shall correspond to the approved samples or other data.

PART 2 - PRODUCTS

(Not Used)

PART 3 - EXECUTION

(Not Used)

END OF SECTION

SECTION NO. 01041

PROJECT COORDINATION

PART 1 – GENERAL

1.01 SCOPE

- A. Management of the Project shall be through the use of a logical method of construction planning, inspection, scheduling and cost value documentation.
- B. The work under this Section includes all surface and subsurface condition inspections and coordination by the Contractor necessary for the proper and complete performance of the Work.
- C. This Section applies to the work of every division and every section of these Specifications.

1.02 SITE CONDITIONS

- A. Inspection
 - 1. Prior to performing any work under a section, the Contractor shall carefully inspect the installed work of other trades and verify that all such work is complete to the point where the work under that section may properly commence.
 - 2. The Contractor shall verify that all materials, equipment and products to be installed under a section may be installed in strict accordance with the original design and pertinent reviewed shop drawings.
- B. Discrepancies
 - 1. In the event of discrepancy, immediately notify the Engineer.
 - 2. Do not proceed with construction in areas of discrepancy until all such discrepancies have been fully resolved.

1.03 EXISTING FACILITIES

- A. The Contractor shall coordinate the work with the Owner so that the construction will not restrain or hinder the operation of existing pump station
- B. After having coordinated the work with the Owner, the Contractor shall notify the Engineer of the time, time limits and methods of each connection or alteration and have the approval of the Engineer before any work is undertaken on the connections or alterations.

- C. Before any roadway or facilities are blocked off, the Owner's approval shall be obtained to coordinate operations for the pump station.

1.04 COORDINATION

- A. Carefully coordinate work with all other trades and subcontractors to insure proper and adequate interface of the work of other trades and subcontractors with the work of every section of these Specifications.
- B. The Contractor shall coordinate operations with all utility companies in or adjacent to the area of Contractor's work. The Contractor shall require said utilities to identify in the field their property and provide drawings as necessary to locate them.
- C. The Contractor shall so schedule the Contractor's Work that the Contractor does not interrupt the operation of any existing facility, including water mains and sewers. In the event certain tie-ins or other operations make it absolutely necessary to interrupt the operation of existing facilities, the Owner will be notified and such work will be done at a time and in a manner acceptable to the Owner/Engineer.

PART 2 - PRODUCTS

(Not Used)

PART 3 - EXECUTION

(Not Used)

END OF SECTION

SECTION NO. 01045

CUTTING AND PATCHING

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED

Contractor shall be responsible for all cutting, fitting, and patching, including excavation and backfill required to complete the work or to:

- A. Make several parts fit together properly.
- B. Uncover portions of the Work to provide for installation of ill-timed work.
- C. Remove and replace defective work.
- D. Remove and replace work not conforming to requirements of Contract Documents.
- E. Remove samples of installed work as specified for testing.
- F. Provide routine penetrations of non-structural surfaces for installation of piping.

1.02 RELATED WORK

- A. Division 1: General Requirements.
- B. Division 2: Sitework.

1.03 SUBMITTALS

- A. Submit a written request to the Owner well in advance of executing any cutting or alteration which affects:
 - 1. Work of the Owner or any separated contractor.
 - 2. Structural value or integrity of any element of the Project.
 - 3. Integrity or effectiveness of weather exposed or moisture resistant elements or systems.
 - 4. Efficiency, operational life, maintenance or safety of operational elements.
 - 5. Visual qualities of sight exposed elements.
- B. Requests shall include:
 - 1. Identification of the Project.
 - 2. Description of the affected work.
 - 3. The necessity for cutting, alteration or excavation.
 - 4. Effect on work of Owner or any separate contractor, or on structural or weatherproof integrity of Project.
 - 5. Description of proposed work:
 - a. Scope of cutting, patching, alteration, or excavation.

- b. Trades who will execute the work.
 - c. Products proposed to be used.
 - d. Extent of refinishing to be done.
6. Alternatives to cutting and patching.
 7. Cost proposal, when applicable.
 8. Written permission of any separate contractor whose work will be affected.
- C. Submit written notice to Engineer designating the date and the time the work will be uncovered.

PART 2 - PRODUCTS

2.01 MATERIALS

Comply with specifications and standards for each specific product involved.

PART 3 - EXECUTION

3.01 INSPECTION

- A. Inspect existing conditions of Project, including elements subject to damage or to movement during cutting and patching.
- B. After uncovering work, inspect conditions affecting installation of products, or performance of work.
- C. Report unsatisfactory or questionable conditions to Owner in writing. Do not proceed with work until Owner has approved further instructions.

3.02 PREPARATION

- A. Provide adequate temporary support as necessary to assure structural value or integrity of affected portion of work.
- B. Provide devices and methods to protect other portions of Project from damage.
- C. Provide protection from elements for that portion of the Project which may be exposed by cutting and patch work, and maintain excavations free from water.

3.03 PERFORMANCE

- A. Execute cutting and demolition by methods which will prevent damage to other work, and will provide proper surfaces to receive installation of repair.
- B. Execute excavating and backfilling by methods which will prevent settlement or damage to other work.

- C. Employ original installer or fabricator or perform cutting and patching for:
 - 1. Weather exposed or moisture resistant elements.
 - 2. Sight exposed finished surfaces.
- D. Execute fitting and adjustment of products to provide a finished installation to comply with specified products, functions, tolerances, and finishes.
- E. Restore work which has been cut or removed and install new products to provide completed work in accordance with the requirements of the Contract Documents.
- F. Fit work airtight to pipes, sleeves, ducts, conduits, and other penetrations through surfaces.
- G. Refinish entire surfaces as necessary to provide an even finish to match adjacent finishes:
 - 1. For continuous surfaces, refinish to nearest intersection.
 - 2. For an assembly, refinish entire unit.

END OF SECTION

SECTION NO. 01150

MEASUREMENT AND PAYMENTS

PART 1 - GENERAL

1.01 PAYMENTS

This Section identifies each Measurement for Payment outlined in the Proposal and describes the methods by which payments shall be based.

1.02 PAYMENT ITEMS

A. Lump Sum Bid Items:

1. THE MAJORITY OF THIS PROJECT SHALL BE BID AS A "LUMP SUM", unless specified as a separate bid item or as Owner Directed Allowance. Lump sum bid items shall include furnishing all labor, equipment, and materials necessary for construction of the work as described in the specifications and shown on the Drawings as indicated in the Bid Proposal. Alterations to the Construction Contract will be based on negotiated additions or deletions to the Base Contract, and the Bidder shall receive no additional compensation for times covered under this scope. The Contractor shall be paid for actual work performed.
2. The Contractor shall submit to Fulton County for approval a Schedule of Values and a Schedule of Work that breaks down itemized costs associated with the work. The Schedule of Values will be used for completed work verification and payment purposes on the monthly Payment Applications. The breakdown of the Schedule of Values and the Schedule of Work shall be to the complete satisfaction of the Owner.
3. The Owner shall withhold as retainage 10% of the Payments requested up to 50% of the project's completion, or as allowed by the General Conditions.
4. Owner reserves the right to reject the Contractor's measure of work-in-place which involves the use of established unit prices, and at Owner's expense to have the work measured by independent surveyor acceptable to the Owner and Contractor.
5. For work items included in the technical specifications and not listed herein, such work shall be considered part of or incidental to its related work and no additional payment will be allowed.
6. When actual field conditions differ from assumed design conditions and result in a reduction in materials, equipment, and appurtenances to be installed, a negative adjustment will be made to the Contract. If items are provided on the bid form these items will be used for adjustment.
7. The Contractor shall furnish all labor, materials, machinery, equipment,

tools, apparatus, services, and other necessary supplies to perform all work shown on the Drawings and/or described in the Specifications and Summary of Work at the price listed in the Bid Form. The Work shall be complete-in-place and ready for operation.

8. Any cost associated with initial testing and startup of new equipment shall be the responsibility of the Contractor.
9. The Contractor shall become familiar with the terms and conditions of the Bidding Documents and with local conditions affecting the performance and costs of the Work at the place where the Work is to be completed, and has fully inspected the site in all particulars informing himself fully regarding all conditions pertaining to the Work site.

1.03 OWNER ALLOWANCES

Owner directed allowances shall be pre-approved in writing by the assigned Fulton County Construction Manager. As many as 3 quotes may be requested by the County on any one of these items. Work performed under Owner directed allowances and not performed by the Prime Contractor or the Prime Contractor's immediate subcontractor can have a 10% markup for administrative costs when billed under this item. Any Work performed under and cost related to The Owner Allowances Section must be pre-approved in writing by the assigned Fulton County Construction Manager. No payment shall be made for work done without preauthorization and approval.

PART 2 - PRODUCTS

(Not Used)

PART 3 - EXECUTION

(Not Used)

END OF SECTION

SECTION NO. 01152

APPLICATIONS FOR PAYMENT

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED

Submit Application for Payment to Engineer in accordance with the schedule established by conditions of the Contract and Agreement between Owner and Contractor.

1.02 RELATED REQUIREMENTS

- A. Agreement between Owner and Contractor: Unit Prices.
- B. Conditions of the Contract: Progress Payments, Retainages and Final Payment.
- C. Section 01700: Contract Closeout.

1.03 FORMAT AND DATA REQUIRED

- A. Submit applications typed on, Application for Payment on a form which shall be pre-approved by the Owner and Engineer, with itemized data typed on 8-1/2" x 11" white paper continuation sheets.
- B. Provide itemized data on continuation sheet.
- C. The forms used shall be AIA G702, G703, as modified and approved by the County's Construction Manager.

1.04 PREPARATION OF APPLICATION FOR EACH PROGRESS PAYMENT

- A. Application Form:
 - 1. Fill in required information, including that for Change Orders executed prior to date of submittal of application.
 - 2. Fill in summary of dollar values to agree with respective totals indicated on continuation sheets.
 - 3. Execute certification with signature of a responsible officer of Contract firm.
- B. Continuation Sheets:
 - 1. Fill in a total itemized list of all scheduled component items of work with item number and scheduled dollar value.
 - 2. List each Change Order executed prior to date of submission at the end of the continuation sheets. List by Change Order Number and description as for an original component item of work.

1.05 SUBSTANTIATING DATA FOR PROGRESS PAYMENTS

- A. When the Owner or the Engineer requires substantiating data, Contractor shall submit suitable information with a cover letter identifying:
 - 1. Project.
 - 2. Application number and date.
 - 3. Detailed list enclosures.
 - 4. For stored products:

- a. Item number and identification as shown on application.
 - b. Description of specific material.
 - B. Submit one copy of data and cover letter for each copy of application.
-

1.06 PREPARATION OF APPLICATION FOR FINAL PAYMENT

- A. Fill in Application form as specified for progress payments.
- B. Use continuation sheets for presenting the final statement of accounting as specified in Section 01700 - Contract Closeout.

1.07 SUBMITTAL PROCEDURE

- A. Submit Applications for Payment to Engineer at the times stipulated in the Agreement.
- B. Number: Five (5) copies of each Application.
- C. When Engineer finds Application properly completed and correct, he will transmit certificate for payment to Owner with one (1) copy to the Contractor.

PART 2 - PRODUCTS

(Not Used)

PART 3 - EXECUTION

(Not Used)

END OF SECTION

SECTION NO. 01155

SCHEDULES, REPORTS, PAYMENTS

PART 1- GENERAL

- 1.01 RELATED DOCUMENTS
Drawings and general provisions of the Contract, including General Conditions and Supplementary Conditions and other Division 1 Specifications apply to work in this section.
- 1.02 COORDINATION
This section serves to coordinate both the procedural timing and the listing (name and sequencing) of reports/activities required by provisions of this section and other sections. to afford consistency and logical coordination between submitted reports or lists. Make appropriate distribution of each report and update report to entities involved in the work including principal subcontractors, suppliers or fabricators, designated Owner's Representative and others with a need-to-know schedule compliance requirements. In particular, provide close coordination of progress schedule, listing of subcontractors, schedule of submittals, progress reports, and payment requests.
- 1.03 PROGRESS SCHEDULE
See Section "CONSTRUCTION PROGRESS DOCUMENTATION"
- 1.04 SUBMITTAL SCHEDULE
- A. General: Immediately following development and acceptance of progress schedule, prepare a complete schedule of work-related establishment of submittals. Submit within 10 calendar days of date required for establishment of progress schedule. Correlate submittal schedule with listing of principal subcontractors, as required by General Conditions, and with the "listing of products" as specified in the contract documents.
 - B. Form: Prepare schedule in chronological sequence of "first submittals". Show category of submittal, name of subcontractor, generic description of work covered, related section numbers, activity or event number on progress schedule, schedule date for first submission, and blank columns for actual date of submittal, resubmittal, and final release or approved by Engineer.
- 1.05 UNIT PRICE SCHEDULE
- A. General: Refer to individual sections of specifications for units of work where the establishment of unit prices is required; methods of measurements and pricing are specified therein. Prepare a schedule of Contract established unit prices, within 15 days of date of commencement of work, and distribute to Owner, Engineering, and each entity involved in performance of work where establishment unit prices could possibly come into force and effect.

- B. Prepare a schedule of established unit prices using the "Unit Price Form" provided herein to show generic name, unit of measure, price per unit, related specification sections, subcontractor (if any) assigned to work so named.
- C. Owner reserves the right to reject Contractor's measure of work-in-place which involves use of established unit prices, and at Owner's expense to have work measured by independent surveyor acceptable to Contractor.

1.06 PAYMENT REQUESTS

- A. General: Except as otherwise indicated, sequence of progress payments to be regular, and each must be consistent with previous applications and payments. It is recognized that certain applications involve extra requirements, including initial application, application at time of substantial completion, and final payment application.
- B. Payment Application Time: The date for each progress payment is the 15th day of each month. The period indicated in the Owner-Contractor Agreement or, if none is indicated therein, it is 15 days prior to the date for each progress payment, and starting day following the end of the preceding period.
- C. Payment Application Forms: Payment Application Forms shall be pre-approved by the Owner and Engineer. An Example of such an approved form is AIA Document G702 and Continuation Sheets.
- D. Application Preparation: Except as otherwise indicated, complete every entry provided for on the form, including notarization and execution by authorized persons. Incomplete applications will be returned by Engineering without action. Entries must match current data of both progress schedule and reports. Listing must include amounts of change orders issued prior to last day of the period of construction covered by application.
- E. Initial Payment Application: The principal administrative actions and submittals which must precede or coincide with the submittal of first payment application, can be summarized as follows, but not necessarily by way of limitation:

Listing of subcontractors and principal suppliers and fabricators.

Progress schedule (preliminary if not final)

Schedule of principal products

Schedule of submittal (preliminary if not final)

Listing of Contractor's staff assignments and principal consultants

Initial progress report, including report of pre-construction meeting

- 1.07 Application of Time of Substantial Completion: Following issuance of Engineer's final certificate of substantial completion, and also in part as

applicable to prior certificates on portions of completed work as designated, a special payment application may be prepared and submitted by Contractor.

PART 2 - PRODUCTS

(Not Used)

PART 3 - EXECUTION

(Not Used)

END OF SECTION

SECTION NO. 01556

CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

A. RELATED DOCUMENTS

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

B. SUMMARY

This Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:

1. Preliminary Construction Schedule.
2. Contractor's Construction Schedule.
3. Submittals Schedule.
4. Daily construction reports.
5. Material location reports.
6. Field condition reports.
7. Special reports.

Related Sections include the following:

1. Division 01 Section "Measurement and Payment"
2. Division 01 Section " Schedules, Reports and Payments "
3. Division 01 Section "Submittal"
4. Division 01 Section " Project Document Tracking and Control System"

C. DEFINITIONS

Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.

1. Critical activities are activities on the critical path. They must start and finish on the planned early start and finish times.
2. Predecessor Activity: An activity that precedes another activity in the network.
3. Successor Activity: An activity that follows another activity in the network.

Cost Loading: The allocation of the Schedule of Values for the completion of an activity as scheduled. The sum of costs for all activities must equal the total Contract Sum, unless otherwise approved by the Owner.

CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Project.

Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.

Event: The starting or ending point of an activity.

Float: The measure of leeway in starting and completing an activity.

1. Float time is not for the exclusive use or benefit of either Owner or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.
2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.

Fragnet: A partial or fragmentary network that breaks down activities into smaller activities for greater detail.

Major Area: A story of construction, a separate building, or a similar significant construction element.

Milestone: A key or critical point in time for reference or measurement.

Network Diagram: A graphic diagram of a network schedule, showing activities and activity relationships.

Resource Loading: The allocation of manpower and equipment necessary for the completion of an activity as scheduled.

D. SUBMITTALS

Preliminary Construction Schedule: Submit two opaque copies.

Approval of cost-loaded preliminary construction schedule will not constitute approval of Schedule of Values for cost-loaded activities.

Contractor's Construction Schedule: Submit two opaque copies of initial schedule, large enough to show entire schedule for entire construction period.

CPM Reports: Concurrent with CPM schedule, submit three copies of each of the following computer-generated reports. Format for each activity in reports shall contain activity number, activity description, cost and resource loading, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float in calendar days.

1. **Activity Report:** List of all activities sorted by activity number and then early start date, or actual start date if known.
2. **Logic Report:** List of preceding and succeeding activities for all activities, sorted in ascending order by activity number and then early start date, or actual start date if known.

3. Total Float Report: List of all activities sorted in ascending order of total float.

Material Location Reports: Submit two copies at weekly intervals.

Special Reports: Submit two copies at time of unusual event.

E. COORDINATION

Coordinate preparation and processing of schedules and reports with performance of construction activities and with scheduling and reporting of separate contractors.

Coordinate Contractor's Construction Schedule with the Schedule of Values, list of subcontracts, Submittals Schedule, progress reports, payment requests, and other required schedules and reports.

1. Secure time commitments for performing critical elements of the Work from parties involved.
2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 - PRODUCTS

A. CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

Procedures: Comply with procedures contained in AGC's "Construction Planning & Scheduling."

Time Frame: Extend schedule from date established for the Notice to Proceed to date of Substantial Completion.

Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.

Activities: Treat each story or separate area as a separate numbered activity for each principal element of the Work. Comply with the following or as may be modified by the Construction Project Manager and Engineer:

- i. Activity Duration: Define activities so no activity is longer than 20 days, unless specifically allowed by Engineer.
- ii. Procurement Activities: Include procurement process activities for the following long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
- iii. Submittal Review Time: Include review and resubmittal times indicated in Division 01

Section "Submittals" in schedule. Coordinate submittal review times in Contractor's Construction Schedule with Submittals Schedule.

- iv. Startup and Testing Time: Include not less than three days for startup and testing.
- v. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Engineer's and Construction Manager's administrative procedures necessary for certification of Substantial Completion.

Constraints: Include constraints and work restrictions as applicable and or as indicated in the Contract Documents and as follows in schedule; show how the sequence of Work is affected.

1. Phasing: Arrange list of activities on schedule by phase.
2. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.
3. Owner-Furnished Products/Equipment: Include a separate activity for each product/equipment. Include delivery date indicated in Division 01 Section "Summary." Delivery dates indicated stipulate earliest possible delivery date.
4. Work Restrictions: Show the effect of the following items on the schedule:
 - Coordination with existing construction.
 - Limitations of continued occupancies.
 - Uninterruptible services.
 - Partial occupancy before Substantial Completion.
 - Use of premises restrictions.
 - Provisions for future construction.
 - Seasonal variations.
 - Environmental control.
5. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:
 - Subcontract awards.
 - Submittals.
 - Purchases.
 - Mockups.
 - Fabrication.
 - Sample testing.
 - Deliveries.
 - Installation.
 - Tests and inspections.
 - Adjusting.
 - Curing.
 - Training and demonstration.
 - Startup and placement into final use and operation.
6. Area Separations: Identify each major area of construction for each major portion of the Work. Indicate where each construction activity

within a major area must be sequenced or integrated with other construction activities to provide for the following:

- Structural completion.
- Permanent space enclosure.
- Completion of mechanical installation.
- Completion of electrical installation.
- Substantial Completion.

Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and Final Completion.

Cost Correlation: At the head of schedule, provide a cost correlation line, indicating planned and actual costs. On the line, show dollar volume of the Work performed as of dates used for preparation of payment requests.

1. Refer to Division 01 Section "Payment Procedures" for cost reporting and payment procedures.
2. Contractor shall assign cost to construction activities on the CPM schedule. Costs shall not be assigned to submittal activities unless specified otherwise but may, with Engineer's approval, be assigned to fabrication and delivery activities. Costs shall be under required principal subcontracts for testing and commissioning activities, operation and maintenance manuals, punch list activities, Project Record Documents, and demonstration and training (if applicable), in the amount of 5 percent of the Contract Sum.
3. Each activity cost shall reflect an accurate value subject to approval by Engineer.
4. Total cost assigned to activities shall equal the total Contract Sum.

Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using fragments to demonstrate the effect of the proposed change on the overall project schedule.

Computer Software: Prepare schedules using a program that has been developed specifically to manage construction schedules. Refer to Project Document Tracking and Control System section.

B. PRELIMINARY CONSTRUCTION SCHEDULE

Bar-Chart Schedule: Submit preliminary horizontal bar-chart-type construction schedule within seven days of date established for the Notice to Proceed.

Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line. Outline significant construction activities for first 60 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.

C. CONTRACTOR'S CONSTRUCTION SCHEDULE (GANTT CHART)

Gantt-Chart Schedule: Submit a comprehensive, fully developed, horizontal Gantt-chart-type, Contractor's Construction Schedule within 30 days of date established for the Notice to Proceed. Base schedule on the Preliminary Construction Schedule and whatever updating and feedback was received since the start of Project.

Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line.

For construction activities that require 3 months or longer to complete, indicate an estimated completion percentage in 10 percent increments within time bar.

D. CONTRACTOR'S CONSTRUCTION SCHEDULE (CPM SCHEDULE)

General: Prepare network diagrams using AON (activity-on-node) format.

Preliminary Network Diagram: Submit diagram, if required, within 14 days of date established for the Notice to Proceed. Outline significant construction activities for the first 60 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.

CPM Schedule: Prepare Contractor's Construction Schedule using a computerized, cost-loaded, time-scaled CPM network analysis diagram for the Work.

1. Develop network diagram in sufficient time to submit CPM schedule so it can be accepted for use no later than 30 days after date established for the Notice to Proceed.

Failure to include any work item required for performance of this Contract shall not excuse Contractor from completing all work within applicable completion dates, regardless of Architect's approval of the schedule.

2. Conduct educational workshops to train and inform key Project personnel, including subcontractors' personnel, in proper methods of providing data and using CPM schedule information.
3. Establish procedures for monitoring and updating CPM schedule and for reporting progress. Coordinate procedures with progress meeting and payment request dates.
4. Use "one workday" as the unit of time. Include list of nonworking days and holidays incorporated into the schedule.

CPM Schedule Preparation: Prepare a list of all activities required to complete the Work. Using the preliminary network diagram, prepare a skeleton network to identify probable critical paths.

1. Activities: Indicate the estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Include estimated time frames for the following activities:
 - Preparation and processing of submittals.
 - Mobilization and demobilization.
 - Purchase of materials.
 - Delivery.
 - Fabrication.
 - Utility interruptions.
 - Installation.

Work by Owner that may affect or be affected by Contractor's activities.

Testing and commissioning.

2. Critical Path Activities: Identify critical path activities, including those for interim completion dates. Scheduled start and completion dates shall be consistent with Contract milestone dates.
3. Processing: Process data to produce output data on a computer-drawn, time-scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the CPM schedule within the limitations of the Contract Time.
4. Format: Mark the critical path. Locate the critical path near center of network; locate paths with most float near the edges.

Subnetworks on separate sheets are permissible for activities clearly off the critical path.

Initial Issue of Schedule: Prepare initial network diagram from a list of straight "early start-total float" sort. Identify critical activities. Prepare tabulated reports showing the following:

1. Contractor or subcontractor and the Work or activity.
2. Description of activity.
3. Principal events of activity.
4. Immediate preceding and succeeding activities.
5. Early and late start dates.
6. Early and late finish dates.
7. Activity duration in workdays.
8. Total float or slack time.
9. Average size of workforce.
10. Dollar value of activity (coordinated with the Schedule of Values).

Schedule Updating: Concurrent with making revisions to schedule, prepare tabulated reports showing the following:

1. Identification of activities that have changed.
2. Changes in early and late start dates.
3. Changes in early and late finish dates.
4. Changes in activity durations in workdays.
5. Changes in the critical path.
6. Changes in total float or slack time.
7. Changes in the Contract Time.

Value Summaries: Prepare two cumulative value lists, sorted by finish dates.

8. In first list, tabulate activity number, early finish date, dollar value, and cumulative dollar value.
9. In second list, tabulate activity number, late finish date, dollar value, and cumulative dollar value.
10. In subsequent issues of both lists, substitute actual finish dates for activities completed as of list date.
11. Prepare list for ease of comparison with payment requests; coordinate timing with progress meetings.

In both value summary lists, tabulate "actual percent complete" and "cumulative value completed" with total at bottom.

Submit value summary printouts one week before each regularly scheduled progress meeting.

E. REPORTS

Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:

1. List of subcontractors at Project site.
2. List of separate contractors at Project site.
3. Approximate count of personnel at Project site.
4. Equipment at Project site.
5. Material deliveries.
6. High and low temperatures and general weather conditions.
7. Accidents.
8. Meetings and significant decisions.
9. Unusual events (refer to special reports).
10. Stoppages, delays, shortages, and losses.
11. Meter readings and similar recordings.
12. Emergency procedures.
13. Orders and requests of authorities having jurisdiction.
14. Change Orders received and implemented.
15. Work Change Directives received and implemented.
16. Services connected and disconnected.
17. Equipment or system tests and startups.
18. Partial Completions and occupancies.
19. Substantial Completions authorized.

Material Location Reports: At monthly intervals, prepare and submit a comprehensive list of materials delivered to and stored at Project site. List shall be cumulative, showing materials previously reported plus items recently delivered. Include with list a statement of progress on and delivery dates for materials or items of equipment fabricated or stored away from Project site.

PART 3 - EXECUTION

A. CONTRACTOR'S CONSTRUCTION SCHEDULE

Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.

- i. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
- ii. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.

- iii. As the Work progresses, indicate Actual Completion percentage for each activity.

Distribution: Distribute copies of approved schedule (hard and electronic copy) to Engineer, Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.

1. Post copies in Project meeting rooms and temporary field offices.
2. One copy of the final approved Baseline Schedule shall be submitted to the Owner on ANSI D size paper, or larger if required, to show full legible detail.
3. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION

SECTION NO. 01200

PROJECT MEETINGS

PART 1 - GENERAL

1.01 SCOPE

- A. Work under this Section includes all scheduling and administering of pre-construction and progress meetings as herein specified and necessary for the proper and complete performance of this Work.
- B. Scheduling and Administration by Engineer
 - 1. Prepare agenda
 - 2. Make physical arrangements for the meetings
 - 3. Preside at meetings
 - 4. Record minutes and include significant proceedings and decisions
 - 5. Distribute copies of the minutes to attendees

1.02 PRE-CONSTRUCTION CONFERENCE

- A. The Construction Project Manager shall schedule the pre-construction conference prior to the issuance of the Notice to Proceed.
- B. Representatives of the following parties are to be in attendance at the meeting:
 - 1. Owner
 - 2. Design Team
 - 3. Contractor and superintendent
 - 4. Major subcontractors
- C. The agenda for the pre-construction conference shall consist of the following as a minimum:
 - 1. Distribute and discuss a list of major subcontractors and a tentative construction schedule
 - 2. Critical work sequencing
 - 3. Designation of responsible personnel and emergency telephone numbers
 - 4. Processing of field decisions and change orders
 - 5. Adequacy of distribution of Contract Documents
 - 6. Schedule of submittal of shop drawings, product data and samples
 - 7. Pay request format, submittal cutoff date, pay date and retainage
 - 8. Procedures for maintaining record documents
 - 9. Use of premises, including office and storage areas and Owner's requirements
 - 10. Major equipment deliveries and priorities
 - 11. Safety and first aid procedures
 - 12. Security procedures
 - 13. Housekeeping procedures
 - 14. Workhours

1.03 PROJECT COORDINATION MEETINGS

- A. Schedule regular monthly meetings as directed by the Construction Project Manager.
- B. Hold called meetings as progress of the work dictates.
- C. The meetings shall be held at the location indicated in the notice.
- D. Representatives of the following parties are to be in attendance at the meetings:
 - 1. Engineer
 - 2. Contractor and superintendent
 - 3. Major subcontractors as pertinent to the agenda
 - 4. Owner's representative as appropriate
- E. The minimum agenda for progress meetings shall consist of the following:
 - 1. Review and approve minutes of previous meetings
 - 2. Review work progress since last meeting
 - 3. Note field observations, problems and decisions
 - 4. Identify problems which impede planned progress
 - 5. Review off-site fabrication problems
 - 6. Review Contractor's corrective measures and procedures to regain plan schedule
 - 7. Review Contractor's revision to the construction schedule as outlined in the Supplementary Conditions
 - 8. Review submittal schedule; expedite as required to maintain schedule
 - 9. Maintenance of quality and work standards
 - 10. Review changes proposed by the Owner for their effect on the construction schedule and completion date
 - 11. Complete other current business

PART 2 - PRODUCTS

(Not Used)

PART 3 - EXECUTION

(Not Used)

END OF SECTION

SECTION NO. 01230

ALTERNATES

PART 1 - GENERAL

RELATED DOCUMENTS

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

SUMMARY

This Section includes administrative and procedural requirements for alternates.

DEFINITIONS

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

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

PROCEDURES

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

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

Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated modifications to alternates.

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

Schedule: A Schedule of Alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

PART 2 – PRODUCTS

(Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

- A. Alternate Bid Item No. 1: Additive alternate for all work associated with furnishing and installing grasscrete access drive to meter vault and by-pass connections.

END OF SECTION

SECTION NO. 01300

SUBMITTALS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Definitions:

1. Samples: Physical examples prepared to illustrate materials, equipment or workmanship and to establish standards by which work will be judged as complying with contract requirements.
2. Shop drawings: Drawings, diagrams, illustrations, schedules and performance charts, prepared to illustrate a portion of work in detail.
3. Product data: Dated, printed literature of a product manufacturer which describes product and installation procedures.
4. Submittals: General term including samples, shop drawings and product data, as applicable.

B. General provisions:

1. Provisions in this section are mandatory procedures for preparing and submitting samples, shop drawings and product data.
2. Submissions shall be in orderly sequence and timed to cause no delay in the Work.
3. Job delays occasioned by requirement of submissions of samples, shop drawings and product data not in accordance with Contract Documents are Contractor's responsibility, and will not be considered valid justification for extension of Contract Time.
4. Commence no portion of work requiring submittals until submittal has been acted upon by the Owner's Representative.

1.02 SAMPLE PREPARATION

- A. Prepare samples in sizes, shapes and finishes in accord with provisions of individual specification sections.
- B. Samples furnished under this section are not to be confused with full-size, on-the-site "Mock-Ups" called for in some specification sections.
- C. Unless otherwise indicated, the number of samples submitted shall be the number required by contractor, plus two which will be retained by Engineer.

1.03 SHOP DRAWING PREPARATION

A. Shop drawing submittals shall comply with the following:

1. Number sheets consecutively.
2. Indicate working and erection dimensions and relationships to adjacent work.
3. Show sectional views, where applicable.
4. Indicate material, gauges, thicknesses, finishes, and characteristics.
5. Indicate anchoring and fastening details, including information for making connections to adjacent work.

- B. Form: Submit three bond prints of shop drawings. One to Owner and two to Engineer.

1.04 PRODUCT DATA PREPARATION

- A. Include product manufacturer's dated, printed material with product description and installation instructions indicated. Data not related to project shall be deleted.
- B. Number of copies submitted shall be the number required by Contractor plus two which will be retained by Engineer and one copy which shall be included in the Owner's file.

1.05 CONTRACTOR'S REVIEW

- A. Review all submittals before forwarding to the Engineer and stamp to indicate conformance with requirements of the Contract Documents.
- B. Determine and verify field measurements and construction, materials, catalog numbers and similar data. Coordinate each submittal with requirements of work and Contract Documents.
- C. Where work is indicated "By Others", Contractor shall indicate subcontractor responsibility for providing and coordinating such work.
- D. Contractor agrees that submittals processed by Engineer are not Change Orders, that purpose of submittals by contractor is to demonstrate that Contractor understands design concept, that he demonstrates his understanding by indicating materials he intends to furnish and install and by detailing fabrication and installation methods he intends to use.
- E. Contractor represents by submitting samples, shop drawings and product data that he has complied with provisions specified above. Submissions made without Contractor's approval indicated thereon will be returned without being reviewed for compliance with this requirement.
- F. Date each submittal and indicate name of Project, Engineer, Contractor and Subcontractor, as applicable, description or name of equipment, material or product and location at which material or product is to be used.
- G. Accompany submittal with transmittal letter containing project name, Contractor's name, number of submittals, titles and other pertinent data. Transmittal shall outline deviations, if any, in submittals from requirements of Contract Documents.

1.06 ENGINEER'S REVIEW

- A. Engineer will review submittals with reasonable promptness so as to cause no delay in work.
- B. Engineer's review is only to determine conformance with design concept of project and with information in Contract Documents. Engineer's determination regarding an individual item shall not extend to the entire assembly in which the item functions.
- C. Engineer's review of submittals shall not relieve Contractor of responsibility for any deviation from requirements of Contract Documents unless Contractor has informed Engineer in writing of such deviation at time of submission and Engineer has given written acknowledgment of the specific deviation. Engineer's review shall in no way relieve Contractor from responsibility for errors or omissions in submittals.
- D. Engineer will return submittals to Contractor marked with appropriate comment as defined below:

1. "Reviewed " indicates the drawings have been reviewed for conformance with design and no exceptions are taken. Proceed with the work.
 2. "Furnish as Corrected" indicates drawings have been reviewed for conformance with design and exceptions have been noted by the Engineer. Re-submittal is not required, however, Contractor is responsible for incorporating Engineer's comments as annotated.
 3. "Revise and Resubmit" indicates that annotations are to be confirmed in a resubmittal of the affected drawing. However, subject to prior arrangement with the Engineer, the Contractor may proceed with the work as annotated during the interim required for resubmittal.
 4. "Rejected" indicates drawing to be revised and resubmitted for further review prior to proceeding with the work.
- E. Engineer will return two (2) bond copy of reviewed shop drawings for printing and distribution by Contractor. Contractor will immediately provide one original marked up copy to Owner.

1.07 RESUBMISSION

- A. Make corrections and changes indicated for unacceptable submissions and resubmit in same manner as specified above.
- B. In resubmission transmittal direct specific attention to revisions other than corrections requested by Engineer on previous submissions, if any.

1.08 DISTRIBUTION

- A. Contractor is responsible for obtaining and distributing copies of submittals to his Subcontractors and material suppliers after as well as before final approval. Prints of reviewed shop drawings shall be made from transparencies which carry the Engineer's appropriate stamp.
- B. Contractor shall maintain a file of processed submittals for the duration of the project, including a complete set in the project field office.

PART 2 - PRODUCTS

(Not Used)

PART 3 - EXECUTION

(Not Used)

END OF SECTION

SECTION NO. 01320

PROGRESS REPORTS AND PHOTOGRAPHS

PART 1 – GENERAL

1.01 WORK INCLUDED

- A. The Contractor shall submit to the Engineer on the last day of each week daily progress reports for each day worked that week. The progress reports shall be sent via any means (mail, fax, e-mail) previously agreed to by the Engineer. The progress reports shall including the following information:
1. A statement of work performed that day.
 2. A manpower report indicating numbers working that day by trade, including subcontractors.
 3. A copy of a delivery receipt of all deliveries, to the project on that day, of the equipment or materials that require approval according to these Specifications.
 4. Weather conditions.
 5. Other data pertinent to the progress of the work.
- B. Prior to the beginning of any work, the Contractor shall take project photographs of the work area to record existing conditions. Following completion of the work, another recording shall be made showing the same area and features as in the pre-construction photographs. All conditions which might later be subject to disagreement shall be shown in sufficient detail to provide a basis for decisions. The pre-construction photographs shall be submitted to the Engineer within 25 calendar days after the date of receipt by the Contractor of Notice to Proceed. Post-construction photographs shall be provided prior to final acceptance of the project.
- C. The Contractor shall provide record photographs with negatives of all major components of the construction. Submit two 8" x 10" color prints of each photograph. The photographs shall be taken at least monthly, or more frequently as necessary to provide an appropriate record of the work. A minimum of ten (10) photographs shall be submitted monthly with pay requests, for a total of twenty (20) prints submitted each month. The view selection will be agreed to with the Engineer. Pertinent information will be provided on the bottom left corner of each photograph, including: project name, Contractor name, description of subject, orientation, and date and time of exposure. Photographs submitted shall be enclosed back to back in a double face plastic sleeve punched to fit standard three-ring binders. Photographs taken with a high quality digital camera will be permitted, provided that they are printed on photograph quality paper and presented in the manner outlined above.

END OF SECTION

SECTION NO. 01335

PROJECT DOCUMENT TRACKING AND CONTROL SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

- A. This section includes requirements for the implementation and use of the Project Document Tracking and Control System for the S-129 Chattahoochee III Pump Station Upgrades Project.
- B. Related Sections include the following:
 - 1. Division 01 Section "Application for Payment"
 - 2. Division 01 Section "Schedules, Reports and Payments"
 - 3. Division 01 Section "Submittals"
 - 4. Division 01 Section "Contract Closeout"
 - 5. Division 01 Section "Record Documents"
 - 6. Division 01 Section "Operation and Maintenance Data"
 - 7. Division 01 Section "Material and Equipment"

1.2 SCOPE

- A. The Project Document Tracking and Control System (DTCS) will be utilized by the Owner and Contractor. The primary function of the system is to facilitate timely processing and approval of all contract documentation in coordination with the Overall Project Schedule established by these Specifications and the Contractor. This system will utilize software equal to the following:
 - 1. Primavera P6 for CPM scheduling;
 - 2. Primavera Contract Management (Oracle) for document tracking and control;
 - 3. Other software and licenses necessary for the installation and running of the DTCS.
- B. The software will:
 - 1. Facilitate communication among the Owner, and Contractor.
 - 2. Facilitate turn-around time with regard to responses and approvals.
 - 3. Provide a central location for all Project information to facilitate all Project participants in performing their tasks based on the latest Project data.
 - 4. Provide a standard system of project reporting and administration with accountability.
- C. The Contractor will use the system to create the required project documents and monthly project status reports. All appropriate Project documents generated by the Users will be maintained within the DTCS database. The system will be used to create and track the following documents:
 - 1. Project Directory/Contact List: Addresses, phone numbers, personnel contacts, etc.
 - 2. Drawings Log: Current drawing revision log.
 - 3. Shop drawing submittal log.
 - 4. Transmittals and submittals forms and logs.
 - 5. Requests for Information & Answers (RFIs) forms and logs.

6. Change Documents, Forms, and Logs, Including:
7. Daily Reports: Integrated with the Overall Project Schedule, including Contractor's daily reports and Engineer's reports.
8. Field Orders & Clarification Memos.
9. Notices of Non-Conformance and Non-Compliance.
10. Construction Issue Memos
11. Test reports
12. Task and issue management
13. Schedule and calendar Management.
14. Punchlists.
15. Meeting Minutes & Agendas.
16. Correspondence.
17. Progress Payments (integrated with cost loaded P6 schedule of values).
18. Work plans.
19. Start-up plans.
20. Equipment Operation and Maintenance Training.
21. Spare Parts.
22. Equipment Vendor
23. Payment application forms
24. Reminder and tracking functions
25. Photo documentation
26. Drawing and specification document hosting, viewing, and updating
27. Online document collaboration
28. Archiving functions
29. Other functions as required by the Construction Manager.

D Software:

1. The Contractor shall include in their base bid the cost for procuring software and current licenses of the DTCS software and hardware for the duration of the project.
 - a. Primavera Contract Management (Expedition) - Three licenses, Two of which shall be turned over to the Owner. One shall be retained by the Contractor for use during the Project and turned over to the Owner at the end of the Project. Version is latest at time of NTP issuance, as determined by the Owner.
 - b. Primavera P6 - Three licenses, Two of which shall be turned over to the Owner. One shall be retained by the Contractor for use during the Project and turned over to the Owner at the end of the Project. Version is latest at time of NTP issuance, as determined by the Owner.
 2. The Contractor shall also purchase technical support, maintenance, and upgrades for the duration of the Project for all software identified above for the full duration of the Project. This shall also include the cost of any upgrades, both hardware and software.
 3. Ownership of all software licenses shall be assigned to and retained by the County.
 4. Software shall be delivered to the Owner within 15 days after issuance of the Notice to Proceed.
- E The Contractor shall be responsible for providing training of the project team for the DTCS software. Training shall include space for up to Two of Owner's personnel and up to two for the Contractor.

- F On completion of the Project, the Contractor shall provide one complete archive copy of Project Document Tracking and Control System files to the Owner in a digital storage format acceptable to Owner.

PART 2 - PRODUCTS

(Not Used)

PART 3 - EXECUTION

(Not Used)

END OF SECTION

SECTION NO. 01370

SCHEDULE OF VALUES

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED

- A. Submit a Schedule of Values allocated to the various portions of the Work, within 21 days after the effective date of the Agreement.
- B. Upon request, support the values with data which will substantiate their correctness.
- C. The Schedule of Values, unless objected to by the Owner, shall be used as the basis for the Contractor's Applications for Payment.
- D. The items listed in the final detailed Schedule of Values shall reflect the cost loaded CPM schedule.
- E. This Section defines the process whereby the Schedule of Values (lump sum price breakdown) shall be developed and incorporated into the cost loading function of the CPM Schedule as specified in Schedules, Reports and Payments. Monthly progress payment amounts shall be determined from the monthly progress updates of the CPM Schedule activities.
- F. The Schedule of Value shall be developed independently but simultaneous with the development of the CPM Schedule activities and logic.

1.02 RELATED REQUIREMENTS

- A. Type schedule on an 8-1/2 inch by 11 inch white paper; Contractor's standard forms and automated printout will be considered for approval by the Engineer upon Contractor's request. Identify schedule with:
 1. Title of Project and location
 2. Owner and Project number
 3. Name and Address of Contractor
 4. Contract designation
 5. Date of submission
- B. Schedule shall list the installed value on the component parts of the Work in sufficient detail to serve as a basis for computing values for progress payments during construction.
- C. Identify each line item with the number and title of the respective major section of the specifications.
- D. For each major line item list sub-values of major products or operations under the item.
- E. For the various portions of the Work:
 1. Each item shall include a directly proportional amount of the Contractor's overhead and profit.
 2. For items on which progress payments will be requested for stored materials, break down the value into:
 - a. The cost of the materials, delivered and unloaded, with taxes paid. Paid invoices are required for materials upon request by the Owner.
 - b. The total installed value.

- F. The sum of all values listed in the schedule shall equal the total Contract Sum.
- G. Owner and Engineer shall have final say in the detail of breakdown of the SOV
- H. Should inequities discovered in the original accepted detailed Schedule of Values, increases and equal decreases to values for activities may be made.

1.03 SUBSCHEDULE OF UNIT MATERIAL VALUES

- A. Submit a sub-schedule of unit costs and quantities for:
 - 1. Products on which progress payments will be requested for stored products.
- B. The form of submittal shall parallel that of the Schedule of Values, with each item identified the same as the line item in the Schedule of Values.
- C. The unit quantity for bulk materials shall include an allowance for normal waste.
- D. The unit values for the materials shall be broken down into:
 - 1. Cost of the material, delivered and unloaded at the site, with taxes paid.
 - 2. Copies of invoices for component material shall be included with the payment request in which the material first appears.
 - 3. Paid invoices shall be provided with the second payment request in which the material appears or no payment shall be allowed and/or may be deleted from the request.
- E. The installed unit value multiplied by the quantity listed shall equal the cost of that item in the Schedule of Values.

1.04 DETAILED SCHEDULE OF VALUES

- A. The contractor shall prepare and submit a detailed Schedule of Values within 15 calendar days from the date of Notice of Proceed. The detailed Schedule of Values shall be based on the accepted preliminary Schedule of Values for major work components. Use the project specifications table of contents as a guide to establish line items for schedule of values. Because the ultimate requirement is to develop a detailed Schedule of Values sufficient to determine appropriate monthly progress payment amounts through cost loading of the CPM Schedule activities, sufficient detailed breakdown shall be provided to meet the requirement. The Contractor shall prepare the Schedule of Values acceptable to the Construction Manager. If, in the opinion of the Construction Manager, the Schedule of Values are unbalanced, he may require the Contractor to submit a detailed estimate to justify the values. Also, if, in the opinion of the Construction Manager, a greater number of Schedule of Values items than proposed by the Contractor or Subcontractor are necessary, the Contractor or Subcontractor shall add the additional items so identified by the Construction Manager.
 - 1. The minimum detail of breakdown of the major work components is indicated below. Greater detail shall be provided as directed by the Construction Manager.

- a. Mobilization and demobilization: not to exceed 1% of the total Contract Price - no breakdown required.
 - b. The electrical work shall be, at minimum, broken down by structure and yard facilities. Structures electrical work shall be broken down into conduit and raceway, cable and wire, electrical equipment, terminations and lighting. Yard facilities shall be broken down by ductbank and substations.
 - c. Instrumentation and control work broken down by structure.
 - d. Yard piping work shall be broken down into individual pipelines running from and to Contract termination points. Each pipeline shall be an individual pay item.
 - e. Mechanical work shall be broken down within each structure to identify individual piping systems, equipment installation by equipment name and number, and equipment testing and checkout.
 - f. Civil site work shall be broken down into individual drainage piping, drainage structures, site concrete, paving, excavation cut and fill, removal of existing pipe, clearing and grubbing and any other items determined to be necessary for the establishment of Pay and Schedule Activity items.
 - g. All other work not specifically included in the above items shall be broken down as necessary for establishment of pay and Schedule activity items.
2. The value allocations and extent of detail shall be reviewed to determine any necessary adjustments to the values and to determine if sufficient details have been proposed to allow acceptable cost loading of the CPM Schedule activities. Any adjustments deemed necessary to the value allocation or level of detail shall be made and a revised detailed Schedule of Values shall be submitted within 10 days of this meeting.
 3. Following acceptance of the detailed Schedule of Values, the Subcontractor shall incorporate the values into the cost loading portion of the CPM Schedule. The CPM activities and logic shall have been developed concurrent with development of the detailed Schedule of Values; however, it shall be necessary to adjust the detailed Schedule of Values to correlate to individual Schedule activities, where interfacing these two documents will require changes to each document. Schedule activities may need to be added to accommodate the detail of the Schedule of Values. Schedule of Value items may need to be added to accommodate the detail of the CPM Schedule activities. Where such instances arise, the Subcontractor shall propose changes to the Schedule of Values and to the CPM Schedule activities to satisfy the CPM Schedule cost loading requirements.

1.05 CROSS REFERENCE LISTING

- A. To assist in the correlation of the Schedule of Values and the CPM Schedule, the Subcontractor shall provide a Cross Reference listing, which shall be furnished in two parts. The first part shall list each

Scheduled Activity with the breakdown of the respective valued items making up the total cost of the activity. The second part shall list the valued item with respective Scheduled Activity or Activities that make up the total cost indicated. In the case where a number of schedule items make up the total cost for valued item (shown in Schedule of Values) the total cost for each scheduled item should be indicated.

- B. These listings shall be updates and submitted in conjunction with the CPM monthly submittals.
- C. Approved change orders reflected in CPM Schedule shall be incorporated into the Schedule of Values as a single unit identified by the change order number.

1.06 CHANGES TO SCHEDULE OF VALUES

- A. Changes to the CPM Schedule which add activities not included in the original schedule but included in the original work (schedule omissions) shall have values assigned as approved by the Construction Manager. Other activity values shall be reduced to provide equal value adjustment increases for added activities as approved by the Construction Manager.
- B. In the event that the Subcontractor and Contractor agree to make adjustments to the original Schedule of Values because of inequities discovered in the original accepted detailed Schedule of Values, increases and equal decreases to values for activities may be made.

PART 2: PRODUCTS
(Not Used)

PART 3: EXECUTION
(Not Used)

END OF SECTION

SECTION NO. 01410

TESTING LABORATORY SERVICES

PART 1 – GENERAL

1.01 SCOPE

- A. This Section includes testing which the Owner may require, beyond that testing required of the manufacturer, to determine if materials provided for the Project meet the requirements of these Specifications.
- B. This work also includes all testing required by the Owner to verify work performed by the Contractor is in accordance with the requirements of these Specifications (i.e., concrete strength and slump testing, existing soils conditions, soil compaction, etc.).
- C. This work does not include materials testing required in various sections of these Specifications to be performed by the manufacturer (e.g., testing of pipe).
- D. The testing laboratory or laboratories will be pre-approved by the Owner.

1.02 PAYMENT FOR TESTING SERVICES

- A. The cost of testing services required by the Contract shall be the responsibility of the Contractor.
- B. The cost of additional testing services not specifically required in the Specifications, but requested by the Owner or Engineer, shall be paid for by the Owner.
- C. The cost of material testing described in various sections of these Specifications or as required in referenced standards to be provided by a material manufacturer, shall be included in the price bid for that item and shall not be paid for by the Owner.
- D. The cost of retesting any item that fails to meet the requirements of these Specifications and/or false starts due to the Contractor's failure to properly schedule testing technicians shall be paid for by the Contractor. Retesting shall be performed by the testing laboratory approved by the Owner.

1.03 LABORATORY DUTIES

- A. Cooperate with the Owner, Engineer and Contractor.
- B. Provide qualified personnel promptly on notice.

- C. Perform specified inspections, sampling and testing of materials.
 - 1. Comply with specified standards, ASTM, other recognized authorities, and as specified.
 - 2. Ascertain compliance with requirements of the Contract Documents.
- D. Promptly notify the Engineer and Contractor of irregularity or deficiency of work which are observed during performance of services.
- E. Promptly submit three copies (two copies to the Engineer and one copy to the Contractor) of report of inspections and tests in addition to those additional copies required by the Contractor with the following information included:
 - 1. Date issued.
 - 2. Project title and number.
 - 3. Testing laboratory name and address.
 - 4. Name and signature of inspector.
 - 5. Date of inspection or sampling.
 - 6. Record of temperature and weather.
 - 7. Date of test.
 - 8. Identification of product and Specification section.
 - 9. Location of Project.
 - 10. Type of inspection or test.
 - 11. Results of test.
 - 12. Observations regarding compliance with the Contract Documents.
- F. Perform additional services as required.
- G. The laboratory is not authorized to release, revoke, alter or enlarge on requirements of the Contract Documents, or approve or accept any portion of the Work.

1.04 CONTRACTOR RESPONSIBILITIES

- A. Cooperate with laboratory personnel, provide access to Work and/or manufacturer's requirements.
- B. Provide to the laboratory, representative samples, in required quantities, of materials to be tested.
- C. Furnish copies of mill test reports.
- D. Furnish required labor and facilities to:
 - 1. Provide access to Work to be tested.
 - 2. Obtain and handle samples at the site.
 - 3. Facilitate inspections and tests.
 - 4. Build or furnish a holding box for concrete cylinders or other samples as required by the laboratory.
- E. Notify the laboratory sufficiently in advance of operation to allow for the assignment of personnel and schedules of tests.
- F. Laboratory Tests: Where such inspection and testing are to be conducted by an independent laboratory agency, the sample(s) shall be selected by such laboratory or agency, or the Engineer, and shipped to the laboratory by the Contractor at Contractor's expense.
- G. Copies of all correspondence between the Contractor and testing agencies shall be provided to the Engineer.

1.05 QUALITY ASSURANCE

Testing shall be in accordance with all pertinent codes and regulations and with procedures and requirements of the American Society for Testing and Materials (ASTM).

1.06 PRODUCT HANDLING

Promptly process and distribute all required copies of test reports and related instructions to insure all necessary retesting or replacement of materials with the least possible delay in the progress of the Work.

1.07 FURNISHING MATERIALS

The Contractor shall be responsible for furnishing all materials necessary for testing.

1.08 CODE COMPLIANCE TESTING

Inspections and tests required by codes or ordinances or by a plan approval authority, and made by a legally constituted authority, shall be the responsibility of, and shall be paid for by the Contractor, unless otherwise provided in the Contract Documents.

1.09 CONTRACTOR'S CONVENIENCE TESTING

Inspection or testing performed exclusively for the Contractor's convenience shall be the, sole responsibility of the Contractor.

1.10 SCHEDULES FOR TESTING

A. Establishing Schedule

1. The Contractor shall, by advance discussion with the testing laboratory selected by the Owner, determine the time required for the laboratory to perform its tests and to issue each of its findings, and make all arrangements for the testing laboratory to be on site to provide the required testing.
2. Provide all required time within the construction schedule.

B. When changes of construction schedule are necessary during construction, coordinate all such changes of schedule with the testing laboratory as required.

C. When the testing laboratory is ready to test according to the determined schedule, but is prevented from testing or taking specimens due to incompleteness of the Work, all extra costs for testing attributable to the delay will be back-charged to the Contractor and shall not be borne by the Owner.

1.010 TAKING SPECIMENS

Unless otherwise provided in the Contract Documents, all specimens and samples for tests will be taken by the testing laboratory or the Engineer.

1.011 TRANSPORTING SAMPLES

The Contractor shall be responsible for transporting all samples, except those taken by testing laboratory personnel, to the testing laboratory.

PART 2 - PRODUCTS

(Not Used)

PART 3 - EXECUTION

(Not Used)

END OF SECTION

SECTION NO. 01420

INSPECTION OF WORK

PART 1 – GENERAL

1.01 ENGINEER'S INSPECTION

- A. The Owner and Engineer shall have the right of access to and inspection of the work at all times. Materials, equipment and products shall be subject to the Owner and Engineer 's review as specified herein.
- B. The Owner or Engineer is responsible for general surveillance of the work. The Owner is not responsible for construction means, methods, sequences, or procedures or for safety precautions and programs in connection with the work. The Owner or Engineer shall not give instruction to the Contractor's personnel as to methods of execution of the work. The Owner or Engineer is not responsible for the Contractor's failure to carry out the work in accordance with the Contract Documents.

1.02 CONTRACTOR'S DUTIES

- A. The Contractor is responsible for all materials, equipment, methods, and procedures in execution of the work.
- B. The Contractor shall correct to the satisfaction of the Engineer any work or material found to be defective or of deficient quality. Such corrections shall be made by the Contractor at no additional expense to the Owner.

1.03 RIGHT OF ENTRY

Any government representative or other individual identified by the Owner shall have access to the work wherever it is in preparation or progress. The Contractor shall provide proper facilities for such access and inspection.

PART 2 - PRODUCTS

(Not Used)

PART 3 - EXECUTION

(Not Used)

END OF SECTION

SECTION NO. 01500

TEMPORARY FACILITIES

PART 1 - GENERAL

1.01 SCOPE

- A. Temporary facilities required for this work include, but are not necessarily limited to:
1. Temporary utilities such as water, electricity and telephone.
 2. First aid facilities.
 3. Sanitary facilities.
 4. Temporary heat.
 5. Temporary enclosures and construction facilities.

1.02 PRODUCT HANDLING

- A. Protection: Use all means necessary to maintain temporary facilities in proper and safe condition throughout progress of the Work.
- B. Replacements: In the event of loss or damage, immediately make all repairs and replacements necessary as approved by the Engineer and at no additional cost to the Owner.

PART 2 - PRODUCTS

2.01 UTILITIES

- A. Temporary Utilities
1. General
 - a. Provide and pay all costs for all water, electricity and telephone service required for the performance of the Work.
 - b. Pay all costs for temporary utilities until Project completion.
 - c. Costs for temporary utilities shall include all power, water, and the like necessary for testing equipment as required by the Contract Documents.
 2. Temporary Water: Furnish and install all necessary temporary piping, and upon completion of the Work, remove all such temporary piping. Install and remove water meters.
 3. Temporary Electricity:
 - a. Furnish and install all necessary temporary wiring for Contractor's use.
 - b. Furnish, locate and install area distribution boxes such that the individual trades may use their own construction type

extension cords to obtain adequate power and artificial lighting at all points where required by inspectors and for safety.

B. Telephones

1. The Contractor shall make all necessary arrangements for outside telephone service to Contractor's office. All portions of the communication system shall be maintained in good working condition.
2. All expenditures for the installation costs of lines, line extensions, service charges and recurring service charges for telephone services shall be paid for by the Contractor. The Owner will reimburse the Contractor for long distance telephone charges made by the Inspector, Engineer and Owner's personnel.

2.02 FIRST AID FACILITIES

The Contractor shall provide a suitable first aid station equipped with all facilities and medical supplies necessary to administer emergency first aid treatment. The Contractor shall have standing arrangements for the removal and hospital treatment of and injured person. All first aid facilities and emergency ambulance service shall be made available by the Contractor to the Owner and the Engineer's personnel.

2.03 SANITARY FACILITIES

Prior to starting Work, the Contractor shall furnish for use of Contractor's forces on the job, all necessary toilet facilities which shall be secluded from public observation. These facilities shall be either chemical toilets or shall be connected to the Owner's sanitary sewer system. All facilities, regardless of type, shall be kept in a clean and sanitary condition and shall comply with the requirements and regulations of the area in which the Work is performed. Adequacy of these facilities will be subject to the Engineer's review and maintenance of same must be satisfactory to the Engineer at all times.

2.04 POTABLE WATER

The Contractor shall be responsible for furnishing a supply of potable drinking water for employees, subcontractors, inspectors, engineers, and the Owner who are associated with the Work.

2.05 ENCLOSURES AND CONSTRUCTION FACILITIES

Furnish, install and maintain for the duration of construction, all required scaffolds, tarpaulins, canopies, steps, bridges, platforms and other temporary construction necessary for proper completion of the Work in compliance with all pertinent safety and other regulations.

2.06 PARKING FACILITIES

- A. Parking facilities for the Contractor's and Contractor's subcontractors' personnel shall be the Contractor's responsibility. The storage and work facilities provided by the Owner will not be used for parking by the Contractor's or subcontractors' personnel.

PART 3 - EXECUTION

3.01 REMOVAL

Maintain all temporary facilities and controls as long as needed for the safe and proper completion of the Work. Remove all such temporary facilities and controls as rapidly as progress of the Work will permit.

END OF SECTION

SECTION NO. 01562

DUST CONTROL

PART 1 – GENERAL

1.01 SCOPE

Limit blowing dust caused by construction by applying water or employing other appropriate means or methods to maintain dust control subject to the approval of the Owner. As a minimum, this may require the use of a water wagon twice a day to suppress dusty conditions.

1.02 PROTECTION OF ADJACENT PROPERTY

- A. The Bidders shall visit the site and note the buildings, landscaping, roads, parking areas, and other facilities near the Work site that may be damaged by their operations. The Contractor shall make adequate provision to fully protect the surrounding area and will be held fully responsible for all damages resulting from Contractor's operations.
- B. Protect all existing facilities (indoors and out) from damage by dust, spray or spills (indoors or out). Protect motors, bearings, electrical gear, instrumentation and building or other surfaces from dirt, dust, welding fumes, paint spray, spills or droppings causing wear, corrosion, malfunction, failure or defacement by enclosure, sprinkling or other dust palliatives, masking and covering, exhausting or containment.

PART 2 - PRODUCTS

(Not Used)

PART 3 - EXECUTION

(Not Used)

END OF SECTION

SECTION NO. 01600

MATERIAL AND EQUIPMENT

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED

- A. Material and equipment incorporated into the Work:
 - 1. Conform to applicable specifications and standards.
 - 2. Comply with size, make, type and quality specified, or as specifically approved in writing by the Engineer.
 - 3. Manufactured and Fabricated Products:
 - a. Design, fabricate and assemble in accord with the best engineering and shop practices.
 - b. Manufacturer like parts of duplicate units to standard size and gages, to be interchangeable.
 - c. Two or more items of the same kind shall be identical, by the same manufacturer.
 - d. Products shall be suitable for service conditions.
 - e. Equipment capacities, sizes and dimensions shown or specified shall be adhered to unless variations are specifically approved in writing.
 - 4. Do not use material or equipment for any purpose other than that for which it is designed or is specified.

1.02 RELATED WORK

- A. Conditions of the Contract.
- B. Section 01010: Summary of Work.
- C. Section 01300: Submittals.

1.03 MANUFACTURER'S INSTRUCTIONS

- A. When Contract Documents require that installation of work shall comply with manufacturer's printed instructions, obtain and distribute copies of such instructions to parties involved in the installation, including two copies to Engineer.
 - 1. Maintain one set of complete instructions at the job site during installation and until completion.
- B. Handle, install, connect, clean, condition and adjust products in strict accord with such instructions and in conformance with specified requirements.
 - 1. Should job conditions or specified requirements conflict with manufacturer's instructions, consult with Engineer for further instructions.
 - 2. Do not proceed with work without clear instructions.
- C. Perform work in accord with manufacturer's instructions. Do not omit any preparatory step or installation procedure unless specifically modified or exempted by Contract Documents.

1.04 TRANSPORTATION AND HANDLING

- A. Arrange deliveries of Products in accord with construction schedules, coordinate to avoid conflict with work and conditions at the site.

1. Deliver Products in undamaged condition, in manufacturer's original containers or packaging, with identifying labels intact and legible.
 2. Immediately on delivery, inspect shipments to assure compliance with requirements of Contract Documents and approved submittals and that Products are properly protected and undamaged.
- B. Provide equipment and personnel to handle Products by methods to prevent soiling or damage to Products or packaging.

1.06 STORAGE AND PROTECTION

- A. Store Products in accord with manufacturer's instructions, with seals and labels intact and legible.
1. Store Products subject to damage by the elements in weathertight enclosures.
 2. Maintain temperature and humidity within the ranges required by manufacturer's instructions.
- B. Exterior Storage:
1. Store fabricated products above the ground, on blocking or skid, prevent soiling or staining. Cover products which are subject to deterioration with impervious sheet coverings, provide adequate ventilation to avoid condensation.
 2. Store loose granular materials in a well-drained area on solid surfaces to prevent mixing with foreign matter.
- C. Arrange storage in a manner to provide easy access for inspection. Make periodic inspections of stored products to assure that Products are maintained under specified conditions, and free from damage or deterioration.
- D. Protection After Installation:
1. Provide substantial coverings as necessary to protect installed Products from damage from traffic and subsequent construction operations. Remove when no longer needed.

1.07 PRODUCT OPTIONS

- A. Products List:
1. Within 10 days after Contract Date, submit to Engineer a complete list of major products proposed to be used, with the name of the manufacturer and the installing subcontractor.
- B. Contractor's Options:
1. For Products specified only by reference standard, select any product meeting that standard with Owner's approval.
 2. For Products specified by naming one or more products or manufacturers, select one of the products or manufacturers named, which complies with the specifications with Owner's approval.
 3. For Products specified by naming one or more Products or manufacturers and "or equal" or "or approved equal" (or similar language,) Contractor must submit a request for Approval for any Product or manufacturer not specifically named.
 4. For Products where the words "or equal" or "or approved equal" (or similar language) do not follow the manufacturer's name, only such items may be used in the Base Bid.

1.08 PRODUCT SUBSTITUTIONS

A. General

1. Allowance of substitute products does not constitute a waiver of the specifications.
2. Substitute products may be deemed equal provided that the "equal" product is the same or better than the product specified in function, performance, reliability, quality, general configuration, and cost to owner.
3. Determination of "equal" in reference to the project design requirements will be made solely by the engineer and owner.
4. No substitute equipment will be considered unless, in the opinion of the engineer or owner, it conforms to the Contract Drawings and Specifications in all respects, except for make and manufacturer and minor details.
5. Reimbursements for the Engineer's re-design work and any other costs resulting from substitutions shall be at the contractor's expense.

B. Submittal Requirements:

1. For a period of 10 days after NTP Date, Engineer will consider written requests from Contractor for substitution of products specified as "or equal" in paragraph 1.07 B.3 above.
2. The engineer will consider substitution requests for products specifically identified by manufacturer, name, and/or catalog number in paragraph 1.07 B.4 above that are included with the bid.
3. Submit a separate substitution request for each Product, supported with complete data, with drawings and samples as appropriate, including (as applicable):
 - a. Complete description of the product, equipment, system, process, or function.
 - b. Complete list of system components and dimensional and weight information on separate components and assemblies.
 - c. Drawings, catalog information and cuts.
 - d. Manufacturer's specifications, including materials, description and paint system.
 - e. Performance data and pump curves.
 - f. Horsepower and efficiency of all motors supplied.
 - g. Outside utility requirements for each component.
 - h. List of parameters controlled, monitored, or alarmed.
 - i. Addresses and phone numbers of for the nearest parts warehouse capable of providing full parts replacements and/or repair services.
 - j. Addresses and phone numbers of nearest service centers and a listing of manufacturer's representative's services available at these locations.
 - k. List of the three most recent installations where similar products by the manufacturer or manufacturer's representative are currently in service; include contact name, telephone number, mailing address, and the names of the engineer, owner, and installing contractor. If three installations do not exist, the list should include all that do exist, if any.
 - l. Comparison of the qualities of the proposed substitution with that specified.
 - m. Detailed information on structural, electrical, mechanical, and all other changes or modifications necessary to adapt the product to the arrangement shown and/or functions described on the contract documents.
 - n. Any additional space requirements necessary to provide the minimum clear space around the product as shown.

- o. Submittal requirements specified herein in the individual product specifications.
 - p. Effect on the construction schedule.
 - q. Any required license fees or royalties.
 - r. Availability of maintenance service, and source of replacement materials.
 - s. Detailed information regarding owner's purchase and operations and maintenance costs.
 - t. No reimbursement will be provided for submission of request for substitute equipment.
 - u. Any additional information requested by the Owner or Engineer.
- C. Contractor's Representations:
- 1. A request for a substitution constitutes a representation that the Contractor:
 - a. Has investigated the proposed Product and determined that is equal to or superior in all respects to that specified.
 - b. Will provide the same warranties or bonds for the substitution as for the Product specified but shall not be less than the proposed products standard warranty.
 - c. Will coordinate the installation of an accepted substitution into the work, and make such other changes as may be required to make the work complete in all respects.
 - d. Waives all claims for additional cost, under his responsibility, which may subsequently become apparent.
- D. Engineer will review requests for substitutions with reasonable promptness, and notify Contractor, in writing, of the decision to accept or reject the requested substitution.

PART 2 - PRODUCTS

(Not Used)

PART 3 - EXECUTION

(Not Used)

END OF SECTION

SECTION NO. 01700

CONTRACT CLOSEOUT

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED

Comply with requirements stated in Conditions of the Contract and in Specifications for administrative procedures in closing out the work.

1.02 REQUIREMENTS

- A. Conditions of the Contract. Fiscal provisions, legal submittals and additional administrative requirements.
- B. Section 01720: Record Documents.
- C. The respective sections of Specifications: Closeout Submittals Required of Trades.

1.03 SUBSTANTIAL COMPLETION

- A. When Contractor considers the work is substantially complete, he/she shall submit to the Engineer.
 - 1. A written notice that the work, or designated portion thereof, is substantially complete.
 - 2. A list of items to be completed or corrected.
- B. Within a reasonable time after receipt of such notice, the Engineer will make an inspection to determine the statue of completion.
- C. Should the Engineer determine that the work is not substantially complete:
 - 1. Engineer will promptly notify the Contractor in writing, giving the reasons therefore.
 - 2. Contractor shall remedy the deficiencies in the work, and send second written notice of substantial completion to the Engineer.
 - 3. Engineer will reinspect the work.
- D. When the Engineer finds that the work is substantially complete, he will:
 - 1. Prepare and deliver to the Owner a tentative Certificate of Substantial Completion, with a tentative list of items to be completed or corrected before final payment.
 - 2. After consideration of any objections made by the Owner as provided in Conditions of the Contract, and when the Engineer considers the work substantially complete, he will execute and deliver to the Owner and the Contractor a definite Certificate of Substantial Completion with a revised tentative list of items to be completed or corrected.

1.04 INSPECTION

- A. When Contractor considers the work is complete, he shall submit written certification that:
 - 1. Documents have been reviewed.
 - 2. Work has been inspected for compliance with Contract Documents.
 - 3. Work has been completed in accordance with Contract Documents.
 - 4. Equipment and systems have been tested in the presence of the Owner's representative and are operational.
 - 5. Work is completed and ready for final inspection.
- B. Engineer will make an inspection to verify the status of completion with reasonable promptness after receipt of such certification.
- C. Should the Engineer consider that the work is incomplete or defective:
 - 1. Engineer will promptly notify the Contractor in writing, listing the incomplete or defective work.
 - 2. Contractor shall take immediate steps to remedy the stated deficiencies and send a second written certification to the engineer that the work is complete.
 - 3. Engineer will reinspect the work.
- D. When the Engineer finds that the work is acceptable under the Contract Documents, he shall request the Contractor to make closeout submittals.

1.05 REINSPECTION FEES

- A. When the Engineer performs reinspections due to failure of the work to comply with the claims of status of completion made by the Contractor:
 - 1. Owner will compensate Engineer for such additional services.
 - 2. Owner will deduct the amount of such compensation from the final payment to the Contractor.

1.06 CLOSEOUT SUBMITTALS TO ENGINEER

- A. Evidence of compliance with requirements of governing authorities.
- B. Record Documents: To requirements of Section 01720.
- C. Evidence of payments and Release of Liens: To requirements of General and Supplementary Conditions.
- D. Certificate of Insurance for Products and Completed Operations.

1.07 FINAL ADJUSTMENT OF ACCOUNTS

- A. Submit a final statement of accounting to Engineer.
- B. Statement shall reflect all adjustments to the Contract Sum:
 - 1. The original Contract Sum.
 - 2. Additions and deductions resulting from:
 - a. Previous Change Orders.
 - b. Allowances.
 - c. Unit Prices.
 - d. Deductions for uncorrected work.

- e. Penalties and Bonuses.
- f. Deductions for liquidated damages.
- g. Deductions for reinspection payments.
- h. Other adjustables.
- 3. Total Contract Sum as adjusted.
- 4. Previous payments.
- 5. Sum remaining due.

- C. Engineer will prepare a final Charge Order reflecting approved adjustments to the Contract Sum which were not previously made by Change Orders.

1.08 APPLICATION FOR PAYMENT

- A. Contractor shall submit the final Application for Payment in accordance with procedures and requirements stated in the Conditions of the Contract.

PART 2 - PRODUCTS

(Not Used)

PART 3 - EXECUTION

(Not Used)

END OF SECTION

SECTION NO. 01710

CLEAN-UP

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

- A. Contractor shall keep the project site free from accumulation of waste materials and rubbish at all times during the construction period. At completion of the work, he shall remove all waste materials and rubbish from and about the Project, as well as his tools, construction equipment, machinery and surplus materials, except those specifically required by the Contract Documents to be left for the Owner's maintenance.
- B. If Contractor fails to keep project clean or to clean up prior to Date of Substantial Completion, the Owner may do so, and the cost thereof will be charged to the Contractor.

1.02 SAFETY REQUIREMENTS

- A. Store volatile waste in covered metal containers. Remove from project site daily.
 - 1. Allow no volatile wastes to accumulate on project site.
 - 2. Provide adequate ventilation during use of volatile substances.
- B. Do not burn or bury waste materials and rubbish on project site.
- C. Dispose of no volatile wastes such as mineral spirits, oil or paint thinner in storm or sanitary drains, on pavements or in gutters, or on project site.
- D. Dispose of no waste or cleaning materials which contain materials harmful to plant growth on project site. Clean up materials which are accidentally spilled as quickly as possible.

1.03 CLEAN-UP DURING CONSTRUCTION

- A. Execute cleaning procedures to insure that building, project site and adjacent properties are maintained free from debris and rubbish.
- B. Wet down materials subject to blowing. Throw no waste materials from heights.
- C. Provide covered, on-site containers for waste collection. Place all waste materials and rubbish in containers in a expeditious manner to prevent accumulation. Remove waste from project site when containers become full.
- D. Legally dispose of all waste materials, rubbish, volatile materials and cleaning materials off project site.

- E. At time finishing work begins, maintain project in a "broom-clean" state until Date of Substantial Completion. Protect newly finished and clean surfaces from contamination during cleaning operations.
- F. Allow no accumulation of debris which contributes to survival or spread of rodents, roaches or other pests.
 - 1. Remove debris containing food scraps on a daily basis.
 - 2. Should pests inhabit project, Contractor shall be responsible for securing services of a pest exterminator at no additional cost to the Owner.

1.04 PROTECTION AND CLEAN-UP OF ROADS

- A. Spillovers on roads from trucks entering or leaving the site shall be cleaned up on a continuing basis so that pavements and adjacent sidewalks will not be littered with earth, stones, or any other debris resulting from construction operations.
- B. Large accumulations of earth and mud shall be removed from truck wheels and loose accumulations of earth, sand or gravel shall be removed from vehicle underbodies and ledges as much as feasible before entry upon public roads.

1.05 FINAL CLEAN-UP

- A. Prior to Date of Substantial Completion clean all finished surfaces in accord with manufacturer's product data and requirements specified in trade sections. All general and specific cleaning shall be performed prior to Contractor's request that the project or portion thereof be inspected for Substantial Completion.
- B. Remove dust, debris, oils, stains and fingerprints and labels from exposed interior and exterior finish surfaces, including glazing materials.
- C. Repair, patch and touch up marred surfaces to match adjacent finishes. Replace materials which cannot be repaired or patched.
- D. Clean disturbed areas of project site of debris. Broom clean paved surfaces. Remove oil and similar deleterious substances.

PART 2 - PRODUCTS

(Not Used)

PART 3 - EXECUTION

(Not Used)

END OF SECTION

SECTION NO. 01720

RECORD DOCUMENTS

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED

- A. Maintain at the site for the Owner one (1) record copy of:
1. Drawings.
 2. Specifications.
 3. Addenda.
 4. Change Orders and other Modifications to the Contract.
 5. Engineer's Field Orders or written instructions.
 6. Approved Shop Drawings, Working Drawings and Samples.
 7. Field Test Records.
 8. Construction photographs.

1.02 RELATED REQUIREMENTS

- A. Division 1: General Requirements.

1.03 MAINTENANCE OF DOCUMENTS AND SAMPLES

- A. Store documents and samples in Contractor's field office apart from documents used for construction.
1. Provide files and racks for storage of documents.
 2. Provide locked cabinet or secure storage space for storage of samples.
- B. File documents and samples in accordance with CSI/CSC format.
- C. Maintain documents in a clean, dry, legible condition and in good order. Do not use record documents for construction purposes.
- D. Make documents and samples available at all times for inspection by the Owner.
- E. As a prerequisite for monthly progress payments, the Contractor is to exhibit the currently updated "Record Documents" for review by the Engineer and the Owner.

1.04 MARKING DEVICES

- A. Provide felt tip marking pens for recording information in the color code designated by the Engineer.

1.05 RECORDING

- A. Label each document "PROJECT RECORD" in neat large printed letters.
- B. Record information concurrently with construction progress. Do not conceal any work until required information is recorded.
- C. Drawings: Legibly mark to record actual construction:
 - 1. Depths of various elements of foundation in relation to finish first floor datum.
 - 2. All underground piping with elevations and dimensions. Changes to piping location. Horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements. Actual installed pipe material, class, etc.
 - 3. Location of internal utilities and appurtenances concealed in the construction, referenced to visible and accessible features of the structure.
 - 4. Field changes of dimension and detail.
 - 5. Changes made by Field Order or by Change Order.
 - 6. Details not on original contract drawings.
 - 7. Equipment and piping relocations.
 - 8. Major architectural and structural changes including relocation of doors, windows, etc.
 - 9. Architectural schedule changes according to Contractor's records and shop drawings.
- D. Specifications and Addenda: Legibly mark each Section to record:
 - 1. Manufacturer, trade name, catalog number, and supplier of each Produce and item of equipment actually installed.
 - 2. Changes made by Field Order or by Change Order.
- E. Shop Drawings (after final review and approval):

1. One (1) set of record shop drawings for each process equipment, piping, including casings, electrical system and instrumentation system.
- F. Certified site survey and line elevations and stationing at 100 foot increments by a registered land surveyor.
- 1.06 SUBMITTAL
- A. At Contract close-out, deliver Record Documents to the Engineer for the Owner.
 - B. Accompany submittal with transmittal letter in duplicate, containing:
 1. Date.
 2. Project title and number.
 3. Contractor's name and address.
 4. Title and number of each Record Document.
 5. Signature of Contractor or his authorized representative.

PART 2: PRODUCTS
(Not Used)

PART 3: EXECUTION
(Not Used)

END OF SECTION

SECTION NO. 01730

OPERATION AND MAINTENANCE DATA

PART 1 – GENERAL

1.01 SCOPE OF WORK

- A. This section includes procedural requirements for compiling and submitting operation and maintenance data required to complete the project.

1.02 RELATED WORK

- A. Division 1: General Requirements.

1.03 SERVICES OF MANUFACTURERS' REPRESENTATIVE

- A. Selected equipment furnished under Divisions 11, 13, 15 and 16 shall include the cost of a competent representative of the manufacturers of all equipment to supervise the installation, adjustment, and testing of the equipment and to instruct the Owner's operating personnel on operation and maintenance. This supervision may be divided into two or more time periods as required by the installation program.
- B. See the detailed Specifications for additional requirements for furnishing the services of manufacturer's representatives.

1.04 OPERATING MANUALS

- A. Five (5) complete sets in hard copies and one (1) complete set in electronic format of operation and maintenance instructions covering all equipment furnished under Divisions 11, 13, 15 and 16, shall be delivered directly to the Owner. The electronic format shall be compatible with the Owner's CMMS system, Infor.
1. The manual for each piece of equipment shall be a separate document with the following specific requirements:
 - a. Contents:
 - Table of Contents and Index
 - Brief description of each system and components
 - Starting and stopping procedures
 - Special operating instructions
 - Routine maintenance procedures
 - Manufacturer's printed operating and maintenance instructions, parts list, illustrations, and diagrams
 - One (1) copy of each wiring diagram
 - One (1) copy of each approved shop drawing and each Contractor's coordination and layout drawing

List of spare parts, manufacturer's price, and recommended quantity

Name, address and telephone numbers of local service representatives.

- b. Material:
Loose leaf on 60 pound, punched paper

Holes reinforced with plastic cloth or metal

Page size, 8-1/2 inches by 11 inches

Diagrams, illustrations, and attached foldouts as required of original quality, reproduced by dry copy method

Covers: oil, moisture, and wear resistant, size 9 inches by 12 inches

1.05 MANUAL FOR EQUIPMENT AND SYSTEMS

- A. For each Item of Equipment and each system provide the following:
 - 1. Description of unit or system, and component parts. Identify function, normal operating characteristics, and limiting conditions. Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.
 - 2. Panelboard Circuit Directories including electrical service characteristics, controls and communications, and color coded wiring diagrams as installed.
 - 3. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences; regulation, control, stopping, shut-down, and emergency instructions; and summer, winter, and any special operating instructions.
 - 4. Maintenance Requirements:
 - a. Routine procedures and guide for troubleshooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
 - b. Servicing and lubrication schedule, and list of lubricants required.
 - c. Manufacturer's printed operation and maintenance instructions.
 - d. Sequence of operation by controls manufacturer.
 - e. Original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
 - 5. Control diagrams by controls manufacturer as installed.
 - 6. Contractor's coordination drawings, with color coded piping diagrams as installed.

7. Charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
8. List of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
9. Test and balancing reports as specified.
10. Additional Requirements: As specified in individual product specification Sections.

1.06 INSTRUCTION OF OWNER PERSONNEL

- A. Before final inspection, instruct Owner's designated personnel in operation, adjustment, and maintenance of products, equipment, and systems at agreed upon times.
- B. Use operation and maintenance manuals as basis for instruction. Review contents of manual with personnel in detail to explain all aspects of operation and maintenance.
- C. Prepare and insert additional data in Operation and Maintenance Manual when need for such data becomes apparent during instruction.

PART 2: PRODUCTS
(Not Used)

PART 3: EXECUTION
(Not Used)

END OF SECTION

SECTION NO. 01740

WARRANTIES AND BONDS

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 Owner.
- B. The Contractor shall warrant for a minimum period of two years 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. The warranty period stated here does not limit any manufacturer's standard warranty. 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 defects, the Owner 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. 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.
- D. 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, and excessive wear or excessive leakage around seals. Failures which are directly and clearly traceable to operator abuse shall be exempted from the scope of the one year warranty. Operator abuse may include, but not be limited to, 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. 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 rewarranted for one year.
- E. The Contractor shall, at Contractor's expense, furnish all labor, materials, tools and equipment required, as well as make such repairs and removals as necessary to perform work or reconstruction of 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 that 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 the same for a period of one year from the date of final acceptance. In the event of 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.

PART 2 - PRODUCTS
(Not Used)

PART 3 - EXECUTION
(Not Used)

END OF SECTION

SECTION NO. 01760

SPARE PARTS AND SPECIAL TOOLS

PART 1 – GENERAL

1.01 DESCRIPTION

- A. The Contractor shall furnish complete spare parts and special tools for each type of equipment supplied under Divisions 11, 13, 15 and 16 of the Contract Documents. Parts and special tools shall be packaged securely and labeled as to content and application.
- B. Spare parts and special tools are defined as all parts and appurtenances identified in the equipment manufacturer's current published parts list and operation and maintenance literature as spare parts and special tools recommended for that item of equipment. Parts and appurtenances identified as "Optional" or otherwise identified by words or symbols of similar meaning shall be considered spare parts and special tools and shall be furnished.
- C. One complete set of spare parts shall be furnished for each group of two or less items of identical equipment.
- D. Shop drawings submitted for all items of equipment shall include complete current published parts information, which shall clearly show the manufacturer's and submanufacturer's recommended spare parts.
- E. Any spare parts and special tools in addition to the above requirements shall be furnished when specifically specified.
- F. The cost for spare parts and special tools shall be included in the bid prices for the equipment and no extra payment will be made for spare parts.

PART 2 - PRODUCTS

(Not Used)

PART 3 - EXECUTION

(Not Used)

END OF SECTION

SECTION NO. 02060

DEMOLITION

PART 1 - GENERAL

1.01 WORK INCLUDES

- A. Remove materials and equipment from site.
- B. Remove pumps and appurtenances from inside the building.
- C. Remove HVAC equipment from inside and on top of facility.

1.02 RELATED WORK

- A. Section 01500: Temporary Facilities.
- B. Section 01700: Contract Closeout.
- C. Section 02062: Removal of Existing Equipment.
- D. Section 02221: Excavating, Backfill, and Fill for Pipe.

1.03 SUBMITTALS

- A. Permit for transport and disposal of debris.
- B. Demolition procedures and operation sequence for review and acceptance by Contracting Officer.

1.04 PHASING

- A. The by-pass connection and plug valves must be installed on the 30-inch force main pipe.
- B. Commence by-pass pumping.
- C. Demolition of interior of pump station will commence after by-pass pumping is approved.
- D. Pump station shutdown not to exceed 4 hours for by-pass connection installation.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Immediately remove from site.

PART 3 - EXECUTION

3.01 DEMOLITION

- A. Perform demolition in accordance with authorities having jurisdiction.
- B. Repair demolition performed in excess of that required.
- C. Do not burn materials on site.
- D. Pollution Controls: Comply with governing regulations for environmental protection.
 - 1. Use water sprinkling, temporary enclosures, and other suitable methods to limit amount of dust and dirt rising and scattering in air.
 - 2. Provide hoses and water main or hydrant connections.
 - 3. Do not use water when it may create hazardous or objectionable conditions such as ice, flooding, and pollution.
- E. Demolition: Completely demolish structure(s) and appurtenances in orderly and careful manner and remove materials from site.
 - 1. Break up and remove concrete slabs-on-grade, unless otherwise indicated to remain.
 - 2. Locate demolition equipment throughout structure and remove materials so not to impose excessive loads to supporting walls, floors, or framing.
 - 3. Demolish and remove below-grade construction and concrete slabs-on-grade.
 - 4. Filling Basements and Voids:
 - a) Completely fill below-grade areas and voids resulting from demolition of structures.
 - b) Use soil materials consisting of stone, gravel, and sand; free from debris, trash, frozen materials, roots and other organic matter, and stones larger than 2 inches.
 - c) Prior to placement of fill materials, ensure that areas to be filled are free of standing water, frost, frozen material, trash, and debris.
 - d) Place fill materials in horizontal layers not exceeding 6 inches loose depth.
 - e) Compact each layer at optimum moisture content of fill material to density equal to original adjacent ground, unless subsequent excavation for new work is required.

- f) After fill placement and compaction, grade surface to meet adjacent contours and provide flow to surface drainage structures.

- F. Check with Contracting Officer to coordinate building items to be turned over to C.O. Remove demolished materials, tools, and equipment upon completion of work. Dispose of materials at an off-installation site at the Contractor's expense.

- G. Leave site in condition acceptable to Contracting Officer.

- H. Utility System Demolition: Completely remove all utility lines shown on the drawings, including electric, water, sanitary sewer, storm sewer, and spill control, etc. Repair pavement as necessary following demolition. Turn over interior/exterior lights, power panels, window air conditioner, hot water tanks, eyewash/shower to C.O.

3.2 PROTECTION

- A. Remove from site, contaminated, vermin-infested, or dangerous materials encountered; and dispose of so not to endanger health of workers and public.

END OF SECTION

SECTION NO. 02062

REMOVAL OF EXISTING EQUIPMENT

PART 1 - GENERAL

1.01 SCOPE OF WORK

Furnish all labor, equipment, materials, and incidentals required to remove all existing equipment and all pipe, fittings, valves, and appurtenances. Removal will be consistent with the final configuration of the pump station as indicated on the Drawings, as specified herein or as required by the Engineer. The equipment and piping shall be removed from their present locations and disposed of off-site.

1.02 RELATED WORK

- A. Storage of existing equipment is included in Section 02063.
- B. Modifications to Existing Structures, Piping, and Equipment is included in Section 02064.

PART 2 - PRODUCTS

(Not Used)

PART 3 - EXECUTION

3.01 GENERAL

- A. The Contractor shall not proceed with the removal of any equipment, piping, or appurtenances without specific approval of the Engineer. Any equipment, piping or appurtenances removed without proper authorization, which are necessary for the operation of the existing systems or of the extended systems, shall be replaced to the satisfaction of the Engineer at the Contractor's expense.
- B. All existing tubing, insulation, hangers, and supports shall become the property of the Contractor immediately upon removal from their present locations. The Contractor shall remove such material from the plant site at his own expense and it shall not be reused.
- C. Owner shall have first right of refusal for all existing valves, strainers, and other special line elements, greater than 3-in. diameter which are removed. The Contractor shall furnish all labor and material to identify, clean, protect, crate, and box and store them at a place designated by the Owner.
- D. Pieces of equipment weighing 150 lbs. or more shall be provided with suitable skids before storing.

- F. Equipment to be retained by the Owner shall be carefully removed from the present location, cleaned, and immediately stored by the Contractor, at a place designated by the Owner.
- G. The Contractor shall take all necessary precautions against damaging the material and equipment to be stored. The Contractor shall repair any damage resulting from his operation, as directed by and to the satisfaction of the Engineer. Itemized lists of materials removed and stored shall be given to the Engineer daily. A final typed itemized list shall be furnished to the Engineer in 6 copies at the completion of construction. The list shall include items, method of packaging, and place of storage.

3.02 STORAGE LOCATIONS

All equipment to be retained by the Owner shall be moved to a location by the Contractor as directed by the Owner.

3.03 EQUIPMENT TO BE RETAINED

- A. The Contractor shall coordinate with the Owner for any equipment which shall be retained. If the Owner elects not to retain ownership of a certain item, the item shall become the property of the Contractor and shall be removed from the plant site at the Contractor's expense.
 - 1. The following equipment are to be retained by the Owner:
 - a. The existing VFDs.

END OF SECTION

SECTION NO. 02063

PACKAGING AND STORAGE OF EXISTING EQUIPMENT

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, equipment, material, power and incidentals required and clean, prepare, crate and store all existing equipment to be retained by the Owner, The equipment will be removed from its existing installation and stored in locations as directed by the Engineer.
- B. Any items of equipment, damaged or lost due to the Contractor's carelessness, mishandling, or faulty procedures and/or workmanship shall be repaired or replaced in kind to the satisfaction of the Engineer.
- C. Before packaging, the Owner shall be permitted to perform any routine maintenance on the equipment which he deems necessary.
- D. Equipment which has been installed indoors shall not be exposed to the weather at any point of the salvaging and storage operation.

1.02 RELATED WORK

- A. Removal of existing equipment is included in Section 02062.
- B. Demolition of existing structures is included in Section 02060.

1.03 SUBMITTALS

- A. In accordance with the provisions of the General Conditions, submit to the Engineer for approval the following:
 - 1. Description of the salvaging procedure for each item of equipment covering the cleaning, preparation, and protection aspects of the operation.
 - 2. Submittals shall include the type of rust resistant coatings and all other materials to be used.

PART 2 - PRODUCTS

(Not Used)

PART 3 - EXECUTION

3.01 SURFACE PREPARATION

- A. The surfaces of all equipment and materials to be salvaged and stored shall be thoroughly cleaned, dried, and free of all rust, loose paint, dirt, and foreign matter. If required, in the opinion of the Engineer, equipment and materials shall be steam cleaned.

- B. The interior of all equipment shall be cleaned, flushed, and dried. Oil shall be flushed from all oil lubricated gear reducers and other related equipment.
- C. Gears, bearing surfaces, other similar surfaces, and other surfaces which have started to rust shall be given a coat of grease or other suitable rust resistant coating.

3.02 PROTECTION

- A. All equipment and materials to be salvaged and stored shall be properly protected from damage. All nozzles and overhung loads shall be suitably braced as to prevent the development of any damaging stresses.
- B. Crates shall not be larger than 3' high x 3' wide x 5' long, in general, and the weight of the crate and its contents shall not exceed 2000 lbs.
- C. Equipment shall be packaged as complete assemblies, where possible. Equipment assemblies which are larger than the above dimensions or weight requirements permit shall be broken down into subassemblies, where possible, before crating. Equipment which, in the opinion of the Engineer, cannot be readily broken down or which should not be broken down shall not be crated.
- D. Crates shall have cradles or supports built-in to the bottom of the crates such that the bottoms of the crates will not rest directly on the floor.
- E. Crates shall be labeled in indelible markings which describe completely the item and quantity of the equipment. All crates shall be numbered. A list giving each crate number and a description of its contents shall be prepared by the Contractor and submitted to the Engineer.

END OF SECTION

SECTION NO. 02064

MODIFICATIONS TO EXISTING STRUCTURES, PIPING, AND EQUIPMENT

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials, equipment, and incidentals required to modify, alter and/or convert existing structures as shown or specified and as required for the installation of new mechanical equipment, piping, and appurtenances. Existing piping and equipment shall be removed and dismantled as necessary for the performance of structural and mechanical alterations in accordance with the requirements herein specified.

1.02 RELATED WORK

- A. Section 02063: Packaging and Storage of Existing Equipment
- B. Section 02100: Site Preparation
- C. Section 02220: Excavation, Backfill, Fill and Grading for Structures
- D. Section 02221: Excavation, Backfill and Grading for Pipe
- E. Section 02276: Temporary Erosion and Sediment Control
- F. Section 02999: Miscellaneous Work and Clean-up

PART 2 - PRODUCTS

(Not Used)

PART 3 - EXECUTION

3.01 GENERAL

- A. The contractor shall cut, repair, reuse, excavate, demolish, or otherwise remove parts of the existing structures or appurtenances, as indicated on the Contract Drawings, herein specified, or necessary to permit completion of the work under this Contract. He shall dispose of surplus materials resulting from the above work in an approved manner. The above work shall include the coring of holes in existing structures for the installation of pipe, conduits, mechanical equipment and other appurtenances.
- B. The Contractor shall dismantle and remove all existing equipment, piping, and other appurtenances required for the completion of the work. Where called for or required, the Contractor shall cut existing pipelines for the purpose of making connections thereto. Anchor bolts for equipment and structural steel removed shall be cut off one inch below the concrete surface.

- C. At the time that a new connection is made to an existing pipeline, additional new piping, extending to and including the most convenient new valve, shall be installed.
- D. No existing structure, equipment, or appurtenance shall be shifted, cut, removed, or otherwise altered except as shown on the drawings without approval from the Engineer.
- E. When removing materials or portions of existing structures and when making openings in walls and partitions, the Contractor shall take all precautions and use all necessary barriers and other protective devices so as not to damage the structures beyond the limits necessary for the new work, and to damage the structures or contents by falling or flying debris.
- F. Materials and equipment removed in the course of making alterations and additions shall remain the property of the Owner, except those items not salvageable, as determined by the Engineer and/or the Owner shall become the property of the Contractor to be disposed of by him off the work site at his own place of disposal. Operating equipment shall be thoroughly cleaned, lubricated, and greased for protection during prolonged storage.
- G. All alterations to existing structures shall be done at such time and in such manner as will comply with the approved time schedule. So far as possible before any part of the work is started, all tools, equipment, and materials shall be assembled and made ready so that the work can be completed without delay.
- H. All workmanship and new materials involved in constructing the alterations shall conform to the General Specifications for the classes of work insofar as such specifications are applicable.
- I. All cutting of existing masonry or other material to provide suitable bonding to new work shall be done in a manner to meet the requirements of the respective section of these specifications covering the new work. When not covered, the work shall be carried on in the manner and to the extent directed by the Engineer.
- J. Where holes in existing masonry are required to be sealed, unless otherwise herein specified, they shall be sealed with cement mortar or concrete. The sides of the openings shall be provided with keyed joints and shall be suitably roughened to furnish a good bond and make a watertight joint. All loose or unsound material adjacent to the opening shall be removed and, if necessary, replaced with new material. The method of placing the mortar seal shall provide a suitable means of releasing entrapped air.
- K. Visible surfaces in the completed work shall be made to match as nearly as possible the adjacent surfaces.
- L. Non-shrink grout shall be used for setting wall castings, sleeves, leveling pump bases, doweling anchors into existing concrete, and elsewhere as shown.

- M. Where necessary or required for the purpose of making connections, the Contractor shall cut existing pipelines in a manner to provide an approved joint. Where required, he shall weld beads, flanges, or provide Dresser Couplings, as required.
- N. The Contractor shall provide flumes, hoses, piping, and other related items to divert or provide suitable plugs, bulkheads, or other means to hold back the flow of wastewater, water, or other liquids, as required in the performance of the work under this Contract.

3.02 CLEANING EXISTING STRUCTURES

- A. Blasting will not be permitted to complete any work under this Contract. Care shall be taken not to damage any part of existing buildings, foundations, or outside structures.
- B. All existing structures to be cleaned shall be pressure washed. All debris, water, and other items shall be removed from the structure prior to cleaning.

END OF SECTION

SECTION NO. 02100

SITE PREPARATION

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. This Section covers clearing, grubbing, and stripping of the construction site, as specified.
- B. Clear and grub areas as required for construction. The area to be cleared shall be approved by the Owner's representative prior to the beginning of any clearing.
- C. No trees, rocks, utilities or landscaped areas shall be cleared without specific approval by the Owner.
- D. Attention is directed to any Soil Erosion and Sediment Control Ordinances in force.

1.02 RELATED WORK

- A. Section 02220: Excavation, Backfill, and Compaction for Structures and Pavement
- B. Section 02221: Excavation, Backfill, Fill, and Grading for Pipe
- C. Section 02276: Temporary Erosion and Sediment Control

PART 2- PRODUCTS

(Not Used)

PART 3 - EXECUTION

3.01 SILTATION CONTROL

Before any clearing and grubbing operations, install all sedimentation and erosion control items.

3.02 TREES TO REMAIN

Prior to starting work, protect all trees with temporary fences, boxing, or other approved protective barrier. Areas under spread of branches shall not be used for any purpose likely to damage trees including parking or driving of vehicles.

3.03 CLEARING

Clearing consists of the removal of all exposed objectionable matter such as trees, brush, stumps, logs, grass, weeds, roots, organic matter, poles, stubs, rubbish, refuse dumps, sawdust piles, loose boulders of one cubic yard and other debris resting on or protruding through the ground surface. Clearing may

be done by any method the Contractor elects to use, provided no damage is done to property, trees, or shrubbery to be retained in, or outside, the limits of construction.

3.04 GRUBBING

Grubbing shall consist of the complete removal of all objectionable matter defined under Clearing, which is embedded in the underlying soil. Objectionable roots are defined as matted tree and brush roots regardless of the size of the roots, and individual roots more than 3/4" in diameter. All grubbed items shall be removed to a minimum depth of 24" below subgrade.

3.05 STRIPPING

In areas so designated, topsoil shall be stockpiled. The topsoil shall be protected until it is placed as specified. Any topsoil remaining after all work is in place shall be used on-site in areas designated.

3.06 DISPOSAL OF CLEARED AND GRUBBED MATERIAL

The cost of disposal, including hauling if necessary, of cleared and grubbed material and debris shall be considered a subsidiary obligation; the cost of which shall be included in the contract prices. The contractor shall insure that no damage to adjacent trees, property, or building shall be incurred.

3.07 PRESERVATION OF DEVELOPED PRIVATE PROPERTY

- A. Exercise extreme care to avoid causing any unnecessary disturbance to developed property bordering construction.
- B. Improvements to the land such as fences, walls, outbuildings and other structures which, if necessary, must be removed, shall be replaced with equal quality materials and workmanship.

3.08 ACTIVE UTILITIES

Active utilities traversing the site shall be preserved in operating condition. Repair damage to all such utilities due to work under this Contract to the satisfaction of the authority having jurisdiction over the utility.

3.09 EXISTING SERVICE

Disconnect or arrange for the disconnection of utility service in accordance with regulations governing the utility concerned and as shown on the drawings or which interfere with the work.

3.10 BENCH MARKS

Maintain carefully all benchmarks, monuments, and other reference points. If disturbed, replace as directed by the Engineer.

END OF SECTION

SECTION NO. 02140

DEWATERING

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1, General Requirements, apply to this Section.

1.02 SUMMARY

- A. This Section includes provisions for site dewatering.
- B. Dewatering consists of lowering and controlling groundwater levels and hydrostatic pressures to permit excavation and construction to be performed in near-dry conditions.
- C. The Contractor shall determine the depth of soil below subgrade elevation that is to be dewatered.

1.03 SUBMITTALS

- A. The Contractor shall submit the following in accordance with Conditions of Contract and Division 1, General Requirements:
 - 1. A layout of the dewatering system to coordinate with other construction activities.
 - 2. Observation well reports recording elevation of groundwater and piezometric water levels.

1.04 QUALITY ASSURANCE

- A. The Contractor shall perform dewatering operations with supervisory personnel having at least 5 years experience in field of dewatering.
- B. The Contractor shall maintain adequate supervision and control to ensure that stability of excavated and constructed slopes are not adversely affected by water, that erosion is controlled and that flooding of excavation or damage to structures does not occur.

PART 2 – PRODUCTS

(Not Applicable)

PART 3 – EXECUTION

3.01 DEWATERING

- A. The Contractor shall provide an adequate system to lower and control groundwater in order to permit excavation, construction of structures and placement of fill materials under dry conditions. Install sufficient dewatering equipment to drain water-bearing strata above and below bottom of structure foundations, drains, sewers and other excavations.
- B. The Contractor shall reduce hydrostatic head in water-bearing strata below structure foundations, drains, sewers and other excavations to extent that water level and piezometric water levels in construction areas are below prevailing excavation surface.
- C. Prior to excavation below groundwater level, the Contractor shall place the system into operation to lower water levels as required and then operate it continuously 24 hours a day, 7 days a week until drains, sewers and structures have been constructed, including placement of fill materials and until dewatering is no longer required.
- D. The Contractor shall dispose of water removed from excavations in a manner to avoid endangering public health, property and portions of work under construction or completed. The Contractor shall dispose of water in a manner to avoid inconvenience to others. The Contractor shall provide sumps, sedimentation tanks and other flow control devices as required by governing authorities.
- E. The Contractor shall provide standby equipment on site, installed and available, for immediate operation if required to maintain dewatering on a continuous basis in event any part of system becomes inadequate or fails. If dewatering requirements are not satisfied due to inadequacy or failure of dewatering system, the Contractor shall perform such work as may be required to restore damaged structures and foundation soils at no additional expense.

3.02 OBSERVATION WELLS

- A. The Contractor shall provide, take measurements and maintain at least a minimum number of observation wells (piezometers) as indicated and additional observation wells as may be required by governing authorities.
- B. The Contractor shall observe and record daily elevation of groundwater and piezometric water levels in observation wells.
- C. The Contractor shall repair or replace within 24 hours, observation wells that become inactive, damaged, or destroyed. If required, suspend

construction activities in areas where observation wells are not functioning properly until reliable observations can be made. The Contractor shall add or remove water from observation well risers to demonstrate that observation wells are functioning properly.

- D. The Contractor shall remove observation wells when dewatering completed.

END OF SECTION

SECTION NO. 02200

EARTHWORK

PART 1 – GENERAL

1.01 WORK INCLUDED

- A. The work covered by this Section includes furnishing all labor, equipment, and materials required to accomplish all clearing, grubbing, excavation, dewatering, sheeting, backfilling, grading, and any other similar earthwork operation which may be necessary to properly complete the work. All work shall be done in conformity with the Specifications and the directions of the Engineer.

- B. This Section includes the following:
 - 1. Preparing and grading subgrades for slabs, walks, pavements and landscaping.
 - 2. Excavating and backfilling for buildings and structures.
 - 3. Drainage and moisture-control fill course for slabs-on-grade.
 - 4. Subbase course for walks and pavements.
 - 5. Subsurface drainage backfill for walls and trenches.
 - 6. Excavating and backfilling trenches within building lines.
 - 7. Excavating and backfilling for underground mechanical and electrical utilities and appurtenances.

1.02 RELATED DOCUMENTS

- A. Division 1: General Requirements.
- B. Division 2: Site Work.

1.03 DEFINITIONS

- A. Excavation: Consists of the removal of material encountered to subgrade elevations and the reuse or disposal of materials removed.
- B. Subgrade: The uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.
- C. Borrow: Soil material obtained off-site when sufficient approved soil material is not available from excavations.
- D. Subbase Course: The layer placed between the subgrade and base course in a paving system or the layer placed between the subgrade and surface of a pavement or walk.
- E. Base Course: The layer placed between the subbase and surface pavement in a paving system.
- F. Drainage Fill: Course of washed granular material supporting slab-on-grade placed to cut off upward capillary flow of pore water.
- G. Unauthorized Excavation: Consists of removing materials beyond indicated subgrade elevations or dimensions without direction by the Engineer. Unauthorized excavation, as well as remedial work directed by the Engineer, shall be at the Contractor's expense.
- H. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below ground surface.
- I. Utilities: On-site underground pipes, conduits, ducts and cables, as well as underground services within building lines.

1.04 SUBMITTALS

- A. General: Submit the following according Section 01300 of the Specifications.
- B. Product data for the following:
 - 1. Each type of plastic warning tape.
 - 2. Filter fabric.
 - 3. Ground stabilization fabric.

- C. Samples of the following:
 - 1. 20-lb samples sealed in airtight containers, of each proposed fill and backfill soil material from on-site or borrow sources.
 - 2. 12-by-12-inch sample of filter fabric.
 - 3. 12-by-12-inch sample of ground stabilization fabric.

- D. Test Reports: In addition to test reports required under field quality control, submit the following:
 - 1. Laboratory analysis of each soil material proposed for fill and backfill from on-site and borrow sources.
 - 2. One optimum moisture-maximum density curve for each soil material.
 - 3. Report of field density test of each stratum tested.

1.05 SUMMARY

- A. The elevations shown on the Drawings as existing are taken from the best existing data and are intended to give reasonable, accurate information about the existing elevations. They may not be exact, and the Contractor must satisfy himself as to the exact quantities of excavation and fill required.

- B. Earthwork operations shall be performed in a safe and proper manner with appropriate precautions being taken against all hazards.

- C. All excavated and filled areas for structures, trenches, fills, topsoil areas, embankments and channels shall be maintained by the Contractor in good condition at all times until final acceptance by the Owner. All damage caused by erosion or other construction operations shall be repaired by the Contractor using material of the same type as the damaged material.

- D. Earthwork within the public rights-of-way shall be done in accordance with requirements and provisions of the permits issued by applicable agencies for the construction within their respective rights-of-way. Such requirements and provisions, where applicable, shall take precedence and supersede the provisions of these Specifications.

- E. The Contractor shall control grading in a manner to prevent water running into excavations. Obstruction of surface drainage shall be avoided and

means shall be provided whereby storm water can be uninterrupted in existing gutters, other surface drains, or temporary drains. Free access must be provided to all fire hydrants, valves, and meters.

- F. No classification of excavated materials will be made. Excavation work shall include the removal and subsequent handling of all materials excavated or otherwise removed in performance of the contract work, regardless of the type, character, composition, or condition thereof.
- G. Tests for compaction and density shall be conducted by the Engineer or by an independent testing laboratory selected by him. Costs of compaction tests performed by an independent testing laboratory shall be paid for by the Contractor. The Contractor shall make all necessary excavations and shall supply any samples of materials necessary for conducting compaction and density tests. The cost of all retests made necessary by the failure of materials to conform to the requirements of these Contract Documents shall be paid by the Contractor.
- H. All earthwork operations shall comply with the requirements of OSHA Construction Standards, Part 1926, Subpart P, Excavations, Trenching, and Shoring, and Subpart O, Motor Vehicles, Mechanized Equipment, and Marine Operations, and shall be conducted in a manner acceptable to the Owner and the Engineer.
- I. It is understood and agreed that the Contractor has made a thorough investigation of the surface and subsurface conditions of the site and any special construction problems which might arise as a result of nearby watercourses and floodplains, particularly in areas where construction activities may encounter water-bearing sands and gravels or limestone solution channels. The Contractor shall be responsible for providing all services, labor, equipment, and materials necessary or convenient to him for completing the work within the time specified in these Contract Documents.

1.06 QUALITY ASSURANCE

- A. The Contractor shall perform earthwork in compliance with the requirements of all authorities having jurisdiction over the construction.
- B. Testing and Inspection Service: The Engineer or a qualified independent geotechnical engineering testing agency, designated by the Engineer, will be employed to classify proposed on-site and borrow soils to verify that soils comply with specified requirements and to perform required field and laboratory testing.

- C. Pre-installation Conference: The Contractor will conduct a conference at Project site to comply with requirements of Division 1, Section 01200, Project Meetings.
 - 1. Before commencing earthwork, the Contractor will meet with representatives of the governing authorities, Owner, Engineer, consultants, Geotechnical Engineer, independent testing agency and other concerned entities. The Contractor will review earthwork procedures and responsibilities including testing and inspection procedures and requirements. The Contractor shall notify participants at least 3 working days prior to convening conference. The Contractor shall record discussions and agreements and furnish a copy to each participant.

1.07 PROJECT CONDITIONS

- A. Existing Utilities: The Contractor shall not interrupt existing utilities serving facilities occupied by the Owner or others except when permitted in writing by the Engineer and then only after acceptable temporary utility services have been provided.
 - 1. The Contractor shall provide a minimum 48-hours written notice to the Engineer and receive written notice to proceed before interrupting any utility.
- B. The Contractor shall demolish and completely remove from site existing underground utilities indicated on the plans to be removed. The Contractor shall coordinate with utility companies to shutoff services if lines are active.

PART 2 – PRODUCTS

2.01 SOIL MATERIALS

- A. The Contractor shall provide approved borrow soil materials from off-site when sufficient approved soil materials are not available from excavations.
- B. Satisfactory Soil Materials are defined as ASTM D 2487 soil classification groups GW, GP, GM, SW, SP, SM, ML and CL; free of rock or gravel larger than 2 inches in any dimension, debris, waste, frozen materials, vegetation and other deleterious matter.
- C. Unsatisfactory Soil Materials are defined as ASTM D 2487 soil classification groups GC, SC, MH, CH, OL, OH and PT.

- D. Backfill and Fill Materials shall be satisfactory soil materials.
- E. Engineered fill is defined as subbase or base materials.

2.02 ACCESSORIES

- A. Detectable Warning Tape shall be acid and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches wide and 4 mils thick minimum, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 2'-6" deep.
 - 1. Tape Colors: Provide tape colors to utilities as follows:
 - a. Red: Electric.
 - b. Yellow: Gas, oil, steam and dangerous materials.
 - c. Orange: Telephone and other communications.
 - d. Blue: Water systems.
 - e. Green: Sewer systems.
- B. The Contractor shall install a continuous run of plastic metallic tape above the top of the pipe at 18 to 24 inches below finished grade. Tape shall be suitable for detection with metal pipe location equipment, labeled to identify contents of pipe, and brightly colored to contrast with the soil. In addition to the tape, the contractor shall install a continuous run of tracer wire attached to pipe runs greater than 500'. This tracer wire shall be attached to a 2" galvanized pipe with a 180 degree bend at top extending 36" above grade for connection to locator equipment.
- C. Fabric:
 - 1. Filter Fabric (for underdrains and other drainage use) shall be a non-woven pervious geotextile fabric that meets the following requirements:
 - a. Weight (ASTM D-3776): 4.5 ounces per square yard.
 - b. Thickness (ASTM D-1777): 60 mils.
 - c. Grab Tensile Strength (ASTM D-1682): 120 pounds.
 - d. Grab Elongation (ASTM D-1682): 55%.
 - e. Flow Rate (CFMC-GET-2): 285 gallons per minute per square foot.

PART 3 – EXECUTION

3.01 PREPARATION

- A. The Contractor shall protect structures, utilities, sidewalks, pavements and other facilities from damage caused by settlement, lateral movement, undermining, washout and other hazards created by earthwork operations.
- B. The Contractor shall protect subgrades and foundation soils against freezing temperatures or frost and provide protective insulating materials as necessary.
- C. The Contractor shall provide erosion control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

3.02 DRAINAGE

- A. The Contractor shall provide positive drainage on site at all times and prevent surface water and subsurface or ground water from entering excavations, from ponding on prepared subgrades and from flooding Project site and surrounding area.
- B. The Contractor shall protect subgrades and foundation soils from softening and damage by rain or water accumulation.

3.03 EXCAVATION

- A. The Contractor shall perform all excavation of every description, and of whatever substances encountered, to the dimensions and levels shown on the Drawings and/or specified.
- B. Over excavation of the organic sand layer (i.e. small to large roots) shall be performed. The preliminary soils investigation report shall be made available at the contractors. The over excavation operations shall be monitored by a licensed geotechnical engineer to evaluate the horizontal and vertical extent of the organic zone. The geotechnical engineer shall certify that (1) all organics are removed; and (2) excavation of acceptable soils has been minimized. The over excavation shall be performed within and to a distance of at least five feet beyond each individual structure footprint.

After the organics are removed, compacted of the resulting subgrade should not be attempted. Dry structural fill, as approved by the engineer, shall be placed over the subgrade with relatively light tracked equipment. No rubber tired equipment should be allowed to traverse the areas until at

least two and a half feet of compacted structural fill is in place. The structural fill, after placement and compaction, should have densities equivalent to 95 percent of the Modified Proctor maximum dry density (ASTM D 1557) design grade elevations.

- C. **Unclassified Excavation:** Excavation is unclassified and includes excavation to required subgrade elevations regardless of the character of materials and obstructions encountered.
 - 1. Rock excavating equipment for footings, trenches and pits shall be equivalent to Caterpillar Model No. 215D LC track-mounted hydraulic excavator, equipped with a 42-inch-wide short-tip radius rock bucket, rated at not less than 120-hp flywheel power with bucket-curling force of not less than 25,000 lbs. and stick-crowd force of not less than 18,700 lbs., measured according to SAE Standard J1179.
 - 2. Rock-excavating equipment for open excavations shall be equivalent to Caterpillar Model No. 973, heavy-duty, track-mounted loader, rated at not less than 210-hp flywheel power and developing minimum of 45,000-lb breakout force, measured according to SAE Standard J732c-69. Excavations more than 10 feet in width and pits more than 30 feet in either length or width are defined as open excavations.
- D. Rock will not be classified as such for additional payment. The Bidder shall satisfy himself as to rock and other materials which may be encountered in excavation, and make proper allowances for all contingencies in his lump sum or unit price bid. Neither the Owner nor the Engineer will be responsible for subsurface conditions found.
- E. Excavation for pipelines shall be made in open cut unless shown otherwise on the Drawings. Trenches shall be cut true to the lines and grades shown on the Drawings or established by the Engineer on the ground. The banks of trenches shall be cut in vertical parallel planes equidistant from the pipe centerline. From an elevation 12 inches above the top of the pipe to the bottom of the trench, the horizontal distance between vertical planes for different sizes of pipe shall not exceed those specified and/or shown on the Drawings. When sheeting is used, the width of the trench shall be considered as the distance between the inside faces of the sheeting. The bottom of the trench shall be cut carefully to the required grade of the pipe except where bedding materials or cradles are required, in which case the excavation shall extend to the bottom of the bedding or cradles as shown on the Drawings. Minimum pipe cover shall be as specified or shown on the Drawings.
 - 1. Bell holes for bell and spigot pipe and mechanical joint pipe shall be excavated at proper intervals so the barrel of the pipe will rest

for its entire length upon the bottom of the trench. Bell holes shall be large enough to permit proper installation of all joints in the pipe. Bell holes shall not be excavated more than 10 joints ahead of pipe laying. No part of any bell or coupling shall be in contact with the trench bottom, trench walls, or granular embedment when the pipe is jointed.

2. Pipe trenches shall not be excavated more than 100 feet in advance of pipe laying and all work shall be performed to cause the least possible inconvenience to the public. Adequate temporary bridges or crossings shall be constructed and maintained where required to permit uninterrupted vehicular and pedestrian traffic.
 3. Unless otherwise specified herein or shown on the Drawings, wherever pipe trenches are excavated below the elevation shown on the Drawings, the Contractor, at his own expense, shall fill the void thus made to the proper grade with Class "C" concrete or with compacted layers of crushed rock or gravel conforming to the requirements for bedding materials.
 4. Rock, boulders and large stones encountered in trenches shall be removed to provide a clearance of not less than 6 inches in every direction from all parts of pipe, fittings, and other appurtenances.
 5. In all cases where materials are deposited along open trenches they shall be placed so that no damage will result to the work or adjacent property in case of rain or other surface wash.
- F. If additional material, other than that to be obtained from excavation, is required for backfilling and grading, the Contractor shall obtain that additional material from borrow as directed by the Engineer.
- G. All excess excavated earth, and all excavated rock, shall be hauled off to a designated spoil area. Surfaces and slopes of spoil areas shall be left smooth and free to drain.
- H. All ditches are to be closed at the end of each work day.

3.04 STABILITY OF EXCAVATIONS

- A. Contractor must comply with all local codes, ordinances and requirements of authorities having jurisdiction to maintain stable excavations.
- B. The sides of all excavations shall be sufficiently sheeted, shored, and braced whenever necessary to prevent slides, cave-ins, settlement, or movement of the banks and to maintain the excavation clear of all

obstructions. Wood or steel sheeting of approved design and type shall be used in wet, saturated, or flowing ground. All sheeting, shoring, and bracing shall have sufficient strength and rigidity to withstand the pressures exerted.

- C. The responsibility for correctly assessing the need for sheeting and analyzing the stresses induced shall be the total responsibility of the Contractor. Since the Engineer does not dictate or determine the Contractor's sequence or limits of excavation, the Engineer assumes no responsibility for sheeting and shoring. The Contractor must employ or otherwise provide for adequate professional structural and geotechnical engineering supervision to assess the need for sheeting and shoring and design same. Results of sheeting and shoring analysis and design shall be submitted to the Engineer upon request.
- D. Excavations adjacent to existing or proposed buildings and structures, or in paved streets or alleys shall be sheeted, shored, and braced adequately to prevent undermining beneath or subsequent settlement of such structures or pavements. Underpinning of adjacent structures shall be done when necessary to maintain structures in safe condition. Any damage to structures or pavements occurring through settlements, water or earth pressures, slides, caves, or other causes; due to failure or lack of sheeting or bracing, or due to improper bracing; or occurring through negligence or fault of the Contractor in any other manner shall be repaired by the Contractor at his own expense.
- E. Sheeting, shoring, or bracing materials shall not be left in place unless otherwise specified or shown on the Drawings or ordered by the Engineer in writing. Such materials shall be removed in such manner that no danger or damage will occur to new or existing structures or property, public or private, and so that cave-ins or slides will not take place. Steel sheeting may be removed without cutting, provided the rate of removal is in pace with tamping and backfilling operations to assure complete filling of the void created by the withdrawal of the sheeting. Complete withdrawal of the sheeting in advance of tamping and backfilling will not be permitted.
- F. All holes and voids left in the work by the removal of sheeting, shoring, or bracing shall be filled and thoroughly compacted.

3.05 UNAUTHORIZED EXCAVATION

- A. The Contractor shall not commence or continue any excavation until authorized by the Engineer.
- B. The Contractor shall fill any unauthorized excavation as directed by the Engineer.

3.06 STORAGE OF SOIL MATERIALS

- A. The Contractor shall stockpile excavated materials acceptable for backfill and fill soil materials, including acceptable borrow materials.
- B. The Contractor shall stockpile soil materials without intermixing.
- C. The Contractor shall place, grade and shape stockpiles to drain surface water.
- D. The Contractor shall cover to prevent wind-blown dust.
- E. The Contractor shall stockpile soil materials away from edge of excavations.
- F. The Contractor shall not store soil materials within drip line of remaining trees.

3.07 BACKFILLING

- A. The backfilling of sewer and pipe line trenches shall be started immediately after the construction of same has been inspected by the Engineer. Selected backfill material shall consist of finely divided earth, stone, dust, sand, crushed stone, or other approved material free from all wood, vegetable matter, debris, and other objectionable material and having scattered clods, stone or broken concrete less than 2 inches in maximum dimension.
 - 1. Material that is too dry to be adequately compacted shall receive a prior admix of sufficient water to obtain optimum moisture content. Material having excessive water content shall not be placed at any time.
 - 2. Selected backfill material shall be carefully placed in the trench on each side of the pipe in 6-inch layers for the full width of the trench and thoroughly and uniformly compacted by tamping or ramming. Sufficient select backfill material shall be placed around the pipe and compacted to provide not less than 12 inches cover over the top of the pipe.
 - 3. Backfilling shall be carried on simultaneously on both sides of the pipe and in a manner which will prevent injurious side pressures. If suitable select materials are not available from the trench excavation, the Contractor will be required to obtain the select materials elsewhere.

- B. Across sidewalks and driveways and at any other places subject to vehicular traffic or other superimposed loads, trench backfill shall be compacted in 6 inch layers to the density of the original adjacent material for the full depth of the trench. The top 6 inches of backfill shall consist of uniformly graded crushed stone.
- C. Roadway subgrade shall be accomplished in layers not exceeding 6 inches in depth and each layer shall be thoroughly compacted to minimum 98 percent of the Modified Proctor maximum dry density as determined by ASTM D-698. This operation shall include any reshaping and wetting required to obtain proper compaction. All soft or otherwise unsuitable material shall be removed and replaced with suitable material.
- D. In all other areas not affected by superimposed loads, trench backfill may be placed from the level 12 inches above the top of pipe upward without compaction. At these places backfill shall be neatly rounded over the trench to sufficient height to allow for settlement to grade after consolidation.
- E. Wherever the subgrade is by nature too soft or mucky, in the opinion of the Engineer, for the proper installation of the pipe, he may order the Contractor to undercut the trench and backfill with stone or gravel bedding material. The stone shall be brought to the subgrade required by the class of bedding for the particular location and compacted.
- F. Where slabs are to be constructed on earth fill, the fill shall be of select material. Selected backfill material shall consist of finely divided earth, stone, dust, sand, crushed stone, or other approved material free from all wood, vegetable matter, debris, and other objectionable material and having scattered clods, stone or broken concrete less than 2 inches in maximum dimension. The fill shall be placed in layers of not more than six inches compacted thickness and compacted by the use of heavy rolling or power tamping equipment to secure at least 95% of the Modified Proctor Dry Density.
- G. Backfills around structures shall be properly placed and compacted. The fills shall be brought up in layers. The layers shall be thoroughly compacted to at least 95% of the Modified Proctor Dry Density, each layer to be not deeper than six inches compacted thickness. Compaction around structures shall be by use of heavy power tamping equipment.

3.08 STORM DRAIN TRENCH BACKFILL

- A. The Contractor shall shape bedding course to provide continuous support for bells, joints and barrels of storm drain pipe.
- B. After the trench bottom has been exposed and before placement of any backfill, the trench bottom shall be inspected by the Engineer.

- C. A minimum 12-inch depth course of No. 57 stone wrapped in filter fabric shall be placed in the bottom of the trench. None of the aggregate in this 12-inch course shall be in contact with soil. The filter fabric shall be lapped a minimum of two (2) feet at the joints.
- D. Aggregate backfill shall be placed in 8-inch layers on top of the filter fabric wrapped 12-inch course. The first 8-inch layer shall be consolidated to a uniform density. Each subsequent 8-inch layer of aggregate backfill shall be placed and consolidated to a uniform density. Care shall be exercised in the placement of each layer to see that each section is continuously supported throughout its length. Aggregate shall be so placed up to one-half ($\frac{1}{2}$) the outside diameter of the pipes.
- E. The trench above one-half ($\frac{1}{2}$) the outside diameter of the pipes shall be backfilled with material meeting the requirements of Section 207 of the above-cited standard specification for normal backfill. The material shall be placed in 6-inch layers and compacted to 95 percent of the laboratory dry density except that the 12 inches immediately underneath the stone base shall be compacted to 100 percent of the laboratory dry density.
- F. Compaction tests shall be performed on each 6-inch layer of normal backfill between and alongside each 60-inch pipe at intervals not exceeding 200 feet. The next layer shall not be placed until the specified compaction has been achieved in each underlying layer.

3.09 MOISTURE CONTROL

- A. The site shall be kept free of surface water at all times. The Contractor shall install drainage ditches and dikes and shall perform all pumping and other work necessary to divert or remove rainfall and other accumulations of surface water from the excavations. The diversion and removal of surface water shall be performed in a manner that will prevent the accumulation of water within the construction area where it may be detrimental.
- B. Where groundwater is encountered, the Contractor shall make the effort necessary to secure a dry excavation. In sandy and in other suitable type soils, dewatering shall be done by well pointing. If, in the opinion of the Engineer, the Contractor has failed to obtain an absolutely dry excavation by insufficient use of all known methods of dewatering, the Engineer may order the Contractor to excavate below grade and place not less than 6 inches of graded crushed stone fill material over the bottom to form french drains to suitably located sumps and to remove the water by bailing or pumping. The graded crushed stone fill material shall be placed at the Contractor's own expense and shall be of such depth that there shall be no water in the excavation at the time of pouring concrete. All costs of

equipment, labor, and materials required for dewatering shall be included in the bid price.

3.10 FIELD QUALITY CONTROL

- A. The Contractor shall inspect and test each subgrade and each fill or backfill layer. Do not proceed until test results for previously completed work verify compliance with requirements.
1. Perform field in-place density tests according to ASTM D 1556 (sand cone method), ASTM D 2167 (rubber balloon method), or ASTM D 2937 (drive cylinder method), as applicable.
 - a. Field in-place density tests may also be performed by the nuclear method according to ASTM D 2922, provided that calibration curves are periodically checked and adjusted to correlate to tests performed using ASTM D 1556. With each density calibration check, check the calibration curves furnished with the moisture gages according to ASTM D 3017.
 - b. When field in-place density tests are performed using nuclear methods, make calibration checks of both density and moisture gages at beginning of work, on each different type of material encountered and at intervals as directed by the Engineer.
 2. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, perform at least one field in-place density test for every 2,000 sq. ft. or less of paved area or building slab, but in no case fewer than three tests.
 3. Foundation Wall Backfill: In each compacted backfill layer, perform at least one field in-place density test for each 100 feet or less of wall length, but no fewer than two tests along a wall face.
 4. Trench Backfill: In each compacted initial and final backfill layer, perform at least one field in-place density test for each 150 feet or less of trench, but no fewer than two tests.
- B. When the tests indicate that subgrades, fills or backfills are below specified density, the Contractor shall scarify and moisten or aerate, or remove and replace soil to the depth required, re-compact and retest until required density is obtained.

3.11 PROTECTION AND MAINTENANCE

- A. The Contractor shall protect newly graded areas from traffic, freezing, erosion, trash and debris.
- B. The Contractor shall repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or lose compaction due to subsequent construction operations or weather conditions.

The Contractor shall scarify or remove and replace material to depth directed by the Engineer. The Contractor shall reshape and re-compact at optimum moisture content to the required density.

- C. Where settling occurs during the Project correction period, the Contractor shall remove finished surfacing, backfill with additional approved material, compact and reconstruct surfacing.

The Contractor shall restore appearance, quality and condition of finished surfacing to match adjacent work and eliminate evidence of restoration to the greatest extent possible.

3.12 DISPOSAL OF WASTE AND UNSUITABLE MATERIALS

- A. All materials removed by excavation, which are suitable for the purpose, shall be used to the extent possible for backfilling pipe trenches, foundations, and footings and for making embankment fills or for such other purposes as may be shown on the Drawings. All materials not used for such purposes shall be considered as waste materials and the disposal thereof shall be made by the Contractor in a manner and at locations approved by the Engineer.
- B. Waste materials shall be spread in uniform layers and neatly leveled and shaped. Spoil banks shall be provided with sufficient and adequate openings to permit surface drainage of adjacent lands.
- C. Unsuitable materials, consisting of wood, vegetable matter, debris, soft or spongy clay, peat, and other objectionable material so designated by the Engineer shall be removed from the work site and disposed of by the Contractor in a manner and at a location approved by the Engineer.
- D. No unsuitable or waste material shall be dumped on private property unless written permission is furnished by the owner of the property and unless a dumping permit is issued from the local jurisdiction.

3.13 FINAL GRADING

- A. After other earthwork operations have been completed, the sites of all structures, roads, and embankments shall be graded within the limits and

to the elevations shown on the Drawings. Grading operations shall be so conducted that materials shall not be removed or loosened beyond the required limits. The finished surfaces shall be left in smooth and uniform planes such as are normally obtainable from the use of hand tools. If the Contractor is able to obtain the required degree of evenness by means of mechanical equipment he will not be required to use hand labor methods. Slopes and ditches shall be neatly trimmed and finished to slopes shown on the Drawings unless otherwise approved by the Engineer.

- B. Unless otherwise specified or shown on the Drawings, all finished ground surfaces shall be graded and dressed to present a surface varying not more than plus or minus 0.10 foot as regards local humps or depressions and shall be acceptable to the Engineer.

3.14 TOPSOIL

- A. All areas to be sprigged or planted with trees, shrubs, or grass as shown on the plans shall be prepared by grading to a smooth, even surface to a level 4 inches below the elevation of the finished grade shown on the Drawings. It shall then be brought to a neat and finished grade by the addition of 4 inches of approved topsoil.
- B. Topsoil removed from the construction area may be stockpiled and reused or topsoil may be obtained from approved borrow areas. If obtained from borrow areas, the Contractor shall make suitable arrangements with the property owner and shall pay all costs incident to the borrowed material including royalties.

3.15 SETTLEMENT

- A. Tanks shall be filled to their maximum level and allowed to sit for 7 days prior to the final piping connections are made.
- B. The Contractor shall be responsible for all settlement of backfill, fills, and embankments which may occur within one (1) year after final acceptance of the work by the Owner.
- C. The Contractor shall make, or cause to be made, all repairs or replacements made necessary by settlement within 30 days after receipt of written notice from the Engineer or Owner.

END OF SECTION

SECTION NO. 02220

EXCAVATION, BACKFILL, FILL, AND GRADING FOR STRUCTURES

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials, equipment and incidentals necessary to perform all excavation, backfill, fill, grading for structures, and finish grading in preparation for landscaping and grassing, required to complete the work shown and specified. The work shall include, but not necessarily be limited to: excavation for structures, footings, all backfilling and fill: embankment and grading for structures; disposal of waste and surplus materials; and all related work such as sheeting, bracing and pumping.
- B. Topsoil, if any, excavated under this Section may be salvaged for convenience for use as necessary for landscaping.

1.02 RELATED WORK

- A. Section 02100: Site Preparation
- B. Section 02221: Excavation, Backfill, Fill & Grading for Pipe

1.03 QUALITY ASSURANCE

- A. Provide services of a registered engineer or land surveyor to lay out site.
- B. Establish and maintain benchmarks on the site for reference. All vertical dimensions shall be checked from these benchmarks.
- C. Finished grades, as used herein, mean the required final grade elevations indicated on the drawings. Should finished grades shown on spot elevations conflict with those shown by the contours, the spot elevations shall govern.
- D. Soil moisture during fill placement should be maintained within four percent (4%) of the optimum value determined by ASTM D 698 for general area and structural fill and within two percent (2%) of optimum for wall and backfill.
- E. All fill areas and areas at grade shall be proof-rolled with a fully loaded tri-axle dump truck or a 20-ton roller to detect any soft areas. Any areas which pump or rut excessively and cannot be densified by continued rolling shall be undercut.

1.04 JOB CONDITIONS

- A. Limit grading to the work as shown and do not disturb the existing terrain or trees outside this work.
- B. Subsurface investigation has been performed and data is available for reference. However, neither Architect, nor Owner assumes responsibility for completeness or accuracy of data contained therein and no claims for extra compensation or extension of time will be considered based on assumptions. Data may be examined in Owner's office or by making a written request of the Engineer..
- C. Items of historic or archaeological value discovered during earthwork operations shall remain property of the Owner.

1.05 PROTECTION

- A. Lateral Support of Excavation for Structures: Furnish, put in place, and maintain sheeting and bracing required to support the sides of the excavations, to prevent any movement which could in any way diminish the width of the excavation below that necessary for proper construction, and to protect streets and utilities from damage due to lateral movement or settlement of ground.
- B. Control of Groundwater Level:
 - 1. Maintain the groundwater level below subgrade of the structure until the concrete structures are up high enough to prevent flooding the structure. Support shall be maintained at both bottom and top levels of wall to prevent flotation.
 - 2. After the structure has been completed in its entirety, backfill as described hereinafter.
 - 3. Flotation shall be prevented by maintaining a positive and continuous operation of the dewatering system. The responsibility and liability for all damages which may result from failure of this system shall be included in the work of this Section.
 - 4. Disposal of drainage water shall be in an area approved by the Owner. Precautions shall be taken to prevent the flow or seepage of drainage back into the drainage area. Particular care shall be taken to prevent the discharge of unsuitable drainage to a water supply or surface water body.
 - 5. Removal of dewatering system shall be accomplished after the dewatering system is no longer required; the material and equipment constitute the system.

1.06 TESTING

- A. Additional soil testing shall be performed by an independent testing agency selected by the Owner. The Contractor shall pay for any additional soil testing.
- B. Testing agency shall perform the following testing:
 - 1. Compaction tests in accord with ASTM D698-78.
 - 2. Field density tests for each 2'-0" lift, in accord with ASTM D2937-76 one test for each 10,000 sq. ft. of fill. One test is to be conducted for at least every 500 cubic feet of fill in trenches or restricted area fills.
 - 3. Inspection and testing subgrades and proposed fill materials.
 - 4. Examination of foundation excavations to determine if required soil bearing has been achieved.
 - 5. Examination of excavations to determine that required rock has been removed prior to fill placing and compacting.
 - 6. Verification of unsuitable soil materials to be removed, where classified excavation is indicated.
- C. Duties relative to testing include:
 - 1. Provide representative fill soil samples to testing agency for test purposes. Provide 50 lb. of samples of each fill soil.
 - 2. Advise testing agency sufficiently in advance of operations to allow for completion of quality tests and for assignment of personnel.
- D. The responsibility for paying costs of additional testing beyond scope of that required and for retesting if initial test reveals nonconformance with specified requirements shall be included as part of the work in this Section.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Structural Fill:
 - 1. Compacted granular fill which will provide support for building or structure foundations will be referred to as structural fill. Backfill

which is placed against the exterior side of the building walls or as fill over pipe lines will be referred to as common fill.

2. The soil subgrade immediately beneath pavements and floor slabs should be compacted to at least 98% in the upper 18" of fill areas and the upper 12" of cut areas if they become disturbed during construction.
3. Materials for compacted granular fill shall be gravel, sandy gravel, or gravelly sand free of organic material, loam, wood, trash, and other objectionable material and shall be well graded within the following limits:

Sieve Size	Percent Finer by Weight
6"	100
No. 4	20-95
No. 40	0-60
No. 200	0-8

Fill soils should be non-expansive material with a plasticity index of less than 30, a liquid limit of less than 50 and a maximum dry density (standard proctor ASTM D 698) of at least 90 pcf. Soil classifications GM, GC, SW, SP, SM, SC, ML, and CL will be allowed provided they meet the above criteria.

- B. Common Fill: Mineral soil, substantially free of clay, organic material, loam, wood, trash, or other objectionable material which may be compressible or which cannot be properly compacted. Common fill shall not contain stones larger than 10" (6" max. for within 2'-0" of roadway surface) in any dimension. Common fill shall not contain broken concrete, masonry, rubble, asphalt pavement or other similar materials. It shall have physical properties such that it can be readily spread and compacted during filling.
- C. Except as noted in the following paragraph, material used below subgrade within the limits of support of structures shall consist of lean concrete or material meeting the requirements for structural fill as defined above. Crushed stone of #57 size or finer may be used.
- D. Where excavation occurs in rock, the working mat shall consist of a lean concrete placed directly on firm rock after all loose rock has been removed.

PART 3 - EXECUTION

3.01 EXCAVATION BELOW GRADE

- A. If the bottom of any excavation is taken out below the limits indicated or specified, it shall be refilled with concrete or 6" layers of compacted structural fill.

- B. If the subgrade surface is not cared for through failure to postpone final excavation immediately above the subgrade until shortly before placing of the new work thereon, or other failure, or neglect to conduct the excavation work properly so that the surface of the subgrade is in proper condition when ready for construction, the Contractor shall remove the unsuitable material and replace it with concrete or compacted structural fill.

3.02 STRUCTURE EXCAVATION AND COMPACTION PROCEDURES

- A. Excavation shall be made to such widths as will give suitable room for construction of the structures, for bracing and supporting, pumping and draining; and the bottom of the excavations shall be rendered firm and dry in all respects.
- B. Excavation and dewatering shall be accomplished by methods which preserve the undisturbed state of subgrade soils. Subgrade soils which become soft, loose, quick, or otherwise unsatisfactory for support of structures as a result of inadequate excavation, dewatering or other construction methods shall be removed and replaced by structural fill.
- C. Dewatering shall be such as to prevent boiling or detrimental saturation at the base of the excavation as specified herein. Install such means as required to preserve the stability of the base of the operation.
- D. Excavating equipment shall be satisfactory for carrying out the work in accordance with the Specification. In no case shall earth be plowed, scraped, or dug with machinery so near to the finished subgrade as to result in excavation of, or disturbance of material below grade.
- E. During final excavation to subgrade level, take whatever precautions are required to prevent disturbance and remolding of the subgrade. Material which has become softened and mixed with water shall be removed. Hand excavation of the final 3" to 6" will be required as necessary to obtain a satisfactory undisturbed bottom.
- F. When excavation for foundations has reached prescribed depths, the Owner's Representative shall be notified, and he will inspect conditions.
- G. The fill shall be placed in layers having a maximum thickness of 8" measured before compaction. Each layer of fill shall be compacted to at least 95% of maximum dry density determined by ASTM D 698.
- H. Large compaction equipment should operate no closer than 5' from backfilled wall.

3.05 COMPACTION

- A. Compaction shall be performed as specified hereinafter for the particular materials and operations.
 - 1. Self-propelled compactors shall make compaction passes at a speed of approximately 5 miles per hour.
 - 2. Areas adjacent to structures, and other areas inaccessible to a roller, shall be compacted with hand operated mechanical compaction equipment. Compaction of the fill by such means shall be to the same degree of compaction as obtained by other approved equipment, and the Owner may make the necessary tests to determine the amount of compactive effort necessary to obtain equal compaction. Unless such tests indicated that modifications may be made, the fill compacted by mechanical compactors shall be placed in 6" layers and thoroughly tamped over the entire surface. Compaction equipment is subject to approval by the Owner and/or Engineer.
- B. Compacted structural fill for structural foundations shall be placed in layers not to exceed 8" thickness by loose measure and shall be compacted to at least 95% of maximum dry density as determined by ASTM D 698. The upper one foot of material in fill or at grade areas or cut surfaces should be scarified and compacted to a 98% criteria.
- C. The surface of filled areas shall be graded to smooth, true lines, strictly conforming to grades indicated, and no soft spots or uncompacted areas will be allowed in the work.
- D. Temporary bracing shall be provided as required during filling and backfilling of all structures to protect partially completed structures against all construction equipment loads, hydraulic pressures and earth pressures.

3.06 BACKFILLING - COMMON FILL

- A. Common fill may be used as backfill against the exterior walls of the structures. Material conforming to the requirements of common fill shall be placed in layers having a maximum thickness of 6" measured before compaction.
- B. Common fill shall be compacted to at least 95% of maximum density as determined by ASTM compaction tests, Designation D 698.
- C. Materials placed in fill areas shall be deposited to the lines and grades shown making due allowance for settlement of the material and for the placing of topsoil thereon.
- D. The surfaces of filled areas shall be graded to smooth, true lines, strictly conforming to grades indicated on the paving and grading drawings, and no soft spots or uncompacted areas will be allowed in the work.

- E. No compacting shall be done when the material is too wet either from rain or from excess application of water. At such times, work shall be suspended until the previously placed and new materials have dried sufficiently to permit proper compaction.

3.07 EARTH EMBANKMENTS

- A. All organic materials, including peat and loam, shall be removed from areas beneath new embankments. If the subgrade slopes are excessive, the subgrade shall be stepped to produce a stable surface for the placement of the embankments. The natural subgrade shall then be compacted by mechanical compaction equipment. The prepared subgrade shall be inspected and approved by the Owner's Representative prior to the placement of structural fill.
- B. Fill shall be placed in layers 6" thick measured before compaction. Each layer shall be compacted to at least 95% of the maximum dry density as determined by the ASTM compaction test, Designation D-698.
- C. Existing slopes shall be reconstructed as shown.

3.08 DISPOSAL OF UNSUITABLE AND SURPLUS MATERIAL

- A. Unsuitable excavated materials and pavement shall become the property of the Contractor and removed and disposed of by him off the project site.
- B. Suitable excavated material may be used for fill or backfill if it meets the specifications for common fill and is approved by the Owner's Representative. Excavated material so approved may be neatly stockpiled at the site. If space limitations do not permit stock piling on the site, the Contractor will be required to make arrangements for off-site stockpiling. Transport of such material from and to the immediate site, including any stockpiling agreements, shall be entirely at the Contractor's expense and shall not constitute grounds for additional payment.
- C. Surplus excavated material shall be used to fill depressions or for other purposes as the Owner and/or Engineer may direct; otherwise, it shall become the property of the Contractor and shall be removed and disposed of by the Contractor off the project site.

3.09 GRADING

- A. Grading in preparation for placing of topsoil, planting areas, paved walks and drives and appurtenances shall be performed at all places indicated, to the lines, grades, and elevations shown, and shall be performed in such a manner that the requirements for formation of slopes, lines and grades can be followed. All material encountered, of whatever nature, within the limits indicated, shall be removed and disposed of as directed.

During the process of grading, the subgrade shall be maintained in such condition that it will be well drained at all times. When directed, temporary drains and drainage ditches shall be installed to intercept or divert surface water which may affect the prosecution or condition of the work.

- B. If, at the time of grading, it is not possible to place any material in its proper section of the permanent structure, it shall be stockpiled in approved areas for later use. No extra payment will be made for the stockpiling or double handling of excavated material.
- C. The right is reserved to make minor adjustments or revisions in lines or grades if found necessary as the work progresses, due to discrepancies or in order to obtain satisfactory construction.
- D. Stones or rock fragments larger than 4" in their greatest dimensions will not be permitted in the top 6" of the finished subgrade of all fills or embankments.
- E. In cuts, all loose or protruding rocks on the backslopes shall be barred loose or otherwise removed to line or finished grade of slope. All cut and fill slopes shall be uniformly dressed to the slope, cross section and alignment shown.

3.10 DEFINITION OF ROCK

- A. General Excavation - Any material which cannot be excavated with a single-tooth ripper drawn by a crawler tractor having a draw bar pull rated at not less than 56,000 pounds (Caterpillar D8K or equivalent) or excavated by a front-end loader with a minimum bucket breakout force of 25,600 pounds (Caterpillar 977 or equivalent).
- B. Trench Excavation - Any material that cannot be excavated with a backhoe having a bucket curling force rated at not less than 33,000 pounds (Caterpillar 225B or equivalent).

END OF SECTION

SECTION NO. 02221

EXCAVATION, BACKFILL, FILL, AND GRADING FOR PIPE

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. This section includes, except as elsewhere provided, all excavation for piping and associated appurtenances including: filling, backfilling, grading, disposal of surplus material and restoration of trench surfaces and easements.
- B. Furnish and place all sheeting, bracing, and supports and remove from the excavation all materials which the Engineer may deem unsuitable for backfilling. The bottom of the excavation shall be firm, dry and in all respects acceptable. Deposit pipe bedding, or refill for excavation below grade, directly on the bottom of the trench immediately after excavation has reached the proper depth and before the bottom of the trench has become softened or disturbed by any cause whatever. The length of open trench shall be related closely to the rate of pipe laying. All excavation shall be made in open trenches.

1.02 RELATED WORK

- A. Section 02100: Site Preparation.
- B. Section 02220: Excavation, Filling, Backfilling, Grading for Structures

PART 2 - MATERIALS

2.01 MATERIALS

- A. General:
 - 1. Materials for use as fill shall be as described below. For each material, notify the Owner's representative of the source of the material and furnish, for approval, a representative sample weighing approximately 50 pounds, at least ten calendar days prior to the date of anticipated use of such material.
 - 2. Materials shall be furnished as required from off site sources and hauled to the site.
 - 3. Disposal of unsuitable materials is specified in this Section. See paragraph 3.01.
- B. Common Fill:
 - 1. Common Fill shall consist of mineral soil, free of organic material, loam, wood, trash, and other objectionable material which may be compressible or which cannot be compacted properly. Common

fill shall not contain stones larger than 10" in any dimension, broken concrete, masonry, rubble, or other similar materials. It shall have physical properties such that it can be readily spread and compacted during filling.

2. Material falling within the above specification, encountered during the excavation, may be stored in segregated stockpiles for reuse. All material which, in the opinion of the Owner's Representative, is not suitable for reuse shall be spoiled as specified herein for disposal of unsuitable materials.

C. Crushed Stone:

1. Crushed stone shall be used for pipe bedding, manhole bases, as a drainage layer below structures with underdrains and at other locations indicated on the drawings.
2. Crushed stone shall be size No. 57.

PART 3 - EXECUTION

3.01 DISPOSAL OF MATERIALS

- A. Excavated material shall be stacked without excessive surcharge on the trench bank. Inconvenience to traffic and abutters shall be avoided as much as possible. Excavated material shall be segregated for use in backfilling as specified below.
- B. Surplus excavated material which is suitable for use in backfilling or for replacing rock and boulders shall be stockpiled. Unsatisfactory surplus material including paving, rock or boulders and other material, shall be disposed of.
- C. It is expressly understood that no excavated material shall be removed from the site of the work or disposed of by the Contractor except as directed by the Owner's representative.
- D. Should conditions make it impracticable or unsafe to stack material adjacent to the trench, the material shall be hauled and stored. When required, it shall be re-handled and used in backfilling the trench. No extra compensation will be made for re-handling material.

3.02 SHEETING AND BRACING

- A. Furnish, put in place, and maintain sheeting and bracing required to support the sides of the excavation and prevent loss of ground which could damage or delay the work or endanger adjacent structures. Care shall be taken to prevent voids outside of the sheeting. If voids are formed, they shall be immediately filled and rammed.

3.03 TEST PITS

- A. Contact and coordinate with local utilities before excavating test pits for the purpose of locating underground utilities of structures as an aid in establishing the precise location of new work. Test pits shall be backfilled as soon as the desired information has been obtained. The backfilled surface shall be maintained in a satisfactory condition for travel until resurfaced as hereinafter specified.
- B. Excavation of test pits shall be considered work incidental to furnishing and laying pipe.
- C. If, for any reason, a test pit is left open for any period of time, it shall be barricaded and lighted.

3.04 DRAINAGE

- A. Furnish all materials and equipment and perform all incidental work required to install and maintain the drainage system proposed for handling groundwater or surface water encountered. Construction shall not begin until the Owner's representative is assured that the proposed method will be satisfactory. The requirements for a stable subgrade are indicated above, and the Contractor must alter his drainage methods if the trench bottom is unsatisfactory.
- B. Provide pumping equipment and devices to properly remove and dispose of all water entering trench and excavation for structures. The grade shall be maintained acceptably dry until structures to be built therein are completed. All drainage shall be performed without damage to the trench, pavements, pipes or other utilities.
- C. Pipe and masonry shall not be laid in water or submerged within 24 hours after being placed. Water shall not flow over new masonry within four days after placement.
- D. In no event shall water rise to cause unbalanced pressure on structures until the concrete or mortar has set at least 24 hours. Prevent flotation of the pipe by promptly placing backfill.
- E. If underdrains are used for handling water, furnish and install pipe and crushed stone graded from coarse to fine, and furnish and install all pumps and equipment necessary to maintain the water level continuously at the required elevation. Pipe underdrains shall be laid with open joints and bedded in crushed stone for the full width of trench, to a depth of 6" below the invert of underdrain.
- F. The invert of underdrain shall be 12" below the normal subgrade. Pipe underdrains shall have no permanent outlet and shall be sealed at the completion of the work. The length of continuous underdrain to be used shall be limited as conditions require. An impervious bulkhead of clay or concrete shall be constructed in the trench bottom between 100 ft. lengths of the underdrainage system to obstruct the free flow of

groundwater after construction is completed. For all excavation below normal grade for the purpose of installing underdrains, the crushed stone and underdrain pipe shall be considered a part of the drainage work to be done under the pipe items. Continuously guard against the loss of earth through subbase or the underdrain. Should loss of either take place, alter the stone size to provide a satisfactory barrier or filter.

- G. Where other methods of handling water prove inadequate, furnish, install, operate, and remove proper well point facilities.

3.05 UNCLASSIFIED TRENCH EXCAVATION

- A. Excavation shall be made for all trenches which are required for the installation of pipes and manholes.
- B. Make excavations to the depth indicated on the drawings and in such a manner and to such widths as will give suitable room for laying the pipe within the trenches, for bracing and supporting, and for pumping and drainage facilities. Render the bottom of the excavations firm and dry in all respects.
- C. The trench may be excavated by machinery to, or just below the designated subgrade provided that the material remaining in the bottom of the trench is no more than slightly disturbed.
- D. Rock shall be removed to a minimum of 8" clearance around the bottom and sides of the pipe being laid.
- E. Where the pipes or ducts are to be laid directly on the trench bottom, the lower part of the trenches shall not be excavated to grade by machinery. The last of the material being excavated manually shall be done in such a manner that it will give a flat bottom true to grade, so that pipe or duct can be evenly supported on undisturbed material. Bell holes shall be made to provide proper bedding.

3.06 PIPE BEDDING

- A. The Contractor shall furnish and install pipe on the type of bedding shown on the drawings and as specified herein. Regardless of the type of bedding used, holes in the trench shall be provided to receive the pipe bell. The hole excavated shall be sufficient to relieve pipe bells of all loads and yet provide support over the total length of the pipe barrel.
- B. Bedding classes are as defined below and shown on the drawings:
 - 1. Two (2) types of bedding are specified:
 - a. For Class D Bedding, the trench bottom shall be hand shaped to receive the portion of the circumference of the pipe barrel shown on the drawings. Class D bedding shall

be used for all pipe bedding unless shown otherwise in the drawings.

- b. For Class C bedding, sand shall be compacted in the trench bottom, and compacted around the pipe to a depth shown on the drawings.
 - (1) Where the trench bottom has been excavated below grade, C bedding shall be used.
 - (2) Where consolidated rock has been moved from the trench bottom, Class C bedding shall be used.

3.07 BACKFILLING

- A. As soon as practicable after the pipe has been laid and jointed, backfilling shall begin and thereafter be prosecuted expeditiously. Where indicated on the drawings, crushed stone shall be placed and compacted to a point indicated on the detailed drawing.
- B. After the required crushed stone bedding has been placed, or after the pipe has been properly bedded on a shaped trench bottom, sand free from stones and other foreign material shall be placed to a depth of 1'-0" over the top of the pipe. Backfill shall be thoroughly compacted by hand-tamping as placed.
- C. Any space remaining between the pipe and side of the trench shall be packed full by hand shovel with sand, free from stones having a diameter greater than 2", and thoroughly compacted with a tamper as fast as placed up to a level of one (1) foot above the top of the pipe.
- D. The filling shall be carried up evenly on both sides with at least one person tamping for each person shoveling material into the trench.
- E. The remainder of the trench above the compacted backfill, as just described shall be filled and thoroughly compacted by rolling, ramming, or puddling, to prevent subsequent settling.
- F. Where pipes are laid across country, the trench backfill material shall be mounded 6" above the existing grade or as directed. Wherever a loam or gravel surface exists prior to cross country excavations, it shall be removed, conserved, and replaced to the full original depth as part of the work under the pipe items. In some areas it may be necessary to remove excess material during the cleanup process, so that the ground may be restored to its original level and condition. If loam or topsoil is not stored it may be replaced with loam or topsoil of equal quality and quantity.
- G. Where the pipes are laid in streets, the last 1'-0" layer shall be of aggregate base material otherwise thoroughly compacted.
- H. Backfill around manholes shall be selected material, compacted by puddling. All backfill shall be compacted, especially under and over pipes

connected to the structures. Selected backfill shall be free from stones larger than 3".

- I. Rock fragments shall not be placed until the pipe has at least 2'-0" of earth cover. Small stones and rocks shall be placed in thin layers alternating with earth to insure that all voids are completely filled. Filling shall not be dropped into the trench in a manner to endanger the pipe. Rock fragments used shall not exceed 10 pounds.
- J. Bituminous paving adjacent to or effected by the excavation shall be broomed and hosed-clean immediately after backfilling. Dust control measures shall be employed at all times.

3.08 RESTORING TRENCH SURFACE

- A. Where the trench occurs adjacent to paved street, in shoulders, sidewalks, or in cross-country areas, thoroughly consolidate the backfill and maintain the surface as the work progresses. If settlement takes place, immediately deposit additional fill to restore the level of the ground.
- B. The surface of any driveway or any other area which is disturbed by the trench excavation and which is not a part of the paved highway shall be restored to a condition at least equal to that existing before work began.
- C. In sections where the trench passes through grassy areas, remove and replace the soil, or loam seed. The depth of loam replaced shall be at least equal to that removed during trenching operations, but in no event shall it be placed less than 4" in depth.

3.09 FILL PLACEMENT

- A. General:
 - 1. Material placed in fill areas under and around structures shall be deposited within the lines and to the grades shown on the drawings, making due allowance for settlement of the material. Fill shall be placed only on properly prepared surfaces which have been inspected and approved by the Owner's Representative. If sufficient common fill material is not available from excavation on site, provide borrow as may be required.
 - 2. Gravel base course material and crushed stone shall be provided as borrow.
 - 3. Fill shall be brought up to substantial level lifts throughout the site, starting in the deepest portion of the fill. The entire surface of the work shall be maintained free from ruts, and in such condition that construction equipment can readily travel over any section. Fill shall not be placed against concrete structures until they have attained sufficient strength.

4. Fill shall be dumped and spread in layers by a bulldozer or other approved method. During the process of dumping and spreading, all roots shall be removed from the fill areas.
5. If the compacted surface of any layer of material is determined to be too smooth to bond properly with the succeeding layer, it shall be loosened by harrowing or by another approved method before the succeeding layer is placed.
6. All fill materials shall be placed and compacted in a dry condition. Dewater excavated areas as required to perform the work and in such a manner as to preserve the undisturbed state of the natural inorganic soils.

3.10 COMPACTION

- A. Gravel, sand and backfill in trenches shall be placed in layers not to exceed eight (8) inches in depth as measured before compaction. Each layer shall be compacted by a minimum of four (4) coverages with the equipment described below, to at least 95% of maximum dry density as determined by ASTM D1557, Method D. Incidental compaction due to traffic by construction equipment will not be credited toward the required minimum four (4) coverages.
- B. Common fill not within trenches shall be placed and compacted in a manner similar to that described above, with the following exceptions: layer thickness prior to compaction may be increased to 10" in open areas; and common fill except dike fill, required below water level in peat excavation areas may be placed as one lift, in-the-wet, to an elevation one (1) foot above the water level at the time of filling.
- C. Compaction equipment in open areas shall consist of fully loaded ten-wheel dump trucks, tractor dozers weighing at least 30,000 pounds and operated at top speed, or by vibratory roller.
- D. Areas adjacent to structures and other confined areas inaccessible to the roller or truck shall be compacted with approved hand guided mechanical compaction equipment. Compaction of the fill by such means shall be to the same degree of compaction as obtained by the rubber-tired equipment. Fill compacted by mechanical compactors shall be placed in 6" layers and thoroughly tamped over the entire surface.
- E. It is the intention that the fill materials, with respect to moisture, be used in the condition they are excavated insofar as this is practicable. Material which is too wet shall be spread on the fill area and permitted to dry, assisted by harrowing if necessary, until the moisture content is reduced to allowable limits.
- F. If the Owner's Representative shall determine that added moisture is required, water shall be applied by sprinkler tanks or other sprinkler

systems, which will ensure uniform distribution of the water over the area to be treated, and give complete and accurate control of the amount of water to be used. If too much water is added, the area shall be permitted to dry before compaction is continued.

3.11 GRADING

- A. Grading shall be performed at such places as are indicated on the drawings, to the lines, grades, and elevations shown and shall be made in such a manner that the requirements for formation of embankments can be followed. All unacceptable material encountered, of whatever nature within the limits indicated, shall be removed and disposed of as directed. During the process of excavation, the grade shall be maintained in such condition that it will be well drained at all times. When directed, temporary drains and drainage ditches shall be installed to intercept or divert surface water which may affect the progress or condition of the work.
- B. If at the time of excavation it is not possible to place any material in its proper section of the permanent structure, it shall be stockpiled in approved areas for later use.
- C. The right is reserved to make minute adjustments or revisions in lines or grades if found necessary as the work progresses, due to discrepancies on the drawings or in order to obtain satisfactory construction.
- D. Stones or rock fragments larger than 4" in their greatest dimensions will not be permitted in the top 6" of the subgrade line of all dikes, fills or embankments.
- E. All fill slopes shall be uniformly dressed to the slope, cross-section and alignment on the drawings.
- F. In cuts, all loose or protruding rocks on the back slopes shall be barred loose or otherwise removed to line or finished grade of slope. All cut and fill slopes shall be uniformly dressed to the slope, cross-section and alignment shown on the drawings.
- G. No grading is to be done in areas where there are existing pipe lines that may be uncovered or damaged until such lines which must be maintained are relocated, or where lines are to be abandoned, all required valves are closed and drains are plugged at manholes.

3.12 DISPOSAL OF UNSUITABLE SURPLUS MATERIAL

- A. Unsuitable and surplus activated materials and pavement shall become the property of the Contractor and removed and disposed of by him off the project site.
- B. Suitable excavated materials may be used for fill or backfill if it meets the Specification for common fill. Excavated material so approved may be

neatly stockpiled at the site where designated by the Owner's Representative provided there is an area available that will not interfere with the operation of the plant or inconvenience traffic of adjoining property Owners. If space limitations do not permit stockpiling on the site, make arrangements for offsite stockpiling.

- C. Surplus excavated materials may be used to fill depressions or other purposes as the Owner's Representative may direct.

3.13 DISPOSAL AND REPLACING OF ROCK

Remove and dispose of all pieces of rock which are not suitable for use in other parts of the work. Rock disposed of by hauling away to spoil area is to be replaced by approved surplus excavation obtained elsewhere on the site, insofar as it is available. Any deficiency in the backfill material shall be made up with acceptable material from outside sources as approved by the Owner's Representative.

END OF SECTION

SECTION NO. 02271

RIP RAP

PART 1 – GENERAL

1.01 WORK INCLUDED

The work covered by this Section includes furnishing all labor, equipment and materials required to furnish and install rip rap as specified herein and as shown on the Drawings.

1.02 RELATED WORK

- A. Division 1: General Requirements
- B. Division 2: Site Work

PART 2 - PRODUCTS

2.01 ROCK RIP RAP

- A. Rock rip rap shall be constructed using sound, dense, durable stones, or rock fragments, free from cracks, pyrite intrusions and other structural defects. Stones which will be used with mortar shall be free from dirt, oil, or other material that might prevent good adhesion with the mortar. Stones with a laminated structure shall be avoided. Field stones shall not be used as a source of rock for rip rap. Only rock that has been approved by the Engineer shall be used for rip rap.
- B. When the crushed aggregate is subjected to five alternations of the sodium sulfate soundness test, the weighted percentage of loss shall be not more than 12 percent.
- C. Shape of the stones shall be generally rectangular or cubic. Flat or elongated stones having a small dimension less than 1/3 of the large dimension shall not be used.
- D. At least 35 percent of the stones or rock fragments for plain rock rip rap shall weigh 125 pounds or more. The sizes of the stones shall be well graded from the smaller to the larger, with the largest stones being a maximum of two cubic feet in size.
- E. At least 90 percent of the stones or rock fragments for hand placed rock rip rap shall weigh 100 pounds or more and shall be not less than 12 inches long, 12 inches deep, and 8 inches wide.

PART 3 - EXECUTION

3.01 CREEK CROSSINGS

- A. Rip rap shall be installed at all creek and storm drain crossings where shown or required by the Engineer in accordance with the Drawing details and specifications. The dimensional width of rip rap material at creek or storm drain crossings shall be equal to the trench width cut to install the pipe line plus 6 feet. The method of installation shall be in accordance with 3.02 Construction Methods.
- B. Installation of rip rap shall be kept up as closely as possible with the progress of pipe laying so as to perform the work in a uniform workmanlike manner.

3.02 CONSTRUCTION METHODS

- A. Unless otherwise shown or specified, plain rock rip rap shall be placed using a crane and clamshell or other suitable equipment approved by the Engineer. The rock shall be placed as nearly as practicable in final position using powered equipment. If necessary, larger rocks shall be worked up to the surface when the material on the surface does not meet the weight specification or when the voids next to the foundation material are too large.
- B. The quantity of small stones shall be kept as low as possible, sufficient only to fill the voids between the larger stones. Care shall be taken that this small material is well distributed throughout the mass and not allowed to segregate or form pockets of small stone. All bridging shall be broken down. Large interstices, or open channels, or voids shall be filled by chinking or otherwise manipulating the stones.
- C. When rip rap is to be built on existing rip rap, special care shall be taken to provide positive anchorage of the new rip rap to the existing rip rap.
- D. The finished rip rap surface shall in general conform to the slope lines shown on the Drawings. No objectionable, hazardous, or unsightly projections above the general plane surface will be permitted.
- E. The main stones shall be thoroughly chinked and filled with the smaller stones by throwing them over the surface in any manner that is practicable for the smaller stones to fill the voids. This work shall continue with the progress of the construction. Tamping of the stones will not be required if the stones have been placed in a reasonable and satisfactory manner.
- F. Knapping of the stones will not be required except stone protruding more than 4 inches above what is considered the normal surface of the stones,

in which case these stones shall be broken down to come within 4 inches of the normal surface.

END OF SECTION

SECTION NO. 02276

TEMPORARY EROSION AND SEDIMENT CONTROL

PART 1 - GENERAL REQUIREMENTS

1.01 DESCRIPTION

- A. The work specified in this Section consists of providing, maintaining and removing temporary erosion and sedimentation controls as necessary.
- B. Temporary erosion controls include, but are not limited to, grassing, mulching, netting, and watering, and reseeding 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 Owner, City and State.
- C. Temporary sedimentation controls include, but are not limited to, silt fencing, silt dams, traps, barriers, and appurtenances at the foot of sloped surfaces which will ensure that sedimentation pollution will be either eliminated or maintained.
- D. Provide effective temporary erosion and sediment control measures during construction or until final controls become effective.
- E. Erosion, Sedimentation and Pollution Control shall be performed in accordance with Georgia's NPDES Permit No. GAR100001 and as detailed in the drawings.

1.02 WORK SPECIFIED IN OTHER SECTIONS

- A. Section 02221: Excavation, Backfill, Fill and Grading for Pipe
- B. Section 02486: Seeding
- C. Section 02542: Silt Fence

1.03 REFERENCE DOCUMENTS

- A. Georgia Building Code.
- B. Any Soil Erosion and Sediment Control Ordinances in force by the local Government.
- C. State of Georgia, Department of Transportation, Standard Specifications.

PART 2 - PRODUCTS

2.01 EROSION CONTROL

- A. Seeding
- B. Sodding
- C. Netting - fabricated of material acceptable to the Owner.

2.02 SEDIMENTATION CONTROL

- A. Bales - clean, seed-free cereal hay type.
- B. Netting - fabricated of material acceptable to the Owner.
- C. Filter stone - No. 57 - crushed stone.

PART 3 - EXECUTION

3.01 EROSION CONTROL

- A. Minimum procedures for grassing are:
 - 1. Scarify slopes to a depth of not less than 6" and remove large clods, rock, stumps, roots larger than 1/2" in diameter and debris.
 - 2. Sow seed within 24 hours after the ground is scarified with either mechanical seed drills or rotary hand seeders.
 - 3. Apply mulch loosely and to a thickness of between 3/4" and 1-1/2".
 - 4. Apply netting over mulched areas of sloped surfaces.
 - 5. Roll and water seeded areas in a manner which will encourage sprouting of seeds and growing of grass. Reseed areas which exhibit un-satisfactory growth. Backfill and seed eroded areas.

3.02 SEDIMENTATION CONTROL

- A. Install and maintain silt fencing, silt dams, traps, barriers and appurtenances as shown on the approved descriptions and working drawings. Hay bales which deteriorate and filter stone which is dislodged shall be replaced.

3.03 PERFORMANCE

- A. Should any of the temporary erosion and sediment control measures employed fail to produce results which comply with the requirements of the State, immediately take whatever steps are necessary to correct the deficiency.

3.04 MONITORING, REPORTING AND RETENTION OF RECORDS

Contractor shall monitor, report and retain records as required by the GA NPDES Permit No. GAR100001. Attached to the end of this section are the minimal reports which should be performed and maintained. The following are the attached reports:

- A. Erosion and Sedimentation Inspection and Maintenance Reports
- B. Daily Rainfall Monitoring Report
- C. Stormwater Monitoring Data

END OF SECTION

Erosion & Sedimentation Inspection and Maintenance Report

To be completed every 7 days AND within 24-hours of a qualifying rainfall event of 0.5-inches or more.

Project:

Time/date of last rainfall: _____ Amount of last rainfall: _____ inches

Inspector:

Date:

Time:

Describe the most recent land disturbance/phase of the project:

Date of the most recent disturbance: _____

Weather:

Cold

Mild

Hot

Clear

Cloudy

Rain

Windy

Erosion Control:

- 1. Construction Exit: Good N/A Deficient Redress Other
- 2. Silt Fence: Good N/A Deficient Remove Silt Other
- 3. Sediment Traps: Good N/A Deficient Remove Silt Other
- 4. Sediment Ponds: Good N/A Deficient Remove Silt Other
- 5. Outlet Protection: Good N/A Deficient Remove Silt Other
- 6. Temporary Ground Cover: Good N/A Deficient Remove Silt Other
- 7. Permanent Vegetation: Good N/A Deficient Remove Silt Other

Other Erosion Control Comments:

Has Silt Left the Site: Yes Not Apparent N/A

Drainage:

- Detention Pond Grade: Good N/A Deficient
- Detention Pond Outlets: Good N/A Deficient
- Detention Pond Vegetation: Good N/A Deficient

Other Drainage Comments:

Other Additional Notes:

Deficiencies:

Is this site in compliance? Y or N If not, complete the following information for each deficiency.

1. Deficiency(ies): _____	Location: -	Code: I M GC
Corrective actions:		

2. Deficiency(ies): _____	Location: -	Code: I M GC
Corrective actions:		

3. Deficiency(ies): _____	Location: -	Code: I M GC
Corrective actions:		

4. Deficiency(ies): _____	Location: -	Code: I M GC
Corrective actions:		

Required under the EPD NPDES Construction Permit for sites between 5 and 250 acres.

Photo document deficiencies and retain in permanent file. Codes:

I Immediate – Must be corrected in 24 hours.

Include site map identifying location of all deficiencies.
hours.

M Minor – Must be corrected within 72

Return original reports to construction site file and copy in
monthly.

GC General Condition – Must be maintained

SECTION NO. 02486

SEEDING

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. Contractor shall furnish all labor, materials, equipment and incidentals necessary and place seed and maintain all seeded areas as shown on the Drawings and as specified herein including all areas disturbed by the Contractor's operations.
- B. Furnish and install all supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a sound, secure and complete lawn installation.
- C. All areas which have been graded or otherwise disturbed during construction and not occupied by structures, pavement, sidewalk or other improvements shall be planted or seeded as shown on the drawings or directed by Engineer.

1.02 SUBMITTALS

- A. Submit signed copies of vendor's statement for each grass seed mixture required, stating botanical and common name, percentage by weight, and percentages of purity, germination and weed seed. Statement shall certify that each container of seed delivered is fully labeled in accordance with Federal Seed Act and equals or exceeds specification requirements.
- B. Submit copies of invoices for all fertilizer lime and mulch used on project showing grade furnished. Each lot of fertilizer and lime is to be subject to sampling and testing, at discretion of Engineer, in accordance with current methods of Association of Official Agricultural Chemists. Upon completion of project, a final check of total quantities of fertilizer lime and mulch used will be made against total area seeded, and if minimum rates of application have not been met, Engineer may require distribution of additional quantities to make up minimum application specified.

1.02 RELATED WORK

- A. Section 02100: Site Preparation
- B. Section 02221: Excavation, Backfill, Fill, and Grading for Pipe

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Fertilizer shall be a complete commercial fertilizer of 10-10-10 analysis, meeting applicable State and Federal requirements. Cyanamic compounds or hydrated lime are not permitted in mixed fertilizers. It shall be delivered to the site in the

original unopened containers each showing the manufacturer's guaranteed analysis. Store fertilizer so that when used it shall be dry and free flowing. If liquid fertilizer is used, it shall be kept agitated during application and shall be applied in amounts sufficient to provide the same value of nutrients per acre as specified for dry fertilizer. If liquid fertilizer is used in a hydroseeder, Contracto shall apply material on a poundage basis and mix with the same volume of water as used with dry fertilizer.

1. Hydroseeding is allowed only with the approval of the Authority Manager. Specifications for hydroseeding shall be submitted and approved by the Authority Manager. After the soil has been properly prepared, the seed shall be planted.
- B. Lime shall be agricultural grade granulated limestone containing not less than 85 percent calcium and magnesium carbonates, with 60 percent passing a 50 mesh sieve and 95 percent passing a 10 mesh sieve.
- C. Furnish grass seed consistent with season in which planting is undertaken in accordance with the Georgia Erosion Control Manual at a rate of 4 pounds per 1000 square feet. Seed shall be from the same or previous year's crop; each variety of seed shall have a percentage of germination not less than 90, a percentage purity of not less than 85, and shall have not more than one percent weed content. Furnish seed in sealed standard containers labeled with producer's name and seed analysis. Any seed that has become wet, moldy, or otherwise damaged in transit shall not be used. Provide vendor's certified statement of composition, mixture and percentages of purity, germination and weed seed for each grass seed species required.
- D. Furnish clean, seed-free hay or threshed straw of wheat or other locally available mulch material approved by Engineer. Do not use mulch that contains excessive quantities of matured seeds of noxious weeds or other species that will grow or be detrimental to overseeding, or provide a menace to surrounding land. Mulch material which is fresh or excessively brittle, or which is decomposed and will smother or retard the growth of the grass shall not be used.
- E. Provide emulsified asphalt as per State DOT specifications.
- F. Water used shall be free of oil, acid, alkali, salt and other substances which are detrimental to the growth of the grass.
- G. The mixture for lawn areas shall consist of seed proportioned by weight as indicated on the drawings.

PART 3 - EXECUTION

3.01 APPLICATION

- A. Lime shall be applied at the rate of 50 pounds per 100 square feet, or as shown on the drawings.

- B. Fertilizer shall be applied at the rate of 50 pounds per 100 square feet, or as shown on the drawings.

3.02 SITE PREPARATION

- A. Soils shall be analyzed at an approved soils laboratory prior to all topsoiling and finish grading operations completing. Laboratory report shall be submitted with recommendations for pH adjustment by lime addition, total, nitrogen, total phosphorous and potassium needs as well as other trace elements required for the type of seeding and grassing to be undertaken.
- B. Work shall be arranged and coordinated such that preparation shall be limited to the areas which are to be seeded soon after preparation.
- C. Areas to be seeded shall be prepared in accordance with:
 - 1. Slopes 3:1 or flatter shall be loosened to a depth of approximately three inches by disking, harrowing or other approved methods.
 - 2. Loosening of slopes steeper than 3:1 will not be required except to eliminate hard or crusted surfaces.
 - 3. Embankment slopes steeper than 3:1 and shoulders shall be loosened to a depth of approximately one inch. All clods, loose stones and other foreign materials larger than three inches in any dimension shall be removed and disposed of as directed by Engineer.
 - 4. All gullies, washes or disturbed areas that develop subsequent to final dressing shall be repaired before such areas are seeded.
 - 5. Topsoil shall be loosed and friable when seed is sown. Topsoil disturbed or lost due to erosion shall be replaced prior to seeding.
 - 6. Seeding shall not be permitted on hard or crushed soil surfaces.
- D. Loosen surface to a minimum depth of four inches. Remove stones, over one inch in any dimension, and sticks, roots, rubbish and other extraneous material.
- E. Furnish and spread lime uniformly over specified areas at specified rate. All lawn areas shall be plowed and cross plowed to a depth of six inches to ensure lime is thoroughly mixed through topsoil layer and worked into the soil. Soil shall be pulverized with a roller type pulverizer with four inch tines.

3.02 INSTALLATION

- A. The subgrade of all areas to be seeded shall be raked and all rubbish, sticks, roots and stones larger than 2 inches shall be removed.
- B. Lime shall be spread evenly over surface and thoroughly incorporated with loam by heavy raking to at least 2 inches deep.

- C. Fertilizer shall be uniformly spread and immediately mixed with the upper 2 inches of the soil.
- D. Immediately following this presentation the seed shall be uniformly applied and lightly raked into the surface. Lightly roll the surface and water with a fine spray. Seed shall be sown in a favorable season, as approved by the Owner's representative.
- E. The Contractor shall keep all seeded areas watered and in good condition, if and when necessary until a good, healthy, uniform growth is established over the entire area seeded, and shall maintain these areas in an approved condition until final acceptance of the Contract.
- F. On slopes, the Contractor shall provide against washouts. Any washout which occurs shall be re-graded and re-seeded at the Contractor's expense until good sod is established.
- G. The Contractor shall maintain the areas in grass in a neat manner by watering, mowing, raking clippings and leaves, and appurtenances until the project is completed.

END OF SECTION

SECTION NO. 02542

SILT FENCE

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. The work covered by this Section consists of furnishing all materials, equipment, and labor and performing all operations in connection with the construction of the Silt Fence System in accordance with the Contract Documents.
- B. The surfaces to be protected shall be prepared and graded to the extent that they are normally stable in the absence of erosion forces. All stones, roots, and other waste material exposed on the slopes which could disturb the finished mat profile shall be removed. The fabric shall be positioned over these surfaces.

1.02 RELATED WORK

- A. Division 2: Site Work
- B. Section 01300: Submittals

1.03 QUALIFICATIONS

- A. Installation shall be by an experienced applicator approved by the manufacturer of the material supplied.
- B. Applicator shall have a minimum of one year experience.
- C. Submit written proof of qualifications to the Engineer.
- D. The woven fiber filter and appurtenances specified under this Section shall be furnished by a manufacturer who is fully experienced, reputable, and qualified in the manufacture of the fabric furnished. The woven fiber filter and all related appurtenances shall be designed, constructed and installed with the best practices and methods.
- E. The woven fiber filter and appurtenances shall be as manufactured by Carthage Mills, Cincinnati, Ohio, Staff Industries, Inc., Upper Montclair, or approved equal.

1.04 SUBMITTALS

- A. Furnish sample 36 by 36 inches for each fabric, as specified in Section 01300.
- B. Final acceptance of fabric shall be contingent upon approval of samples.
- C. Furnish an affidavit that all materials comply with these Specification requirements.

1.05 DELIVERY AND STORAGE

- A. Prevent damage during delivery and handling.
- B. Store all fabric in undamaged condition as packaged by the manufacturer, with manufacturer's seals and labels intact.

- C. Store all materials in a clean, dry storage area.
- D. Do not store fabric in an upright position.
- E. Storage area temperature shall be maintained above 40 degrees F. with normal humidity.

PART 2 - PRODUCTS

2.01 FABRIC

- A. The filter fabric shall be designed to control water seepage of the fine particle and or soil without clogging under varying water flow conditions, thereby serving as a soil stabilizer.
- B. The filter fabric shall be chemically resistant to prolonged exposure to fresh water, and either alkaline or acidic soil conditions.

C. Physical Properties:	<u>TEST METHOD</u>
1. Color	Black ----
2. Weight, oz./sq. ft.	0.8 ASTM D-1910
3. Equivalent opening size	70-100 CE-1310
4. % open area	4-10 CE-1310
5. Tensile Strength, #	400 x 280 ASTM D-1682
6. Elongation, %	34 x 32 ASTM D-1682
7. Trapezoidal tear strength, #	92x 40 ASTM D-2263
8. Mullen burst, psi	510 ASTM D-751
9. Puncture Strength, #	150 ASTM D-751-M
10. Abrasion resistance	ASTM D-01175-71
Abraded strength, #	80 ASTM D-1682
11. Weather-Ometer strength retention, %	90 ASTM E-42-69
12. Water permeability, water flow rates*, milliliters/min.	
6" head	460-520 Canvas Products
8" head	620-760 Assn.Intern'l
36" head	2510-2790 Test Method
	(for canvas)

*Water flow perpendicular to fabric

- D. The upper level of the fabric form work edges shall be structured so as to accommodate the type of anchorage to be utilized at that point.

- E. Individual mill-width panels shall be cut to suitable lengths, and the two layers of fabric separately jointed, edge-to-edge, by means of heavy, double-stitched nylon thread. The tensile strength of stitched joints shall not be less than 100 lbs/inch.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Installation instructions shall be supplied by the manufacturer. The fabric shall be applied in accordance with the manufacturer's recommendations.

END OF SECTION

SECTION NO. 02575

PAVEMENT REPAIR AND RESTORATION

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials equipment and incidentals required and remove and replace pavements over trenches excavated for installation of water lines as shown on the Drawings and/or specified herein.

1.02 RELATED WORK

- A. Earth excavation and backfill is included under Section 02221.
- B. Crushed stone is included under Section 02221.

1.03 GENERAL

- A. All damage, as a result of work under this project, done to existing structures, pavement, driveways, paved areas, curbs and gutters, sidewalks, shrubbery, grass, trees, utility poles, utility pipe lines, conduits, drains, catch basins, flagstones, rocked, graveled or stabilized areas or driveways and including all obstructions not specifically named herein, shall be repaired in a manner to restore the surface to its original condition. The scope of work shall include the furnishing of all labor, materials, equipment and incidentals necessary for the cutting, repair and restoration of the damaged areas.
- B. The Contractor shall keep the surface of the backfilled area of excavation in a safe condition and level with the pavement restored in the manner specified herein. The last 10 inches of the backfill shall be compacted crusher-run gravel to provide a temporary finished surface until the pavement is replaced. All surface irregularities that are dangerous or obstructive to traffic are to be removed.
- C. All materials and workmanship shall be first class and nothing herein shall be construed as to relieve the Contractor from this responsibility. The Owner reserves the right to require soil bearing or loading tests or materials tests, should the adequacy of the foundation or the quality of materials used be questionable. Costs of these tests shall be borne by the Owner.
- D. All street, road, driveway and highway repair shall be made in accordance with the details indicated on the Drawings.
- E. No permanent pavement shall be placed over a backfilled trench within 90 days after completion of the backfilling, unless permitted to do so in writing by the Owner's Representative.

PART 2 - PRODUCTS

2.01 ASPHALT PAVEMENT SURFACE

The material shall be Type E, Bituminous Concrete

2.02 CONCRETE PAVEMENT SURFACE

The material shall be a 4,000 psi strength mix design.

2.03 TEMPORARY PAVEMENT

- A. The material shall be Type B, Bituminous Concrete. Temporary pavement shall be maintained until replaced by permanent pavement.
- B. If points of settlement or holes appear in the temporary pavement, the Contractor shall repair the same within three days of notification by the Owner. Where permanent pavement is to be installed, the Contractor shall remove the temporary pavement and regrade the subbase for installation of permanent pavement.

PART 3 - EXECUTION

3.01 CUTTING PAVEMENT

- A. The Contractor shall cut and remove pavement as necessary for installing the new pipe lines and appurtenances and for making connections to existing pipe lines.
- B. Before removing pavement, the pavement shall be marked for cuts nearly paralleling pipe lines and existing street lines. Asphalt pavements shall be cut 4 inches deep, along the markings with a jackhammer, rotary saw. Concrete pavement and asphalt pavement on concrete base, shall be scored to a depth of approximately two (2) inches below the surface of the concrete along the marked cuts. Scoring shall be done by use of a rotary saw, after which the pavement may be broken below the scoring with a jackhammer or other suitable equipment.
- C. No pavement shall be machine pulled until completely broken and separated along the marked cuts.
- D. The pavement adjacent to pipe line trenches shall neither be disturbed nor damaged. If the adjacent pavement is disturbed or damaged, irrespective of cause, the Contractor shall remove the damaged pavement and shall replace it at his own expense.

3.02 PAVEMENT REPAIR AND REPLACEMENT

- A. All existing pavement cut or damaged by construction under this contract shall be repaired to match the original surface material and original grade unless otherwise specified or shown on the Drawings.
- B. The repair shall include the preparation of the subgrade, the placing and compacting of the base course, the priming of the base, the placing and maintaining of the surface treatment and any special requirements, all as specified herein. All base course to receive an asphaltic concrete surface shall be finished 2 inches compacted thickness of asphaltic concrete. Stabilized roads and drives shall be finished to match the grade of the existing pavement. Dirt roads and drives shall have the final two inches of the backfill material up to the finished surface as crushed stone.

- C. Wherever the water line is run parallel to and within the limits of a paved street under this Contract, the entire width of such street shall be reconstructed and surfaced in accordance with these Specifications. The base shall be 2 feet wider than the street surface, one foot on each side of the surface edge.
- D. The width of all repairs shall extend at least 12 inches beyond the excavation or limits of any damaged section. The edge of the pavement to be left in place shall be cut to a true edge with a saw or other approved method so as to provide a clean edge to abut the repair. The line of the repair shall be reasonably uniform with no unnecessary irregularities.

3.03 MISCELLANEOUS RESTORATION

- A. Trenches cut across sidewalks shall be restored in full sections or blocks to a minimum thickness of four inches. Concrete curb or curb gutter shall be restored to the existing height and cross section in full sections or lengths between joints. Concrete shall be as specified in Division 3. Grassed yards, shoulders and parkways shall be restored to match the existing sections with grass of a type matching the existing grass.

3.04 SPECIAL REQUIREMENTS

- A. The restoration of all surfaces, as described herein, disturbed by the installation or repair to underground facilities shall be completed as soon as is reasonable and practical. In no case shall the surface go unfinished for more than five (5) calendar days after backfilling.

3.05 CLEAN-UP

- A. After all repair and restoration or paving has been completed, all excess asphalt, dirt, rock and other debris shall be removed from the roadways. All existing storm sewers and inlets shall be checked and cleaned of any construction debris.

3.06 MAINTENANCE

- A. All wearing surfaces shall be maintained by the Contractor in good order and be suitable for traffic at all times for a period of one year after completion and acceptance of the work. Approximately at the end of the maintenance period a final inspection will be made of the repaired surface and any settlement or depression shall be adjusted as previously noted herein.

END OF SECTION

SECTION NO. 02615

EXTERIOR DUCTILE IRON PIPE AND FITTINGS

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. The Contractor shall supply all labor, equipment, materials and incidentals necessary to install and disinfect all piping and appurtenances located outside the buildings and structures and test as specified herein.
- B. Yard piping shall begin five (5) feet outside face of structures and buildings.
- C. Yard piping shall not include piping below structures.
- D. Furnish all concrete thrust blocks. Also all excavation, backfilling, sheeting, slope protection, drainage, concrete work, rip rap, grading and all other work necessary to complete the construction, installation and testing of the piping.
- E. The water distribution system shall comply with NFPA 24 and shall have the approval of Factory Mutual and local authorities.

1.02 RELATED WORK

- A. Section 02221: Excavation, Backfill, Fill and Grading for Pipe.
- B. Section 02605: Valves and Appurtenances for Site Utilities.
- C. Division 15: Pipe below structures and buildings shall be included in the respective Section.
- D. Division 15: Plumbing.

1.03 SUBMITTALS

- A. Submit shop drawings showing a complete laying plan of all pipe, including all fittings, adapters, valves and specials along with the manufacturer's drawings and specifications indicating complete details of all items. The above shall be submitted for approval before fabrication and shipment of these items. The locations of all pipes shall conform to the locations indicated in the drawings. In most cases, a certain amount of flexibility in positioning of pipes will be allowed, especially where new pipes will connect to existing structures or piping.
- B. Test certificates in accordance with Section 51-13 of AWWA C151 shall be furnished prior to shipment of valves to the job site.

1.04 INSPECTION

All pipe and fittings to be installed under this Contract may be inspected at the site of manufacture for compliance with these Specifications by an independent laboratory selected by the Owner.

1.05 APPROVAL OF MATERIALS

Submit to the Engineer for approval, within thirty (30) days after the Notice to Proceed, a listing, including materials to be furnished, the name of the suppliers, the date of delivery of materials to the job site, and a time schedule for the completion of the project.

1.06 QUALITY ASSURANCE

It is the Contractor's responsibility that all pipe units and all component parts of the line are manufactured and installed such that the maximum infiltration/exfiltration limit will not be exceeded, as determined by AWWA C600-87.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Ductile iron pipe for yard piping shall meet the following requirements:
1. Ductile iron pipe shall conform to ANSI/AWWA C151/A21.51-91. A minimum of Class 52 pipe shall be supplied for all sizes of pipe unless specifically called out in the drawings. Thickness of pipe to be supplied shall be one (1) class greater than that required under Table 51.1 AWWA C151 (ANSI 21.51). Type 1 Bedding Conditions shall be used for all diameters.
 2. The pipe shall be supplied in length not in excess of 20 feet. Pipe shall be either the rubber-ring type push-on joints, standard mechanical joint pipe or restrained joint where required. Ball joint pipe and flange joint pipe shall be used where shown on the drawings. Pipe shall be as manufactured by the American Ductile Iron Pipe Company, U.S. Pipe and Foundry Company, Clow Corporation, or McWayne Pipe Foundry.
- B. All ductile iron pipe fittings for yard piping shall be cast iron or ductile iron with a minimum pressure rating of 150 psi. Fittings shall meet the requirements of ANSI, NEWWA, and AWWA specifications as applicable. Rubber gasket joints shall conform to ANSI A21.11 for mechanical and push-on type joints. Ball joints shall conform to ANSI A21.51, with a separately cast ductile iron bell conforming to ASTM A536, Grade 70-5-05, and a cast steel retainer ring conforming to ASTM A148, Grade 90-60. Flanged fittings shall be furnished faced and drilled to 125 pounds template and conform to ANSI B16.1. All pipe and fittings shall have a cement mortar lining and bituminous seal coat on the inside and a coal tar enamel coat on the outside in accordance with ANSI A21.51 except that cement mortar lining shall be not less than 1/8" in thickness for pipe 2" to 12" in diameter, 3/16" for 14" to 24" diameter pipe and 1/4" for 30" to 54" pipe with a plus tolerance of 1/8".

PART 3 - EXECUTION

3.01 HANDLING PIPE AND FITTINGS

- A. Care shall be taken in loading, transporting and unloading to prevent injury to the pipe or coatings. Pipe or fittings shall not be dropped. All pipe or fittings shall be examined before laying, and no piece shall be installed which is found to be defective. Any damage to the pipe coatings shall be repaired.

- B. All pipe and fittings shall be subjected to a careful inspection and hammer test just prior to being laid or installed.
- C. If any defective pipe is discovered after it has been laid it shall be removed and replaced with a sound pipe in a satisfactory manner at no additional expense to the Owner. All pipe and fittings shall be thoroughly cleaned before laying, shall be kept clean until they are used in the work, and when installed or laid, shall conform to the lines and grades required.

3.02 DUCTILE IRON PIPE

- A. Ductile iron pipe and fittings shall be installed in accordance with requirements of AWWA Standard Specification C600 except as otherwise provided herein. A firm, even bearing throughout the length of the pipe shall be constructed by tamping selected material at the sides of the pipe up to the springline.
BLOCKING WILL NOT BE PERMITTED.
- B. All pipe shall be sound and clean before laying. When laying is not in progress, including lunch time, the open ends of the pipe shall be closed by watertight plug or other approved means. Good alignment shall be preserved in laying. The deflection at joints shall not exceed that recommended by manufacturer. Fittings, in addition to those shown on the plans, shall be provided, if required, in crossing utilities which may be encountered upon opening the trench.
- C. When cutting pipe is required, the cutting shall be done by machine, leaving a smooth cut at right angles to the axis of the pipe. Cut ends of pipe to be used with a Tyton bell shall be beveled to conform to the manufactured spigot end. Cement lining shall be undamaged.
- D. Jointing Ductile-Iron Pipe:
 - 1. Push-on joints shall be made in strict accordance with the manufacturer's instructions. Pipe shall be laid with bell ends looking ahead. A rubber gasket shall be inserted in the groove of the bell end of the pipe, and the joint surfaces cleaned and lubricated. The plain end of the pipe to be entered shall then be inserted in alignment with the bell of the pipe to which it is to be joined, and pushed home with a jack or by other means. After joining the pipe, a metal feeler shall be used to make certain that the rubber gasket is correctly located.
 - 2. Mechanical joints at valves, fittings and where designated on the drawings and/or as specified shall be in accordance with the "Notes On Method of Installation" under ANSI Specification A21.11 and the instructions of the manufacturer. To assemble the joints in the field, thoroughly clean the joint surfaces and rubber gasket with soapy water before tightening the bolts. Bolts shall be tight to the specified torque. Under no condition shall extension wrenches or pipe over handle or ordinary ratchet wrench be used to secure greater leverage.

- E. Ball joints, where designated on the Drawings and/or as specified, shall be installed in strict accordance with the manufacturer's instructions. Where ball joint assemblies occur at the fact of structures or tanks, the socket end shall be at the structure or tank and the ball end assembled to the socket.
- F. All valves, fittings and other appurtenances needed upon the pipe lines shall be set and jointed as indicated on the Drawings or as required by the manufacturer.

3.03 VALVES AND VALVE BOXES

Valves and valve boxes shall be installed as shown on the drawings. Mechanical joints shall be made in the standard manner. Valve stems shall be vertical in all cases. Place cast iron box over each stem with base bearing on compacted fill and top flush with final grade. Boxes shall have sufficient bracing to maintain alignment during backfilling. Knobs on cover shall be parallel to pipe.

3.04 THRUST BLOCKS

- A. Longitudinal thrust along pipe lines of bends, tees, reducers, and caps or plugs shall be counteracted by thrust blocking, as shown on the drawings. Where the bends are in a vertical plane, the thrust shall be counteracted by enough weight of concrete to counterbalance the vertical thrust forces. Where undisturbed trench walls are not available for thrust blocking, the Contractor shall furnish and install suitable pipe harnesses or ties designed and manufactured specifically for this purpose.
- B. Joints shall be protected by felt roofing paper prior to placing concrete.
- C. Bearing area of thrust blocks shall be adequate to prevent any movement of the fitting and shall be of the size and dimensions as shown on the drawings.
- D. Concrete for thrust blocking shall be no leaner than 1 part cement, 1-1/2 parts sand and 5-1/2 parts stone. Concrete shall be placed against undisturbed material, and shall not cover joints, bolts or nuts, or interfere with the removal of any joint. Wooden side forms shall be provided for thrust blocks.
- E. In lieu of thrust blocking and with prior approval, pipe harnesses and/or ties or restrained push-on or restrained mechanical joints may be used.

END OF SECTION

SECTION NO. 02960

TEMPORARY BY-PASS PUMPING SYSTEMS

SECTION 1 - GENERAL

1.1 DESCRIPTION

- A. Section includes requirements for implementing a temporary pumping system for the purpose of diverting existing sewage flow around work area for duration of the project.

1.2 QUALITY ASSURANCE

- A. Follow national standards and as specified herein.
- B. Perform leakage and pressure tests on discharge piping using clean water, before operation. Notify Contract Manager 24 hours prior to testing.
- C. Maintain and inspect temporary pumping system every two hours. Responsible operator on site when pumps are operating.
- D. Keep and maintain spare parts for pumps and piping on site, as required.
- E. Maintain adequate hoisting equipment and accessories on site for each pump.

1.3 SUBMITTALS

- A. Submit following Section 01300.
 - 1. Detailed plan and description of proposed pumping system. Indicate number, size, material, location and method of installation of suction and discharge piping, size of pipeline or conveyance system to be bypassed, staging area for pumps, site access point, and expected flow.
 - a. Size and location of manhole or access points for suction and discharge hose or piping.
 - b. Sections showing suction and discharge pipe depth, embedment, select fill and special backfill, if buried.
 - c. Temporary pipe supports and anchoring required.
 - d. Thrust and restraint block sizes and locations.
 - e. Sewer plugging method and type of plugs.
 - f. Bypass pump sizes, capacity, number of each size to be on site and power requirements.
 - g. Backup pump, power and piping equipment.
 - h. Calculations of static lift, friction losses, and flow velocity. Pump curves showing pump operating range.
 - i. Design plans and computation for access to bypass pumping locations indicated on drawings.
 - j. Calculations for selection of bypass pumping pipe size.
 - k. Method of noise control for each pump and/or generator. Noise levels shall be 60 dBA or less 30 feet from the pump and /or generator.

- l. Method of protecting discharge manholes or structures from erosion and damage.
 - m. Schedule for installation and maintenance of bypass pumping lines.
 - n. Procedures to monitor upstream mains for backup impacts.
 - o. Procedures for setup and breakdown of pumping operations.
 - p. Emergency plan detailing procedures to be followed in event of pump failures, sewer overflows, service backups, and sewage spillage.
 - 1) Maintain copy of emergency plan on site for duration of project.
 - B. Submit following Section 01300.
 - 1. Certify bypass system will meet requirements of codes, and regulatory agencies having jurisdiction.
- 1.4 **CONTRACTORS RESPONSIBILITY FOR OVERFLOWS AND SPILLS**
 - A. Schedule and perform work in manner that does not cause or contribute to incidence of overflows, releases or spills of sewage from sanitary sewer system or bypass operation.
- 1.5 **DELIVERY AND STORAGE**
 - A. Transport, deliver, handle, and store pipe, fittings, pumps, ancillary equipment and materials to prevent damage and following manufacturer's recommendations.
 - 1. Inspect all material and equipment for proper operation before initiating work.
 - B. Material found to be defective or damaged due to manufacturer or shipment.
 - 1. When Contract Manager deems repairable: Repair as recommended by manufacturer.
 - 2. When Contract Manager deems not repairable: Replace as directed by Contract Manager before initiating work.

SECTION 2 - PRODUCTS

2.1 MATERIALS

- A. Discharge and Suction Pipes: Approved by Contract Manager.
 - 1. Discharge piping: Determined according to flow calculations and system operating calculations.
 - 2. Suction piping: Determined according to pump size, flow calculations, and manhole depth following manufacturer's specifications and recommendations.
- B. Polyethylene Plastic Pipe:
 - 1. High density solid wall and following ASTM F714 Polyethylene (PE) Plastic Pipe (SDR-DR) based on Outside Diameter, ASTM D1248 and ASTM D3550

2. Homogenous throughout, free of visible cracks, discoloration, pitting, varying wall thickness, holes, foreign material, blisters, or other deleterious faults.
- C. High-Density Polyethylene (HDPE).
1. Homogenous throughout, free of visible cracks, discoloration, pitting, varying wall thickness, holes, foreign material, blisters, or other deleterious faults.
 - a. Defective areas of pipe: Cut out and joint fused as stated herein.
 2. Assembled and joined at site using couplings, flanges or butt-fusion method to provide leak proof joint. Follow manufacturer's instructions and ASTM D 2657.
 - a. Threaded or solvent joints and connections are not permitted.
 3. Fusing: By personnel certified as fusion technicians by manufacturer of HDPE pipe and/or fusing equipment.
 4. Butt-fused joint: True alignment and uniform roll-back beads resulting from use of proper temperature and pressure.
 - a. Allow adequate cooling time before removal of pressure.
 - b. Watertight and have tensile strength equal to that of pipe.
 - c. Acceptance by Contract Manager before insertion.
 5. Use in streams, storm water culverts and environmentally sensitive areas.
- D. Flexible Hoses and Associated Couplings and Connectors.
1. Abrasion resistant.
 2. Suitable for intended service.
 3. Rated for external and internal loads anticipated, including test pressure.
 - a. External loading design: Incorporate anticipated traffic loadings, including traffic impact loading.
 4. When subject to traffic loading, compose system, such as traffic ramps or covers.
 - a. Install system and maintain H-20 loading requirements while in use or as directed by the Contract Manager.
- E. Valves and Fittings: Determined according to flow calculations, pump sizes previously determined, and system operating pressures.
- F. Plugs: Selected and installed according to size of line to be plugged, pipe and manhole configurations, and based on specific site.
 1. Additional plugs: Available in the event a plug fails. Plugs will be inspected before use for defects which may lead to failure.
- G. Aluminum "irrigation type" piping or glued PVC piping will not be permitted.
- H. Discharge hose will only be allowed in short sections when approved by Contract Manager.

2.2 EQUIPMENT

A. Pumps.

1. Fully automatic self-priming units that do not require the use of foot-valves or vacuum pumps in priming system.
 2. Electric or diesel powered.
 3. Constructed to allow dry running for long periods of time to accommodate cyclical nature of effluent flows.
- B. Provide.
1. Necessary stop/start controls for each pump.
 2. One standby pump of each size maintained on site.
 - a. On-line, isolated from primary system by a valve.
 3. Quiet flow pumps – 60 dBA or less 30 feet from the pump.
 4. temporary pumps shall be monitored 24 hours per day when the station is being by-passed. There shall be qualified personnel attending the by-pass pump during night time hours.
- 2.3 DESIGN REQUIREMENTS
- A. Bypass pumping systems:
1. Sufficient capacity to pump peak flow of 4 mgd or greater if required at time of by-pass pumping.
 - a. Peak flows greater than 4 mgd as approved by Contract Manager.
 - b. Flow requirements to be verified at time of by-pass pumping.
 2. Operate 24 hours per day.
- B. Provide pipeline plugs and pumps of adequate size to handle peak flow, and temporary discharge piping to ensure total flow of main can be safely diverted around section to be repaired.

SECTION 3 - EXECUTION

3.1 PREPARATION

- A. Determining location of bypass pipelines.
1. Minimal disturbance to existing utilities.
 - a. Field locate existing utilities in proposed bypass area.
 2. Obtain approvals for placement within public or private property.
 3. Obtain Contract Manager's approval of location.

3.2 INSTALLATION AND REMOVAL

- A. Provisions and requirements must be reviewed by Contract Manager before starting construction.
- B. Remove manhole sections or make connections to existing sewer and construct temporary bypass pumping structures at access location indicated on Drawings and as required to provide adequate suction conduit.
- C. Plugging or blocking of sewage flows shall incorporate a primary and secondary plugging device. When plugging or blocking is no longer needed for performance and acceptance of work, remove in a manner that permits the

sewage flow to slowly return to normal without surge, to prevent surcharging or causing other major disturbances downstream.

- D. When working inside manhole or force main, exercise caution. Follow OSHA, Local, State and Federal requirements. Take required measures to protect workforce against sewer gases and/or combustible or oxygen-deficient atmosphere.
- E. Installation of Bypass Pipelines:
 - 1. Pipeline may be placed along shoulder of roads.
 - a. Do not place in streets or sidewalks.
 - 2. When bypass pipeline crosses local streets and private driveways, place in roadway ramps.
 - a. When roadway ramps cannot be used, place bypass in trenches and cover with temporary pavement as approved by Contract Manager.
- F. During bypass pumping operation, protect sewer lines from damage inflicted by equipment.
- G. Upon completion of bypass pumping operations, and after the receipt of written permission from Contract Manager, remove piping, restore property to pre-construction condition and restore pavement.

END OF SECTION

SECTION NO. 02999

MISCELLANEOUS WORK AND CLEAN-UP

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. This section includes operations which cannot be specified in detail as separate items but can be sufficiently described as to the kind and extent of work involved. Furnish all labor, materials, equipment and incidentals to complete the work under this Section.
- B. The work of this Section includes, but is not limited to, the following:
 - 1. Restoring easements and rights of way.
 - 2. Concrete encasements.
 - 3. Cleaning up.
 - 4. Incidental work.

PART 2 - PRODUCTS

2.01 MATERIALS

Materials required for this section shall be of the same quality as materials that are to be restored. Where possible, reuse existing materials that are removed and then replaced.

PART 3 - EXECUTION

3.01 RESTORING OF SIDEWALKS, DRIVEWAYS, CURBING, FENCING AND GUARD RAILS

- A. Existing public and private sidewalks and driveways disturbed shall be replaced. Paved sidewalks and drives shall be repaved to the limits and thickness existing prior to construction. Gravel sidewalks and drives shall be replaced and regraded.
- B. Existing curbing shall be protected. If necessary, curbing shall be removed and replaced after backfilling. Curbing which is damaged during construction shall be replaced with curbing of equal quality and dimension.

3.02 CROSSING UTILITIES

- A. This item shall include any extra work required in crossing culverts, water courses, drains, water mains, and other utilities, including all sheeting and bracing, extra excavation and backfill, or any other work required for the crossing, whether or not shown on the drawings.
- B. In no case shall there be less than 0.3 feet between any two pipe lines and structures.

- C. Provide a 6" minimum concrete encasement around the new sewer whenever the vertical clearance between an existing water main and if the new sewer is less than 18".
- D. Where new sewers cross over existing water mains, they shall be encased in 6" minimum of concrete. Encasement shall be a minimum 5'-0" in length.

3.03 RELOCATIONS OF EXISTING GAS LINES

Notify the proper authority of the utility involved when relocation of gas lines is required. Coordinate all work by the utility so that the progress of construction will not be hampered.

3.04 RESTORING THE EASEMENTS AND RIGHTS-OF-WAY

- A. Portions of the Construction may occur in easements through private property. The Contractor shall be responsible for all damage to private property due to his operations. He shall protect from injury all walls, fences, cultivated shrubbery, pavement, underground facilities, such as water pipe, or other utilities which may be encountered along the easement. If removal and replacement are required, it shall be done in a workmanlike manner so that the replacement is equivalent to that which existed prior to construction.
- B. Existing lawn surfaces damaged by the construction shall be replaced. Cut and replace the sod, or restore the areas with an equivalent depth and quality of loam, seed and fertilizer. These areas shall be maintained and reseeded, if necessary, until all work under this Contract has been completed and accepted.

3.05 CLEANING UP

Remove all construction material, excess excavation, buildings, equipment and other debris remaining on the job as a result of construction operations and shall render the site of the work in a neat and orderly condition.

3.06 INCIDENTAL WORK

Do all incidental work not otherwise specified, but obviously necessary for the proper completion of the contract as specified and as shown on the drawings.

END OF SECTION

SECTION NO. 03100

FORMWORK

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Provide formwork for cast-in-place concrete as indicated, specified, and required.
- B. Principal items of Work included in this Section:
 - 1. Furnishing, erection, and removal of forms.
 - 2. Shoring and bracing of formwork.
 - 3. Setting of embedded items, and in non-water bearing locations, setting of pipe sleeves for mechanical and electrical work under direction of respective trade requiring holes for passage of pipe or conduit.
- C. Related Work Not Included in this Section:
 - 1. Furnishing embedded items with setting instructions,
 - 2. Reinforcement,
 - 3. Concrete mixing, placing and finishing,
 - 4. Waterstops.

1.02 QUALITY ASSURANCE

- A. Requirements of Regulatory Agencies: The requirements of the State of Georgia and of the Occupational Health and Safety and OSHA Part 1926, Section 1926.701 apply to the Work of this Section. The Contractor shall prepare and maintain at least one copy of the required drawings at the site. Design of the structures shown on the Drawings does not include any allowance or consideration for imposed construction loads. Forms, shoring and falsework shall be adequate for imposed live and dead loads, including equipment, height of concrete drop, concrete and foundation pressures, stresses, lateral stability, and other safety factors during construction.
- B. Standards and Tolerances: Formwork shall comply with ACI 347 - latest edition. Recommended Practice for Concrete Formwork, except as exceeded by the requirements of regulatory agencies or as otherwise indicated or specified. Formwork shall be designed and constructed to produce finished concrete conforming to tolerances given in ACI 117 - latest edition.

1.03 SHOP DRAWINGS

- A. Concrete construction joints and expansion joints shall be of the types and locations indicated. Submit shop drawings for approval showing proposed location and type of joint for any joints not shown on the Drawings, and sequence

of forming and concrete placing operations. Submit shop drawings at least 15 working days in advance of form fabrication.

PART 2 - PRODUCTS

2.01 FORM COATING

- A. Non-grain raising and non-straining resin or polymer type that will not leave residual matter on surface of concrete or adversely affect bonding to concrete of paint, plaster, mortar, protective coatings, waterproofing or other applied materials.
- B. Coatings containing mineral oils, paraffins, waxes, or other non-drying ingredients are not permitted.

2.02 LUMBER

- A. WWPA No. 1 Structural Light Framing or No. 1 Structural Joists and Planks, or equal.
- B. Board forms, if used, shall be No. 2 Common or better, T&G or shiplap, S1S2E or better.

2.03 PLYWOOD

- A. Plywood shall conform to U.S. Product Standard PS-1 and shall bear APA or DFPA grade mark.
- B. General Use. Exterior type, grade B-B Plyform, Class I, minimum 5/8" thickness. Mill-oiling is not permitted.
- C. Smooth Surface. Use one or more of the following materials, or equal:
 - 1. HDO coating two sides on Plyform, Class I, Exterior.
 - 2. Exterior Type Grade B-B Plyform, Class I, having 1/8" (3.22 mm) thick fully adhesive bonded facing on one side of tempered structural hardboards.
 - 3. Birch hardwood plywood, all plies of Arctic white birch, panel faces on both sides phenolic plastic impregnated and faced with phenolic plastic by the hot press process, panel edges factory sealed, bearing manufacturer's logo in lieu of grade mark.

2.04 METAL FORM TIES

- A. Prefabricated rod, snap-off, or threaded internal disconnecting type of tensile strength to resist all imposed loads.
 - 1. Ties shall leave no metal within 1-1/2" of concrete surfaces after removal.
 - 2. Snap-off type ties shall have integral washer spreaders of diameter to fully close tie holes in forms.

2.05 METAL FORMS

- A. True to detail, good condition, clean, free from dents, bends, rust and oil. Panel forms such as Symons or Advance are acceptable, provided new, or used in approved good condition.

2.06 FORM JOINT SEALERS

- A. For joints between form panels, use resilient foam rubber strips, non-hardening plastic type caulking compound free of oil, or waterproof pressure-sensitive plastic tape of minimum 8 mil thickness and 2" width.
- B. For form tie holes, use rubber plugs, plastic caulking compound, or equal.

2.07 MOLDS

- A. For grooves, drips, rebates, profiles, chamfers, and similar items, smooth milled pine or Douglas fir coated with specified form coating, or standard product extruded polymer plastic units of the indicated or required shapes.

PART 3 - EXECUTION

3.01 FORM TYPES

- A. Smooth Surface Concrete: Use specified plywood or metal forms, as approved, for interior and exterior exposed above-grade concrete and all formed concrete in contact with liquids, waterproofing and protective coatings.
- B. General Concrete: Use either plywood or board forms for concealed surfaces, or form as specified for smooth surface concrete. Earth forming may be used only with the prior approval of the Construction Manager.

3.02 SHORING AND FALSE WORK

- A. Distribute loads properly over base area on which shoring is erected, either concrete slabs or ground; if on ground, protect against undermining or settlement, particularly against wetting of soils.
- B. Alignment: Construct forms to produce in finished structure all lines, grades, and camber as required.
- C. Camber: Provide jacks, wedges, or similar means to induce camber and to take any settlement in formwork that may occur either before or during placing of concrete. Camber for beams and slabs shall be as and where indicated. Perform screeding in such a manner as to maintain beam depths and slab thickness.

3.03 FORM CONSTRUCTION

- A. Build forms to exact shapes, sizes, lines, and dimensions as required to obtain accurate alignment, location and grades, and level and plumb work in finished structures.
- B. Provide for openings, offsets, keyways, recesses, moldings, reglets, chambers, blocking, joint screeds, bulkheads, anchorages, and other required features.
- C. Make forms easily removable without hammering or prying against concrete. Use approved metal spreaders to provide accurate spreading of forms.
- D. Construct forms so that no sagging, leakage, or displacement occurs during and after pouring of concrete.
- E. Coat forms with specified coating material only prior to placement of reinforcing steel; do not allow coating to contact reinforcing bars.
- F. Chamfers: Provide 3/4" x 3/4" chamfer strips for all exposed concrete corners and edges unless otherwise indicated.
- G. Recesses, Drips and Profiles: Provide types shown and required.
- H. Form Joints and Tie Holes: Seal joints between form panels with specified foam plastic strips, caulking compound, or tape. Unless form tie spreaders fully seal tie holes in forms, seal around ties with specified materials and prevent leakage of concrete mortar.
- I. Form Windows: Provide windows in forms wherever directed or necessary for access for concrete placement and vibration. Windows shall be of size adequate for tremies and vibrators, spaced at maximum 8 ft. centers, as approved by the Construction Manager.
- J. Cleanouts and Cleaning: Provide temporary openings in wall and column forms for cleaning and inspection. Prior to placing, clean all forms and surfaces to receive concrete.
- K. Reglets and Rebates: Properly form all required reglets and rebates to receive flashing, frames, and other equipment. Dimensions, details, and precise positions of all such reglets and rebates shall be ascertained from the trades whose work is related to or contingent upon same, and the concrete work formed accordingly.
- L. Equipment Pads: Equipment pad sizing and location as well as anchor bolt size, type and location shall be confirmed by equipment manufacturer.
- M. Re-use: Clean and recondition form material before each re-use. Unsatisfactory material (in the opinion of the Construction Manager) shall be rejected and removed from the site.

3.04 EMBEDDED PIPING AND ROUGH HARDWARE

- A. All trades that require openings for the passage of pipes, conduits, and other inserts shall be consulted and the necessary pipe sleeves, anchors, or other required inserts shall be properly and accurately installed, and equipment pads properly sized.
- B. Openings shall be reinforced as indicated and required. Conduits or pipes shall be located so as not to reduce the strength of the construction, and in no case shall pipes other than conduits be placed in a slab 4-1/2" or less in thickness.
- C. Conduit embedded in a concrete slab shall not have an outside diameter greater than 1/3 of the thickness of the slab nor be placed below bottom reinforcing steel or over top reinforcing steel.
- D. Conduits may be embedded in walls provided they are not larger in outside diameter than 1/3 the thickness of the wall, are not spaced closer than three diameters on center, and do not impair the strength of the structure.
- E. Embedded pipes and conduits shall be supported independently from reinforcing steel in manner to prevent metallic contact and thereby prevent electrolytic deterioration.
- F. Pipes and conduits where embedded shall be placed as nearly as possible to the center line of the concrete section.
- G. All conduit, piping and other wall penetrations or reinforcements shall be subject to the Construction Manager's review and approval.

3.05 FIELD QUALITY

- A. Inspection of forms: Refer to Section 03300, Cast-In-Place Concrete.
- B. Control During Concrete Placement: Workers shall be assigned to check forms during concrete placement and to promptly seal all mortar leaks and to correct all form movement or misalignment.
- C. Embedded Items: Prior to the placement of concrete within the forms, each trade having embedded items, including waterstops, within the forms and affected by the pour shall certify that all items are properly located and braced. This certification shall be provided to the Construction Manager at least 4 hours in advance of pouring by the Contractor.

3.06 REMOVAL OF FORMS AND SHORING

- A. Do not remove forms or shoring until concrete has attained sufficient strength to support its own weight and all imposed construction and permanent loads. Any damage to the work resulting from early removal of forms or shoring or early imposed loading shall be corrected at no added cost to the Owner.

- B Form Removal: Minimum times for removal after concrete placement are as follows:
 - 1. Column forms and wall forms 2 days
 - 2. Forms for supported slabs but not shoring 14 days

- C. Shoring and Falsework Removal: Do not remove shoring and falsework until 21 days after concrete placement or until concrete has attained at least 90 percent of the 28 day design compressive strength as demonstrated by control test cylinders, but not sooner than 14 days.

- D. Restriction: Do not impose construction, equipment, or permanent loads on columns, piers, or supported slabs until concrete has attained the 28 day design compressive strength.

- E. Concrete Curing During Removals: Concrete shall be thoroughly wetted as soon as forms are first loosened and shall be kept wet as specified in Section 03300, Cast-in-Place Concrete.
 - 1. Potable water supply with hoses shall be ready at each removal location before removal operations are commenced. Contractor shall bear costs and delays caused by any damage resulting from early removal of forms or shoring.

END OF SECTION

SECTION NO. 03200

CONCRETE REINFORCEMENT AND DOWELING

PART 1 - GENERAL

1.01 SCOPE

- A. Contractor shall furnish all labor, materials, equipment and incidentals required to provide concrete reinforcement and doweling as shown on the Drawings and specified.
- B. Related Work Specified Elsewhere:
 - 1. Section 03100, Concrete Formwork,
 - 2. Section 03250, Concrete Joints,
 - 3. Section 03300, Cast-In-Place Concrete,
 - 4. Section 03600, Grout.

1.02 SUBMITTALS

- A. Shop Drawings: Submit shop drawings in accordance with Division 1 of these Specifications and as contained herein:
 - 1. Submit Shop Drawings for fabrication, bending, and placement of concrete reinforcement. Comply with ACI 315, Chapters 1 through 8. For walls, show elevations to a minimum scale of 1/4 inch to 1 foot. Show bar schedules, stirrup spacing, and diagrams of bent bars, arrangements and assemblies, as required for the fabrications and placement of concrete reinforcement unless otherwise noted. Splices shall be kept to a minimum. Splices in regions of maximum tension stresses shall be avoided whenever possible. Show construction joints.
 - 2. Submit copies of manufacturer's specifications and installation instructions for all materials and reinforcement accessories.
- B. Certificates:
 - 1. Submit 5 copies of steel producer's certificates of mill analysis, tensile and bend tests for reinforcing steel.

1.03 QUALITY ASSURANCE

- A. Contractor shall examine the substrate and the conditions under which concrete reinforcement is to be placed, and notify the Construction Manager in writing of unsatisfactory conditions. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Construction Manager.

- B. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified:
 - 1. Concrete Reinforcing Steel Institute, "Manual of Standard Practice", includes ASTM standards referred to herein.
 - 2. ACI 318, "Building Code Requirements for Reinforced Concrete."
 - 3. ACI 315, Manual of Standard Practice for Detailing Reinforced Concrete Structures.
 - 4. Concrete Reinforcing Steel Institute, Placing Reinforcing Bars.
 - 5. AWS D.1, Structural Welding Code.
- C. Minimum Concrete Cover for Reinforcement: Comply with ACI 318, Chapter 7 - Details of Reinforcement, unless as shown otherwise on Drawings.

1.04 DELIVERY, HANDLING AND STORAGE

- A. Deliver concrete reinforcement materials to the site bundled tagged and marked. Use metal tags indicating bar size, length, and other information corresponding to markings shown on placement diagrams.
- B. Store concrete reinforcement material at the site to prevent damage and accumulation of dirt or excessive rust. Store on heavy wood blocking so that no part of it will come in contact with the ground.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Reinforcing Bars and Doweling: ASTM A-615, Grade 60 for all bars.
- B. Steel Wire: ASTM A-82.
- C. Welded Smooth Wire Fabric: ASTM A-185, furnish in flat sheets, not rolls.
- D. Supports for Reinforcement: Bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcement in place.
 - 1. Use wire bar type supports complying with CRSI recommendations, except as specified below. Do not use wood, or other unacceptable materials.
 - 2. For slabs on grade, use supports, slab bolsters or horizontal runners where base materials will not support chair legs.
 - 3. For all concrete surfaces, where legs of supports are in contact with forms, provide supports complying with CRSI "Manual of Standard Practice" as follows:
 - a. Either hot-dip galvanized, plastic protected or stainless steel legs.

2.02 FABRICATION

- A. General: Fabricate reinforcing bars and doweling to conform to required shapes and dimensions, with fabrication tolerances complying with CRSI "Manual of Standard Practice" and ACI minimums. In case of fabricating errors, do not re-bend, re-temper, heat, deform, or straighten reinforcement.
- B. Unacceptable Materials: Reinforcement with any of the following defects will not be permitted in the Work:
 - 1. Bar lengths, bends, and other dimensions exceeding specified fabrication tolerances.
 - 2. Bends or kinks not shown on approved Shop Drawings.
 - 3. Bars with reduced cross-section due to excessive rusting or other cause.
 - 4. Surface contamination that would affect the bond i.e. grease, dirt, paint, rust etc.
 - 5. Heat deformed or torched bars.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Comply with the applicable recommendations of specified codes and standards, and CRSI "Placing Reinforcing Bars" and ACI requirements for details and methods of reinforcement placement and supports.
- B. Clean reinforcement to remove loose rust and mill scale, earth, and other materials which reduce or destroy bond with concrete.
- C. Position, support, and secure reinforcement and doweling against displacement during formwork construction or concrete placement and grouting operations. Locate and support reinforcing by chairs, runners, bolsters, spacers and hangers, as required. No wood blocks or aluminum chairs allowed for rebar support.
 - 1. Place reinforcement to obtain the minimum concrete coverages as shown and as specified in ACI 318 Chapter 7. Arrange, space, and securely tie bars and bar supports together with 16 gage wire to hold reinforcement accurately in position during concrete placement operations. Set wire ties so that twisted ends are directed away from exposed concrete surfaces.
 - 2. Reinforcing steel shall not be secured to forms with wire, nails or other ferrous metal. Metal supports subject to corrosion shall not touch formed or exposed concrete surfaces.
- D. Install welded wire fabric in as long lengths as practical. Lap adjoining pieces at least one full mesh and lace splices with 16 gage wire and tie.

- E. Provide sufficient numbers of supports of strength required to carry reinforcement without sagging. Do not place reinforcing bars more than 2 inches beyond the last leg of any continuous bar support. Do not use supports as bases for runways for concrete conveying equipment and similar construction loads.
- F. Splices:
 - 1. Provide standard reinforcement splices by lapping ends, placing bars in contact, and tying tightly with wire. Comply with requirements shown or specified for minimum lap of spliced bars.

3.02 INSPECTION OF REINFORCEMENT

- A. After the rebar, appliance, anchors and embeds have been installed and checked, the Contractor shall review all aspects of the pending concrete pour. He shall notify the Construction Manager no less than 24 hours prior to the pour, so that the Construction Manager may check the area and pour. No concrete shall be placed until this is complete.
- B. Concrete shall not be placed until the reinforcing steel is inspected and permission for placing concrete is granted by the Construction Manager. All concrete placed in violation of this provision will be rejected.

END OF SECTION

SECTION NO. 03250

CONCRETE JOINTS

PART 1 - GENERAL

1.01 SCOPE

- A. Contractor shall furnish all labor, materials, equipment and incidentals required to provide concrete joints as shown and specified.
- B. The types of concrete joints required include the following:
 - 1. Construction joints.
 - 2. Expansion joints.
- C. General: All joints subject to hydrostatic pressure shall be provided with continuous waterstop.
- D. Related Work Specified Elsewhere:
 - 1. Section 03100, Concrete Formwork.
 - 2. Section 03200, Concrete Reinforcement and Doweling
 - 3. Section 03300, Cast-In-Place Concrete.

1.02 SUBMITTALS

- A. Prior to delivery of materials, submit the following in accordance with Division 1 of these Specifications and as contained herein:
 - 1. Product data for all materials stating the location where product is to be used.
 - 2. Certification that materials meet the specifications.
 - 3. Manufacturer's application and installation instructions.
 - 4. Samples of water stops, concrete roughener, joint fillers, sealants and bonding agent.

1.03 QUALITY ASSURANCE

- A. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified:
 - 1. ACI 301, Specifications for Structural Concrete for Buildings, Chapter 6, Joints and Embedded Items.
 - 2. ASTM D 1752, Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction.
- B. All manufactured items shall be installed in accordance with manufacturer's instructions.
- C. Construction and expansion joints shall not be added or relocated without the approval of the Construction Manager.

PART 2 - PRODUCTS

2.01 JOINT SEALER

- A. Materials shall be two component, polyurethane meeting ASTM-C-920 and FED SPEC TT-S-00227E specifications. Materials shall have + 50% movement.
- B. Manufacturer and Product shall be:
 - 1. Horizontal Joint - Sikaflex 2C Self Leveling by Sika Corp, or equal.
 - 2. Vertical Joint - Sikaflex 2C Non-Sag by Sika Corp, or equal.

2.02 CONSTRUCTION JOINTS

- A. Bonding Agent - Shall meet ASTM C 881 with a bond strength of 1500 psi minimum. Agent shall be capable of spraying in inaccessible locations, if necessary.
- B. Manufacturer and Product shall be:
 - 1. Sika Armatic 110 by Sika Corp., or equal.
 - 2. Sikadur 32 Hi-Mod by Sika Corp., or equal.

2.03 EXPANSION JOINTS

- A. Expansion Joint Material: Type I, preformed sponge neoprene expansion joint filler conforming to AASHTO Designation M-153.

2.04 WATERSTOPS

- A. General: Install waterstops in accordance with manufacturer's written recommendations. Provide factory fabrications for vertical and horizontal tees, crosses, and ells. Field splices shall be on straight sections only.
- B. Unless otherwise indicated on the drawings all waterstops shall be preformed PVC ribbed with center bulb, 6"width, Model 706, as manufactured by Greenstreak, St Louis, Mo., or equal.
- C. Where watertight connection to existing structures is required, and where indicated on the drawings provide 3/8" x 6" ribbed PVC waterstop bedded in epoxy gel and fastened with 1/8" x 1" stainless steel batten bar and 1/4"x 2-1/4 " expansion anchors at 6" o.c. on each flange, designated for retrofit applications, model 609, as manufactured by Greenstreak, St. Louis, Mo., or equal.
- D. Where indicated on the drawings adhesive type waterstops shall be preformed plastic adhesive waterstop, Synko-Flex Products or equal. Use only where shown on Drawings.

PART 3 - EXECUTION

3.01 CONCRETE JOINTS

- A. General:
1. Comply with ACI 301, Chapter 6, and as specified below.
 2. Provide waterstops in construction joints as shown and as specified in this Section.
- B. Installation:
1. Brush blast new and existing concrete surfaces at joint and surrounding area. Dry, oil-free air to be used for blasting operation. Blasting to be sufficient to remove laitance and solid contaminants, open up surface voids, bugholes, air pockets and other subsurface irregularities but not expose underlying aggregate. The abrasive to be dry and clean and will pass through a 16 mesh screen. After blast cleaning is completed, residual abrasive dust and loose particles are to be removed from the surface by vacuuming or by compressed air. Blasting operation is to be repeated if requested by the Construction Manager at no additional compensation to the Contractor.
 2. Install waterstop and bonding agent per manufacturer recommendations and this Section. Spray on epoxy bonding agent in inaccessible areas per manufacturer's recommendations.
 3. Place a 2-inch grout charge over the damp, clean horizontal contact surface of the old concrete. Place fresh-concrete before the grout has attained its initial set. Grout shall be as specified in Section 03600, Grout.
 4. Lengths of concrete pours shall be less than or equal to twice the pour width.
 5. When concrete has been placed and the form removed, wash loosened material off with high pressure water spray to obtain clean surface subject to approval by Construction Manager.
 6. Cure concrete sufficiently prior to placement of joint filler and/or epoxy sealant to obtain optimum bond as per manufacturer's recommendations.
 7. Install appliances per Drawings and Specifications.

3.02 WATERSTOPS

- A. General:
1. Comply with ACI 301, Chapter 6, Section 3.01B. Waterstop shall be installed in accordance with manufacturer's instructions.

END OF SECTION

SECTION NO. 03300

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 SCOPE

A. General:

1. Contractor shall furnish all labor, materials, equipment and incidentals needed to provide formwork, reinforcement, concrete including all concrete joints, grout and incidentals required to complete the Work as shown and specified.
2. The Work includes providing concrete consisting of Portland cement, fine and coarse aggregate, water, and approved admixtures combined, mixed, transported, placed, finished and cured. The Work also includes:
 - a. Providing openings in concrete to accommodate the Work under this and other Sections.
 - b. Build into concrete all items such as sleeves, frames, anchor bolts, inserts and all other items to be embedded.

B. Coordination:

1. Review installation procedures under other Sections and coordinate the installation of items that must be installed in the concrete as a prime responsibility of the Contractor.
2. Notify subcontractors and other contractors in advance of the placing of concrete to provide sufficient time for furnishing of items that must be installed in the concrete.

C. Compressive Strength of Concrete.

1. All concrete used for slabs on grade, footings, pedestals, equipment pads and other structural items, and as otherwise indicated as Class A shall have a minimum 4,000 psi compressive strength at 28 days and shall be steel reinforced. Miscellaneous concrete uses such as duct banks, thrust blocks, etc., and as otherwise indicated as Class B shall have a minimum 3000 psi compressive strength at 28 days.

D. Related Work Specified Elsewhere:

1. Section 02200, Earthwork.
2. Section 03100, Formwork.
3. Section 03200, Concrete Reinforcement & Doweling.
4. Section 03250, Concrete Joints.
5. Section 03600, Grout.
6. Section 09900, Painting.

1.02 SUBMITTALS

- A. Samples: Submit samples of materials as specified and as otherwise may be requested by the Construction Manager, including names, sources, and descriptions.
- B. Shop Drawings: Submit for approval the following in accordance with Division 1 of these Specifications and as contained herein:
 - 1. List of concrete materials and concrete mix designs proposed for use. Include the results of all tests performed to qualify the materials and to establish the mix designs.
 - 2. Copies of manufacturer's specifications with application and installation instructions for proprietary materials and items, including admixtures and bonding agents.
 - 3. Pour sequence and location of construction joints.
- C. Laboratory Test Reports: Submit copies of laboratory test reports for concrete cylinders, materials and mix design tests. Construction Manager's review will be for general information only. Production of concrete to comply with specified requirements is the responsibility of the Contractor. Submit the testing lab's average strength curve from the design mix proportions of the approved materials.
- D. Submit notarized certification of conformance to referenced standards to the Construction Manager and a copy of the batch plant's most recent scale calibration.
- E. Delivery Tickets: Furnish to Construction Manager copies of all delivery tickets for each load of concrete delivered to the site. Provide items of information as specified in ASTM C 94, Section 14.

1.03 QUALITY ASSURANCE

- A. Reference Standards: Comply with the applicable provisions and recommendations of the latest edition following, except as otherwise shown or specified.
 - 1. ACI 301-84, Specification for Structural Concrete for Buildings, (includes ASTM Standards referred to herein).
 - 2. ACI 304-85, Guide for Measuring, Mixing, Transporting and Placing Concrete.
 - 3. ACI 305-77, Hot Weather Concreting.
 - 4. ACI 308-81, Standard Practice for Curing Concrete.
 - 5. ACI 309-87, Guide for Consolidation of Concrete.

6. ACI 318-89, Building Code Requirements for Reinforced Concrete.
7. ACI 347-78, Recommended Practice for Concrete Formwork.
8. ASTM C31-85, Standard Method of Making and Curing Concrete Test Specimens in the Field.
9. ASTM C33-86, Standard Specification for Concrete Aggregates.
10. ASTM C39-86, Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
11. ASTM C40-86, Standard Test Method for Organic Impurities in Fine Aggregates for Concrete.
12. ASTM C42-84a, Standard Methods of Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
13. ASTM C94-86a, Standard Specification for Ready-Mixed Concrete.
14. ASTM C138-81, Standard Test Method for Unit Weight, Yield and Air Content (Gravimetric) of Concrete.
15. ASTM C143-78, Standard Test Method for Slump of Portland Cement Concrete.
16. ASTM C150-85a, Standard for Portland Cement.
17. ASTM C157-86, Standard Test Method for Length Change of Hardened Cement Mortar and Concrete.
18. ASTM C171-69, (1986) Standard Specification for Sheet Materials for Curing Compounds.
19. ASTM C172-82, Standard Method of Sampling Freshly Mixed Concrete.
20. ASTM C192-81, Standard Method of Making and Curing Concrete Test Specimens in the Laboratory.
21. ASTM C494-86, Standard Specification for Chemical Admixtures for Concrete.
22. ASTM C827-82, Standard Test Method for Early Volume Change of Cementitious Mixtures.
23. ASTM E 96, (1994) Water Vapor Transmission of Materials
24. Federal Specification CCC-C-467C: Cloth, Burlap Jute or Kenaf.

B. Concrete Mix Design and Testing:

1. Contractor shall employ, at its own expense, a testing laboratory, approved by the Construction Manager and experienced in design and testing of concrete materials and mixes to perform concrete mix design.
 - a. Testing agency shall meet the requirements of ASTM E 329.
 - b. Selection of a testing laboratory must be approved by the Construction Manager.
 - c. Submit a written description of the qualifications of personnel, laboratory facilities and equipment, and other information which may be requested by the Construction Manager.
 2. Materials and installed Work will be tested by the Construction Manager, at any time during the progress of the Work. The contractor shall notify the Construction Manager with sufficient advance notice so that the Construction Manager may arrange to be present during all concrete pouring to obtain samples for testing. The contractor shall provide complete access to the work and any assistance in obtaining samples that may be requested by the Construction Manager.
 3. Retesting of rejected materials and installed Work, shall be done at the Contractor's expense.
- D. Qualifications of Water-Reducing Admixture Manufacturer:
1. Water-reducing admixtures shall be manufactured under strict quality control in facilities operated under a quality assurance program. Contractor shall furnish copy of manufacturer's quality assurance handbook to document the existence of the program. Manufacturer shall maintain a concrete testing laboratory that has been approved by the Cement and Concrete Reference Laboratory at the Bureau of Standards, Washington, D.C.
 2. Provide a qualified concrete technician employed by the admixture manufacturer to assist in proportioning the concrete for optimum use of the admixture. The concrete technician, when requested, shall advise on proper addition of the admixture to the concrete and on adjustment of the concrete mix proportions to meet changing job site conditions.
- E. Test for Concrete Materials:
1. Submit written reports to the Construction Manager, for each material selected and tested, prior to the start of Work. Provide the Project identification name and number, date of report, name of Contractor, name of concrete testing service, source of concrete aggregates, material manufacturer and brand name for manufactured materials, values specified in the referenced specification for each materials, and test results. Indicate acceptability of materials for intended use.
 2. Approved testing lab shall take samples of the mix designs and make a minimum of 12 test cylinders for each design mix. Lab shall perform cylinder breaks at 3,7,21 and 28 days and plot an

- average strength curve for each mix design. Submit plots to Construction Manager prior to any concrete pour.
3. Certified copies of test results for mix designs performed within the preceding 12-month period, for same aggregates and cement for mix producing strengths equal to required average compressive strengths and from an established central plant may be submitted for review instead of conducting new trial batch tests. If tests from previous work are not acceptable, prepare trial batch tests as specified.

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. All materials used for concrete must be kept clean and free from all foreign matter during transportation and handling and kept separate until measured and placed in the mixer. Bins or platforms having hard clean surfaces shall be provided for storage. Suitable means shall be taken during hauling, piling, and handling to insure that segregation of the coarse and fine aggregate particles does not occur and the grading is not affected.

PART 2 - PRODUCTS

2.01 CONCRETE MATERIALS

- A. Cement:
 1. Portland cement, ASTM C 150, Type I/II.
 2. Use Portland cement made by a qualified, acceptable manufacturer and produced by not more than one plant.
 3. Do not use cement that has deteriorated because of improper storage or handling.
- B. Aggregates: ASTM C 33 and as herein specified.
 1. Do not use aggregates containing soluble salts or other substances such as iron sulfides, pyrite, marcasite, ochre, or other materials that can cause stains on exposed concrete surfaces. Slag materials are not allowed.
 2. Fine Aggregate: Clean, sharp, natural sands free from loam, clay, lumps, or other deleterious substances.
 - a. Dune sand, bank run sand, and manufactured sand are not acceptable.
 3. Coarse Aggregate: Clean granitic, uncoated, processed aggregate containing no clay, mud, loam, or foreign matter as follows:
 - a. Crushed stone processed from natural rock or stone.
 - b. Coarse Aggregate Size: Size to be ASTM C 33, Nos. 57 or 67.
- C. Water: Clean, free from injurious amounts of oils, acids, alkalis, organic materials or other substances that may be deleterious to concrete or steel.

2.02 CONCRETE ADMIXTURES

- A. Provide admixtures produced by established reputable manufacturers, and use in compliance with the manufacturer's printed instruction. Do not use admixtures that have not been incorporated and tested in the accepted mixes, unless otherwise authorized in writing by the Construction Manager.
- B. Water-Reducing Admixture: ASTM C 494, Type A.
 - 1. Proportion all concrete with non-air entraining, normal setting, water-reducing, aqueous solution of a modification of the salt of polyhydroxylated organic acids. The admixture shall not contain more chloride ions than are contained in municipal drinking water. Provide one of the following:
 - a. WRDA-79 as manufactured by Grace Construction Products.
 - b. Pozzolith by Master Builders Company.
 - c. Plastocrete 161 as manufactured by Sika Chemical Corporation.
 - d. Approved Equal.
 - 2. Water-reducing admixture required for all Class A and B concrete unless directed otherwise by the Engineer.
- C. Calcium Chloride: Do not use calcium chloride in concrete.
- D. Do not use a retarder in the slump-testing cone, unless written permission is given by Construction Manager.

2.03 PROPORTIONING AND DESIGN OF MIXES

- A. Prepare design mixes of concrete. Mixes subject to the following limitations:
 - 1. Specified 28-day Compressive Strength - 4000 psi or 3000 psi based on application.
 - 2. Maximum Water-Cement Ratio by Weight: .45.

Coarse Aggregate Number	Minimum Cement Content, Pounds Per Cubic Yard
57,67	564
467	517

- B. Use an independent testing facility approved by the Construction Manager for preparing and reporting proposed mix designs.
 - 1. Calibration charts on the lab equipment must be submitted.
- C. Proportion mixes by either laboratory trial batch or field experience methods, using materials to be employed on the Project for concrete required. Comply with ACI 211.1 and report to the Construction Manager the following data:
 - 1. Complete identification of aggregate source of supply.
 - 2. Tests of aggregates for compliance with specified requirements.
 - 3. Scale weight of each aggregate.

4. Absorbed water in each aggregate.
 5. Brand, type and composition of cement.
 6. Brand, type and amount of each admixture.
 7. Amounts of water used in trial mixes.
 8. Proportions of each material per cubic yard.
 9. Gross weight and yield per cubic yard of trial mixtures.
 10. Measured slump.
 11. Compressive strength developed at 3, 7, 21 and 28 days, from not less than 3 test cylinders cast for each 3, 7, 21 and 28-day test, and for each design mix.
- D. Submit written reports to the Construction Manager of proposed mix of concrete at least 15 days prior to start of Work. Do not begin concrete production until mixes have been approved by the Construction Manager.
- E. Laboratory Trial Batches: When laboratory trial batches are used to select concrete proportions, prepare test specimens and conduct strength test as specified in ACI 301, Chapter 3 - Proportioning, Method 1. Concrete mixes need not be designed for greater than 4,600 psi regardless of the production facilities standard deviation.
- F. Field Experience Method: When field experience methods are used to select concrete proportions, establish proportions as specified in ACI 301, Chapter 3, Method 2.
- G. Water-Cement Ratio Methods: If suitable data from field experience or laboratory trial batches cannot be obtained, concrete proportions may be established as specified in ACI 301, Chapter 3, Method 3.
- H. Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant; at no additional cost to the Owner. Laboratory test data for revised mix designs and compressive strength results from test cylinders must be submitted to the Construction Manager for acceptance before using the revised mixes.
- I. Admixtures:
1. Use amounts of admixtures as recommended by the manufacturer for climatic conditions prevailing at the time of placing. Adjust quantities and types of admixtures as required to maintain quality control.
- J. Slump Limits:

1. Proportion and design mixes to result in concrete slump at the point of placement as follows:
 - a. For footings and substructure walls, not less than 1 inch and not more than 3 inches.
 - b. For slabs on grade, walls and columns, not less than 1 inch and not more than 4 inches.

2.04 EPOXY BONDING AGENT

- A. Provide an epoxy-resin bonding agent as specified in Section 03250, Concrete Joints, everywhere new concrete is poured against old or when the new concrete has been left 30 days or more without the following new pour place against it.

2.05 CONCRETE CURING MATERIALS

- A. Absorptive Cover: Burlap cloth made from jute or kenaf, weighing approximately 10 ounces per square yard and complying with AASHTO M 182, Class 3.
- B. Moisture-Retaining Cover: One of the following, complying with ASTM C 171.
 1. Waterproof paper.
 2. 4 mil polyethylene.

2.06 VAPOR BARRIER

- A. Vapor barrier shall be polyethylene sheeting with a minimum thickness of mils or other equivalent material having a vapor permeance rating not exceeding 0.5 perms as determined in accordance with ASTM E 96.

PART 3 - EXECUTION

3.01 CONCRETE MIXING

- A. General:
 1. Concrete may be produced at batch plants or it may be produced by the ready-mixed process. Batch plants shall comply with the recommendations of ACI 304, and shall have sufficient capacity to produce concrete of the qualities specified, in quantities required to meet the construction schedule. All plant facilities are subject to testing laboratory inspection and acceptance of the Construction Manager.
 2. Mixing:
 - a. Mix concrete with an approved rotating type batch machine, except where hand mixing of very small quantities may be permitted.
 - b. Remove hardened accumulations of cement and concrete frequently from drum and blades to assure acceptable mixing action.
 - c. Replace mixer blades when they have lost 10 percent of their original height.
 - d. Use quantities such that a whole number of bags of cement is required, unless otherwise permitted.

- B. Ready-Mix Concrete:
 - 1. Comply with the requirements of ASTM C 94, and as herein specified. Proposed changes in mixing procedures, other than herein specified, must be accepted by the Construction Manager before implementation.
 - a. Plant equipment and facilities: Conform to National Ready Mix Concrete Association "Plant and Delivery Equipment Specification."
 - b. Mix concrete in revolving type truck mixers which are in good condition and which produce thoroughly mixed concrete of the specified consistency and strength.
 - c. Do not exceed the proper capacity of the mixer.
 - d. Mix concrete for a minimum of two minutes after arrival at the job site, or as recommended by the mixer manufacturer.
 - e. Do not allow the drum to sit while in transit.
 - f. Mix at proper speed until concrete is discharged.
 - g. Maintain adequate facilities at the job site for continuous delivery of concrete at the required rates.
 - h. Provide access to the mixing plant for the Construction Manager at all times.
 - C. Maintain equipment in proper operating condition, with drums cleaned before charging each batch. Schedule rates of delivery in order to prevent delay of placing the concrete after mixing, or holding dry-mixed materials too long in the mixer before the addition of water and admixtures.
- 3.02 TRANSPORTING CONCRETE
- A. Transport and place concrete not more than 60 minutes after water has been added to the dry ingredients.
 - B. Take care to avoid spilling and separation of the mixture during transportation.
 - C. Do not place concrete in which the ingredients have been separated.
 - D. Do not retemper partially set concrete, and do not add any water at the job site.
 - E. Use suitable and approved equipment for transporting concrete from mixer to forms.
- 3.03 CONCRETE PLACEMENT
- A. General: Place concrete continuously so that no concrete will be placed on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness within the section. Where new concrete is placed next to existing, or a section cannot be placed continuously, provide construction joints as specified in Section 03250, Concrete Joints. Apply approved epoxy bonding agent as close as possible to time of actual concrete placement. Do not allow epoxy bonding agent to dry. Deposit concrete as nearly as practical in its final location to avoid segregation due to rehandling or flowing. Do not subject concrete to any procedure that will cause segregation.

1. Screed concrete which is to receive other construction to the proper level to avoid excessive skimming or grouting.
2. Do not use concrete which becomes non-plastic and unworkable, or does not meet the required quality control limits, or which has been contaminated by foreign materials. Do not use retempered concrete. Remove rejected concrete from the job site and dispose of it in an acceptable location.
3. Do not place concrete until all forms, bracing, reinforcement, and embedded items are in final and secure position.
4. Unless otherwise approved, place concrete only when Construction Manager is present.

B. Concrete Conveying:

1. Handle concrete from the point of delivery and transfer to the concrete conveying equipment and to the locations of final deposit as rapidly as practical by methods that will prevent segregation and loss of concrete mix materials.
2. Provide mechanical equipment for conveying concrete to ensure a continuous flow of concrete at the delivery end. Provide runways for wheeled concrete conveying equipment from the concrete delivery point to the locations of final deposit. Keep interior surfaces of conveying equipment, including chutes, free of hardened concrete, debris, water, snow, ice, and other deleterious materials.
3. Do not use chutes for distributing concrete unless approved in writing by the Construction Manager.
 - a. Provide sketches showing methods by which chutes will be employed when requesting such approval.
 - b. Design chutes, if permitted, with proper slopes and supports to permit efficient handling of the concrete.
4. Pumping of concrete is permitted however, do not use aluminum piping to convey the concrete.

C. Placing Concrete into Forms:

1. Place no concrete over water-covered or muddy soil. Placement of reinforcing steel dowels after concrete has been placed is prohibited.
2. Immediately prior to placing concrete, wet construction joints with coat of neat cement and place minimum 2" depth of cement-sand paste containing same proportions of cement, sand, and water as used in concrete in bottom of wall-type forms
3. Where conditions make placement or consolidation difficult or where reinforcement is congested, batches of mortar containing same proportions of cement, sand, and water as used in concrete shall be

deposited in forms around congestion immediately prior to concrete placement to avoid segregation induced "honeycomb."

4. Deposit concrete in forms in horizontal layers not deeper than 18 inches and in a manner to avoid inclined construction joints. Where placement consists of several layers, place concrete at such a rate that concrete that is being integrated with fresh concrete is still plastic with adequate vibration.
5. Do not permit concrete to free fall within the form from a distance exceeding 4 feet. Use "elephant trunks" and tremies to prevent free fall and excessive splashing on forms and reinforcement.
6. Remove temporary spreaders in forms when concrete placing has reached the elevation of such spreaders.
7. Consolidate concrete placed in forms by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping. Use equipment and procedures for consolidation of concrete in accordance with the applicable recommended practices of ACI 309. Vibration of forms and reinforcing will not be permitted, unless otherwise accepted by the Construction Manager.
8. Do not use vibrators to transport concrete inside of forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than the visible effectiveness of the machine. Place vibrators to rapidly penetrate the layer of concrete and at least 6 inches into the preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion, limit the duration of vibration to the time necessary to consolidate the concrete and complete embedment of reinforcement and other embedded items without causing segregation of the mix.
9. Force concrete under pipes, sleeves, openings, and inserts from one side until visible from the other side to prevent voids.

D. Placing Concrete Slabs and Sidewalks:

1. Deposit and consolidate concrete slabs in a continuous operation, within the limits of concrete joints, until the placing of a panel or section is completed.
2. Consolidate concrete during placing operations using mechanical vibrating equipment, so that concrete is thoroughly worked around reinforcement and other embedded items and into corners.
3. Bring slab surfaces to the correct level. Smooth the surface, leaving it free of humps or hollows. Do not sprinkle water on the plastic surface. Do not disturb the slab surfaces prior to beginning finishing operations.

- E. Bonding for Next Concrete Pour: Comply with Section 03250 and 03300 of these Specifications.
- F. Quality of Concrete Work:
1. Make all concrete solid, compact and smooth, and free of laitance, cracks and cold joints. When forms have been removed concrete surfaces shall be free of air pockets or voids. Significant voids, in the opinion of the Construction Manager, shall be cause for the Contractor to chip away and remove in a manner acceptable to the Construction Manager, and recast the defective concrete pour(s).
 2. All concrete for liquid retaining structures, and all concrete in contact with earth, water, or exposed directly to the elements shall be watertight.
 3. Cut out or chip out and properly replace with epoxy grout to the extent ordered by the Construction Manager, or repair to the satisfaction of the Construction Manager, surfaces which contain minor cracks or voids, are unduly rough, or are in any way defective. Thin patches or plastering will not be acceptable.
 4. All leaks through concrete, and cracks, holes or other defective concrete in areas of potential leakage, shall be repaired and made watertight by the Contractor.
 5. Repair, removal, and replacement of defective concrete as ordered by the Construction Manager shall be at no additional cost.
- G. Hot Weather Placing:
1. When hot weather conditions exist that would seriously impair the quality and strength of concrete, place concrete in compliance with ACI 305 and as herein specified.
 2. Cool ingredients before mixing to maintain concrete temperature at time of placement below 90°F when the temperature is rising and below 85°F when the temperature is falling. Mixing water may be chilled, or finely crushed ice may be used to control the concrete temperature provided the water equivalent of the ice is calculated in the total amount of mixing water.
 3. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that the steel temperature will not exceed the ambient air temperature immediately before embedment in concrete.
 4. Wet forms thoroughly before placing concrete.
 5. Do not place concrete at a temperature so as to cause difficulty from loss of slump, flash set, or cold joints.

6. Do not use set-control admixtures unless approved by the Construction Manager in mix designs.
7. Obtain Construction Manager's approval of other methods and materials proposed for use.

3.04 FINISH OF FORMED SURFACES

A. Rough Form Finish:

1. Standard rough form finish shall be the concrete surface having the texture imparted by the form material used. For vertical surfaces, all tie holes and defective areas to be repaired and patched with mortar of 1 part cement to 1 1/2 parts sand and all fins and other projections exceeding 1/4 inch in height rubbed down or chipped off.
2. Use rough form finish for the following:
 - a. Exterior vertical surfaces up to 1 foot below grade.
 - b. Interior exposed vertical surfaces of liquid containers except areas to receive sealers and/or coatings.
 - c. Other areas shown.

B. Smooth Form Finish:

1. Produce smooth form finish by selecting form materials that will impart a smooth, hard, uniform texture. Arrange panels in an orderly and symmetrical manner with a minimum of seams. Repair and patch defective areas as above with all fins or other projections completely removed and smoothed.
2. Use smooth form finish for surfaces that are to be covered with a coating or stucco material. The material may be applied directly to the concrete or may be a covering bonded to the concrete such as waterproofing, damp proofing, painting or other similar system.

D. Smooth Rubbed Finish:

1. Provide smooth rubbed finish in accordance with ACI 301-84, to concrete surfaces which have received smooth form finish as follows:
 - a. Rubbing of concrete surfaces not later than the day after form removal.
 - b. Moistening of concrete surfaces and rubbing with carborundum brick or other abrasive until a uniform color and texture is produced. Do not apply cement grout other than that created by the rubbing process, unless the Construction Manager reviews and approves.
2. Except where surfaces have been previously covered as specified in Paragraph B above, use smooth rubbed finish for the following:
 - a. Exterior exposed walls and other vertical surfaces down to 1 foot below grade.

- b. Exterior horizontal surfaces, except exterior exposed slabs and sidewalks.
- c. Interior exposed vertical surfaces.

E. Related Unformed Surfaces:

- 1. At tops of walls, horizontal offsets, and similar unformed surfaces occurring adjacent to formed surfaces, strike off smooth and finish with a texture matching the adjacent formed surfaces. Continue the final surface treatment of formed surfaces uniformly across the adjacent unformed surfaces, unless otherwise shown.

F. Chamfering:

- 1. External corners that will be exposed shall be chamfered, beveled, or rounded, by moldings placed in the forms unless the drawings specifically state that chamfering is to be omitted.

3.05 SLAB FINISHES

A. Float Finish:

- 1. After placing concrete slabs, do not work the surface further until ready for floating. Begin floating when the surface water has disappeared or when the concrete has stiffened sufficiently. Use a wood float only. Check and level the surface plane to a tolerance not exceeding 1/4 inch in 10 feet when tested with a 10 foot straightedge placed on the surface at not less than 2 different angles. Cut down high spots and fill all low spots. Immediately after leveling, refloat the surface to a uniform, smooth, granular texture.

B. Trowel Finish:

- 1. After floating, begin the first trowel finish operation using a power-finish trowel. Begin final troweling when the surface produces a ringing sound as the trowel is moved over the surface.
- 2. Consolidate the concrete surface by final hand troweling. Finish shall be free of trowel marks, uniform in texture and appearance, and with a surface plane tolerance not exceeding 1/8 inch in 10 feet when tested with a 10 foot straight edge, and all edges adjacent to walls will have a struck, tooled intersection joint. Apply to all slab areas.

C. Non-Slip Broom Finish:

- 1. Apply non-slip broom finish to exterior concrete platforms, sidewalks, drives, and elsewhere as shown or specified.
- 2. Immediately after trowel finishing, slightly roughen the concrete surface by brooming in the direction perpendicular to the main traffic route. Use fiber-bristle broom unless otherwise directed. Coordinate the required final finish with the Engineer before application.

3.06 CONCRETE CURING AND PROTECTION

- A. General:
1. Protect freshly placed concrete from premature drying and excessive hot temperature, and maintain without drying at a relatively constant temperature for the period of time necessary for hydration of the cement and proper hardening of the concrete.
 2. Start initial curing after placing and finishing concrete as soon as free moisture has disappeared from the concrete surface. Keep continuously moist for not less than 72 hours.
 3. Begin final curing procedures immediately following initial curing and before the concrete has dried. Continue final curing for at least 7 days and in accordance with ACI 301 procedures. Avoid rapid drying at the end of the final curing period.
- B. Curing Methods:
1. Perform curing of all concrete by moist curing or by moisture-retaining cover curing. For curing, use water that is free of impurities which could etch or discolor exposed, natural concrete surfaces.
 2. Provide moisture curing by any of the following methods:
 - a. Keeping the surface of the concrete continuously wet by covering with water.
 - b. Continuous water-fog spray.
 - c. Covering the concrete surface with the specified absorptive cover, thoroughly saturating the cover with water, and keeping the absorptive cover continuously wet with sprinklers or porous hoses. Place absorptive cover so as to provide coverage of the concrete surfaces and edges, with a 4-inch lap over adjacent absorptive covers.
 - d. Keep concrete continuously wet for 7 days after placing.
 3. Provide moisture-retaining cover curing as follows:
 - a. Thoroughly saturate concrete surfaces and cover with the specified moisture-retaining cover for curing concrete, placed in the widest practical width with sides and ends lapped at least 3 inches and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during the curing period using cover material and waterproof tape. Keep concrete wet and covered for 7 days after placing.
- B. Curing Formed Surfaces:
1. Cure formed concrete surfaces, including the walls, supported slabs and other similar surfaces by moist curing with the forms in place for the full curing period or until forms are removed. If forms are removed, continue curing by methods specified above.
- C. Curing Unformed Surfaces:
1. Initially cure unformed surfaces, such as slabs, sidewalks and other flat surfaces by moisture curing.

2. Final cure unformed surfaces, unless otherwise specified, by moisture retaining cover curing.
- D. Temperature of Concrete During Curing:
1. When the atmospheric temperature is 80°F and above, or during other climatic conditions which will cause too rapid drying of the concrete, make arrangements before the start of concrete placing for the installation of wind breaks or shading, and for fog spraying, wet sprinkling, or moisture-retaining covering. Protect the concrete continuously for the concrete curing period. Provide hot weather protection complying with the requirements of ACI 305, unless otherwise specified.
 2. Maintain concrete temperature as uniformly as possible, and protect from rapid atmospheric temperature changes. Avoid temperature changes in concrete which exceed 5°F in any one hour and 50°F in any 24 hour period.
- E. Protection from Mechanical Injury:
1. During the curing period, protect concrete from damaging mechanical disturbances including load stresses, heavy shock, excessive vibration, and from damage caused by rain or flowing water. Protect all finished concrete surfaces from damage by subsequent construction operations.

3.07 FIELD QUALITY CONTROL

- A. Construction Manager will direct the number of slump tests and cylinders required and shall make standard compression test cylinders and entrained air tests as specified below. Contractor shall furnish all necessary assistance required.
- B. Quality Control Testing During Construction:
1. An independent testing firm employed by the Construction Manager will perform sampling and testing for field quality control during the placement of concrete, as follows:
 - a. Sampling Fresh Concrete: ASTM C 172.
 - b. Slump: ASTM C 143; one for each set of compressive strength test specimens.
 - c. Compressive Strength Tests: ASTM C 39; one set of compression cylinders for each 50 cubic yards of fraction thereof, of each mix design placed in any one day; 1 specimen tested at 3 and 7 days, and 2 specimens tested at 28 days.
 - 1) Adjust mix if test results are unsatisfactory and resubmit for Construction Manager's approval.
 - 2) Concrete which does not meet the strength requirements is subject to rejection and removal from the Work, or to other such corrective measures as directed by the Construction Manager, at the expense of the Contractor.
 - d. Compression Test Specimens: ASTM C 39; make one set of 4 standard cylinders for each compressive strength test.

- e. Concrete Temperature: Hourly when air temperature is 80°F and above; and each time a set of compression test specimens is made.
 2. Copies of test results will be maintained on file at the project site in Construction Managers office.
- C. Evaluation of Quality Control Tests:
1. Do not use concrete delivered to the final point of placement that has slump, temperature, or total air content outside the specified values.
 2. Compressive strength tests for laboratory-cured cylinders will be considered satisfactory if the averages of all sets of these consecutive compressive strength tests equal or exceed the 28 day design compressive strength of the type or class of concrete and no individual strength test falls below the required compressive strength by more than 300 psi.
 - a. Where questionable field conditions may exist during placing concrete or immediately thereafter, strength tests of specimens cured under field conditions will be required by the Construction Manager to check the adequacy of curing and protecting of the concrete placed. Specimens will be molded at the same time and from the same samples as the laboratory cured specimens.
 - 1) Provide improved means and procedures for protecting concrete when the 28 day compressive strength of field-cured cylinders is less than 90 percent of companion laboratory cured cylinders.
 - 2) When laboratory-cured cylinder strengths are appreciably higher than the minimum required compressive strength, field-cured cylinder strengths need not exceed the minimum required compressive strength even though the 90 percent criterion is not met.
 - 3) If individual tests of laboratory-cured specimens produce strengths more than 500 psi below the required minimum compressive strength, or if tests of field-cured cylinders indicate deficiencies in protection and curing, provide additional measures to assure that the load-bearing capacity of the structure is not jeopardized. If the likelihood of low-strength concrete is confirmed and computations indicate the load-bearing capacity may have been significantly reduced, tests of cores drilled from the area in question, core testing, and core void repair will be required at the Contractor's expense.
 - b. If the compressive strength tests fail to meet the minimum requirements specified, the concrete represented by such tests will be considered deficient in strength and subject to

replacement, reconstruction or to other action approved by Construction Manager, and shall be done at the Contractor's expense.

D. Testing Concrete Structure for Strength:

1. When there is evidence that the strength of the in-place concrete does not meet specification requirements, Contractor shall employ at his expense the services of a concrete testing service, approved by the Construction Manager, to take cores drilled from hardened concrete for compressive strength determination. Tests shall comply with ASTM C 42 and the following:
 - a. Take at least 3 representative cores from each member or suspect area at locations directed by Construction Manager.
 - b. Strength of concrete for each series of cores will be considered satisfactory if their average compressive strength is at least 90 percent and no single core is less than 85 percent of the 28 day required compressive strength, and at least 100% by 56 days.
 - c. Report test results in writing to Construction Manager on the same day that tests are made. Include in test reports the Project identification name and number, date, name of Contractor, name of concrete testing service, location of test core in the structure, type of class of concrete represented by core sample, nominal maximum size aggregate, design compressive strength, compression breaking strength and type of break (corrected for length-diameter ratio), direction of applied load to core with respect to horizontal plane of the concrete as placed, and the moisture condition of the core at time of testing.
2. Fill core holes solid with patching mortar, strength and finish to match adjacent concrete surfaces.
3. Conduct static load test and evaluations complying with ACI 318 if the results of the core tests are unsatisfactory, or if core tests are impractical to obtain, as directed by the Construction Manager.

E. Testing for Watertightness of Concrete Structures.

1. All concrete structures designed to contain or convey fluid shall be tested for watertightness by the Contractor prior to earth backfilling by filling with water to levels approximating what will be attained during operation and measuring the drop in level due to leakage, if any. These tests shall be made under the observation of the Construction Manager, and, if necessary, the tests shall be repeated until watertightness is insured. Perform tests prior to backfilling below grade structures and prior to installations of any coating.
2. Rate of filling shall be limited to minimize shock-effect to new concrete construction. Water shall be held under each condition long enough to satisfy the engineer that the structures are watertight. Structures shall be free of internal or external water leakage.

3. The total loss of water level in any basin or flume shall not exceed ½ in. (13 mm) depth in 24 hours. Leakage shall be located and stopped and the structure again tested until this requirement is met. If the structure does not meet the test, the Contractor shall repair or replace, at his own expense, such part of the work as may be necessary to secure the desired results, as approved by the Construction Manager.
4. Regardless of the rate of leakage, there shall be no visible leakage from any concrete structure.

3.08 MISCELLANEOUS CONCRETE ITEMS

A. Filling-In:

1. Fill-in holes and openings left in concrete structures for the passage of work by other contractors and as indicated on Drawings, with non-shrink nonmetallic grout per Section 03600 of this Specification.
2. Dry packing will be approved by the Construction Manager on case by case basis.

3.09 CONCRETE REPAIRS

A. Repair of Formed Surfaces:

1. Repair exposed-to-view formed concrete surfaces that contain defects that adversely affect the appearance of the finish. Surface defects that require repair include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets, and holes left by the tie rods and bolts; fins and other projections on the surface; and stains and other discolorations that cannot be removed by cleaning.
2. Repair concealed formed concrete surfaces that may contain defects that adversely affect the durability of the concrete. Surface defects that require repair include cracks in excess of 0.01 inch wide, cracks of any width and other surface deficiencies which penetrate to the reinforcement or completely through non-reinforced sections, honeycomb, rock pockets, holes left by tie rods and bolts, and spalls except minor breakage at corners.
3. Pressure grout structural cracks, and cracks in water-holding structures, using one of the following:
 - a. Sikadur 35, Hi-Mod LV Gel by Sika Chemical Company.
 - b. Or equal.
4. Repair and patch defective areas with sand cement mortar having a minimum 28-day compressive strength of 4,000 psi immediately after removal of forms and as directed by the Construction Manager.
5. Cut out or chip out honeycomb, rock pockets, voids over 1/2-inch diameter, and holes left by tie rods and bolts, down to solid concrete but,

in no case, to a depth of less than 1 inch. Make edges of cuts perpendicular to the concrete surface. Before placing the cement mortar, thoroughly clean, dampen with water, and brush coat the area to be patched with the specified bonding agent.

- a. For exposed-to-view surfaces, blend white Portland cement and standard Portland cement so that, when dry, the patching mortar color will match the color of the surrounding concrete.
 - b. Contractor shall impart texture to repaired surfaces to match texture of existing adjacent surfaces. Provide test areas at inconspicuous locations to verify mixture, texture and color match before proceeding with the patching. Compact mortar in place and strike off slightly higher than the surrounding surface.
6. Fill holes extending through concrete by means of a plunger-type gun or other suitable device from the least exposed face, using a flush stop held at the exposed face to insure complete filling.
 7. Sandblast exposed-to-view surfaces that require removal of stains, grout accumulations, sealing compounds, and other substances marring the surfaces. Use sand finer than No. 30 and air pressure from 15 to 25 psi.
- B. Repair of Unformed Surfaces:
1. Test unformed surfaces, such as monolithic slabs, for smoothness and to verify surface plane to the tolerances specified for each surface and finish. Correct low and high areas as herein specified.
 2. Test unformed surfaces sloped to drain for trueness of slope, in addition to smoothness, using a template having the required slope. Correct high and low areas as herein specified.
 3. Repair finish of unformed surfaces that contain defects that adversely affect the durability of the concrete. Surface defects, as such, include crazing, cracks in excess of 0.01-inch wide or which penetrate to the reinforcement or completely through nonreinforced sections regardless of width, spalling, popouts, honeycomb, rock pockets, and other objectionable conditions.
 4. Grout structural cracks, and cracks in water holding structures, using one of the following:
 - a. Sikadur 35, Hi-Mod LV Gel by Sika Chemical Company.
 - b. Or equal.
 5. Correct high areas in unformed surfaces by grinding, after the concrete has cured sufficiently so repairs can be made without damage to adjacent area.
 6. Correct low areas in unformed surfaces during or immediately after completion of surface finishing operations by cutting out the low areas

and replacing with fresh concrete. Finish repaired areas to blend into adjacent concrete. Use one of the following:

- a. Mastertop MP by Master Builders.
 - b. Sikatop by Sika Chemical Company.
 - c. Or equal.
7. Repair defective areas, except random cracks and single holes not exceeding 1-inch diameter, by cutting out and replacing with fresh concrete. Remove defective areas to sound concrete with clean, square cut, and expose reinforcing steel with at least 3/4-inch clearance all around. Dampen all concrete surfaces in contact with patching concrete and brush with the specified bonding agent. Place patching concrete before grout takes its initial set. Mix patching concrete of the same materials and proportions to provide concrete of the same type or class as the original adjacent concrete. Place, compact, and finish as required to blend with adjacent finished concrete. Cure in the same manner as adjacent concrete.
8. Repair isolated random cracks and single holes not over 1-inch diameter, by the dry-pack method. Groove the top of cracks, and cut out holes to sound concrete and clean of dust, dirt and loose particles. Dampen all cleaned concrete surfaces and brush with the specified bonding agent. Place dry-pack before the cement grout takes its initial set. Mix dry-pack, consisting of 1 part Portland cement to 2-1/2 parts fine aggregate passing a No. 16 mesh sieve, using only enough water as required for handling and placing. Compact dry-pack mixture in place and finish to match adjacent concrete. Keep patched areas continuously moist for not less than 72 hours.
9. Repair methods not specified above may be used if approved by the Construction Manager.

END OF SECTION

SECTION NO. 03455

PRECAST CONCRETE MANHOLES

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. The contractor shall furnish all materials, labor, and equipment and construct manholes consisting of precast section as shown on the drawings and as specified herein.
- B. The manholes shall have an invert channel shaped to correspond with the lower half of the pipe. The top of the shelf shall be at the elevation indicated and shall be sloped to drain toward the flowing-through channel.
- C. The forms, dimensions, concrete, and construction methods shall be approved in advance of construction.
- D. All work shall be as specified herein and conform to the State of Georgia Department of Transportation Standards.

1.02 RELATED WORK

- A. Section 02221: Excavation, Backfill, Fill, and Grading for Pipe
- B. Section 05510: Manhole Frames and Covers

1.03 SUBMITTALS

- A. The quality of all materials, the process of manufacture, and the finished sections shall be subject to inspection and approval by the representative of the Owner. Such inspection may be made at the place of manufacture, or at the site after delivery, or at both places, and the sections shall be subject to rejection at any time on account of failure to meet any of the specification requirements; even though sample sections may have been accepted as satisfactory at the place of manufacture. Sections rejected after delivery to the job shall be marked for identification and shall be removed from the job at once.
- B. At the time of inspection, the sections will be carefully examined for compliance with the ASTM designation specified below and these specifications, and with the approved manufacturer's drawing. All sections shall be inspected for general appearance, dimension, "scratch-strength", blisters, cracks, roughness, soundness. The surface shall be dense and close-textured.
- C. Imperfections may be repaired, subject to the approval after demonstration by the manufacturer that strong and permanent repairs result. Repairs shall be carefully inspected before final approval. Cement mortar used for repairs shall have a minimum compressive strength of 4,000 psi at the end of seven days and 5,000 psi at the end of 28 days, when tested in 3" x 6" cylinders stored in the standard manner. Epoxy mortar may be utilized for repairs.

PART 2 - PRODUCTS

2.01 PRECAST CONCRETE SECTIONS

- A. Precast concrete manhole barrel and eccentric top sections shall conform to the specifications for Precast Reinforced Concrete Manhole Sections, ASTM Designation C478, except as otherwise specified below. The method of construction shall conform to the detailed drawings appended to these specifications and the following additional requirements:

1. The minimum wall thickness for the various size barrel sections shall be as listed below.

<u>Inside Diameter of Barrel</u>	<u>Minimum Wall Thickness</u>
----------------------------------	-------------------------------

48"	5"
60"	6"
72"	7"

2. Barrel section shall have tongue and groove joints. Joints shall have round rubber gaskets set in specifically provided indentations. The round rubber "O" ring gasket shall conform to ASTM C443 standard specifications.
3. Type II cement shall be used except as otherwise approved.
4. The date of manufacture and the name or trademark of the manufacturer shall be clearly marked on the inside of each precast section.
5. Sections shall be cured by an approved method and shall not be shipped until at least five days after having been fabricated.
6. Top sections shall be eccentric except that precast concrete slabs shall be used where cover over the top of the pipe is less than 4 feet for all manholes.
7. Precast concrete slabs over top section, where required, shall be capable of supporting the overburden plus a live load equivalent to AASHTO H-20 loading.
8. The tops of bases shall be suitably shaped to make the precast barrel section.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Manholes and other precast structures shall be constructed to the dimensions shown on the drawings and as specified in these specifications.
- B. The base shall be cast-in-place concrete as specified in Division 3 placed on a thoroughly compacted gravel subbase. The tops of the cast-in-place bases shall be shaped to mate with the precast barrel section, and shall be adjusted in grade so that the top of the dome section is at the approximately correct elevation.

- C. Precast bases, conforming to all requirements of ASTM C478 and above listed requirements for precast sections, may be used.
- D. Precast concrete structure sections shall be set so as to be vertical and with sections in true alignment with a 1/4" maximum tolerance to be allowed. The outside and inside joint shall be filled with a comparatively dry mortar (one part cement to two parts sand) and finished flush with the adjoining surfaces. Allow joints to set for 24 hours before backfilling. Backfilling shall be done in a careful manner, bringing the fill up evenly on all sides. If leaks appear in the structures, the inside joints shall be caulked with lead wool. The contractor shall install the precast section in a manner that will result in a watertight joint.
- E. Holes in the concrete pipe sections required for handling or other purposes shall be plugged with a non-shrinking grout or by grout in combination with concrete plugs.
- F. Where holes are cut in the precast sections to accommodate pipes, cutting shall be done prior to setting them in place to prevent any subsequent jarring which may loosen the mortar joints.
- G. Cast iron frames shall be placed, shimmed, and set in Portland cement mortar to the specified grade.

END OF SECTION

SECTION NO. 03456

DRAINAGE STRUCTURES

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials, equipment and incidentals required and install in the locations as shown on the Drawings, the drainage pipe, catch basins, headwalls and appurtenances as specified herein.
- B. All drainage structures shall be manufactured and installed in accordance with details included herein, and as shown on Drawings.

1.02 RELATED WORK NOT INCLUDED

- A. Excavation and Backfill for pipe; Section 02221.
- B. Exterior Ductile Iron Pipes and Fittings, Section 02615.
- C. Seeding; Section 02486.
- D. Concrete and Reinforcing Steel; Division 3.

1.03 QUALIFICATIONS

- A. All precast structures shall be furnished by a single manufacturer who is fully experienced, reputable, and qualified in the manufacture of items to be furnished. The structures shall be designed, constructed, and installed in accordance with the best practices and methods and shall comply with these Specifications.

1.04 SUBMITTALS

- A. Submit for approval six (6) sets shop drawings showing details of construction, reinforcing, joints and catch basin connections.

1.05 INSPECTION

- A. The quality of all materials, the process of manufacture, and the finished sections shall be subject to inspection and approval or other representative of the Owner. Such inspection may be made at the place of manufacture, or on the work after delivery, or at both places, and the sections shall be subject to rejection at any time on account of failure to meet any of the Specification requirements, even though sample section may have been accepted as satisfactory at the place of manufacture. Sections rejected after delivery to site shall be marked for identification and shall be removed from the site at once. All sections which have been damaged after delivery will be rejected, and if already installed, shall be acceptably repaired, if permitted, or removed and replaced, entirely at the Contractor's expense.

- B. At the time of inspection, the sections will be carefully examined for compliance with the ASTM designation specified below and these Specifications, and with the approved manufacturer's drawings. All sections shall be inspected for general appearance, dimension, "scratch-strength", blisters, crack, roughness, soundness, etc. The surface shall be dense and close-textured.
- C. Imperfections may be repaired, subject to the approval of the Engineer, after demonstration by the manufacturer that strong and permanent repairs result. Repairs shall be carefully inspected before final approval. Cement mortar used for repairs shall have a minimum compressive strength of 4,000 psi at the end of 7 days and 5,000 psi at the end of 28 days, when tested in 3" x 6" cylinders stored in the standard manner. Epoxy mortar may be utilized for repairs subject to the approval of the Owner's representative.

PART 2 - PRODUCTS

2.01 MATERIALS AND DESIGN

- A. Precast structures shall conform to ASTM Designation C478 and meet the following additional requirements:
 - 1. Type II cement shall be used except as otherwise approved.
 - 2. Holes to accommodate pipe shall be precast into the section at the foundry.
 - 3. All sections shall be cured by an approved method and shall not be shipped nor manhole rungs subjected to loading until the concrete compressive strength has attained 3,000 psi and not before 6 days after fabrication and/or repair, whichever is the longer.
 - 4. Precast concrete top slabs shall be designed for an H-20 wheel loading.
 - 5. The date of manufacture and the name or trademark of the manufacturer shall be clearly marked on the inside on each precast unit.
 - 6. Minimum wall thickness shall be 5".
 - 7. Minimum inside diameter shall be 48".
 - 8. The precast reinforced base shall be a minimum of 6" thick and be cast monolithically with the bottom section of manhole walls.
 - 9. Catch basin sections shall be jointed with either an O-ring type joint or a tongue and groove joint complete with flexible plastic gasket. The O-ring type joints shall be round compression ring of neoprene material set in annular spaces cast into the spigot end of a bell spigot type joint. The ring shall be uniformly compressed between the positioned sections so as to form a watertight joint. After the sections are assembled, the remaining space in the joint shall be point up and filled with a dense cement mortar and finished so as to make a smooth, continuous surface inside and outside the wall sections. The tongue and groove joint shall be sealed with a flexible plastic gasket as manufactured by K.T. Snyder and Sons or approved equal. After the manhole sections have been assembled, the gasket shall completely fill the joint.
 - 10. If the Owner feels the precast sections do not meet the Specification, the Owner shall require the sections to be tested by a certified testing laboratory. The Owner shall pay for the test if the test shows the

Specifications are met and the Contractor shall pay for the tests if the test shows the Specifications are not met.

- B. Base unit, reducer slabs and flat top slabs shall have steel reinforcement as shown in details.
- C. Openings for pipes larger than six (6) inches in diameter are to be precast. A minimum of six (6) inches between the circumference is to remain between any two holes.
- D. The Contractor will furnish the fabricator with the angle of alignment and size of all pipes to enter manhole and the height of structure.
- E. Base units shall have sufficient height to allow for minimum of six (6) inches of wall between top of highest opening for pipes and bottom of joint.
- F. Pipes are to be extended into structure wall a minimum of four (4) inches, but should not extend beyond interior wall of structure.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Catch basins shall be constructed to the dimensions shown on the Drawings and as specified in these Specifications.
- B. Precast concrete sections shall be set so as to be vertical and with sections in true alignment with a 1/4" maximum tolerance to be allowed. The outside and inside joint shall be filled with a comparatively dry mortar (one part cement and two parts sand) and finished flush with the adjoining surfaces. Allow joints to set for 24 hours before backfilling. Backfilling shall be done in a careful manner, bringing the fill up evenly on all sides. If any leaks appear in the catch basins, the inside joints shall be caulked with lead wool. The Contractor shall install the precast sections in a manner that will result in a watertight joint.
- C. Holes in the concrete pipe sections required for handling or other purposes shall be plugged with a non-shrinking grout or by grout in combination with concrete plugs.
- D. Where holes must be cut in the precast sections to accommodate pipes, cutting shall be done prior to setting them in place to prevent any subsequent jarring which may loosen the mortar joints.
- E. The precast concrete base shall be placed on a bed of crusher-run gravel as shown on the Drawings to provide even bearing and grade control.
- F. Catch basin pipe connections:
 - 1. A tapered hole filled with non-shrink waterproof grout after the pipe is inserted is acceptable, providing the grout is placed carefully to

completely fill all around the pipe. If this method is used, place concrete encasement around the stub.

- G. Cast iron frames specified and furnished under Division 5 shall be placed, shimmed and set in Portland Cement mortar to the required grade.
- H. The catch basin inverts, or channels shall be so constructed as to permit a smooth transition between the up and downstream lines or pipes. The lines or pipes entering the manhole shall be laid to the grade shown on the Drawings. Channels shall be constructed of cement grout and shall be shaped as shown on the Drawings and troweled to render a smooth finish.

END OF SECTION

SECTION NO. 03460

PRE-CAST STRUCTURES

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials, equipment and incidentals required and install precast box structures in the locations as shown on the Drawings.
- B. All structures shall be manufactured and installed in accordance with details included herein, and as shown on Drawings.

1.02 RELATED WORK NOT INCLUDED

- A. Section 02221 Excavation and Backfill for pipe.
- B. Section 02615 Exterior ductile iron pipe and fittings.
- C. Section 02486 Seeding.
- D. Division 3 Concrete and Reinforcing Steel.

1.03 QUALIFICATIONS

- A. All precast structures shall be furnished by a single manufacturer who is fully experienced, reputable, and qualified in the manufacture of items to be furnished. The structures shall be designed, constructed, and installed in accordance with the best practices and methods and shall comply with these Specifications.

1.04 SUBMITTALS

- A. Submit for approval shop drawings showing details of construction, reinforcing, joints and catch basin connections.

1.05 INSPECTION

- A. The quality of all materials, the process of manufacture, and the finished sections shall be subject to inspection and approval or other representative of the Owner. Such inspection may be made at the place of manufacture, or on the work after delivery, or at both places, and the sections shall be subject to rejection at any time on account of failure to meet any of the Specification requirements, even though sample section may have been accepted as satisfactory at the place of manufacture. Sections rejected after delivery to site shall be marked for identification and shall be removed from the site at once. All sections which have been

damaged after delivery will be rejected, and if already installed, shall be acceptably repaired, if permitted, or removed and replaced, entirely at the Contractor's expense.

- B. At the time of inspection, the sections will be carefully examined for compliance with the ASTM designation specified below and these Specifications, and with the approved manufacturer's drawings. All sections shall be inspected for general appearance, dimension, "scratch-strength", blisters, crack, roughness, soundness, etc. The surface shall be dense and close-textured.
- C. Imperfections may be repaired, subject to the approval of the Engineer, after demonstration by the manufacturer that strong and permanent repairs result. Repairs shall be carefully inspected before final approval. Cement mortar used for repairs shall have a minimum compressive strength of 4,000 psi at the end of 7 days and 5,000 psi at the end of 28 days, when tested in 3" x 6" cylinders stored in the standard manner. Epoxy mortar may be utilized for repairs subject to the approval of the Owner's representative.

PART 2 - PRODUCTS

2.01 MATERIALS AND DESIGN

- A. Precast structures shall conform to ASTM Designation C478 and meet the following additional requirements:
 - 1. Type II cement shall be used except as otherwise approved.
 - 2. Holes to accommodate pipe shall be precast into the section at the foundry.
 - 3. All sections shall be cured by an approved method and shall not be shipped nor manhole rungs subjected to loading until the concrete compressive strength has attained 3,000 psi and not before 6 days after fabrication and/or repair, whichever is the longer.
 - 4. Precast concrete top slabs shall be designed for an H-20 wheel loading.
 - 5. The date of manufacture and the name or trademark of the manufacturer shall be clearly marked on the inside on each precast unit.
 - 6. Minimum wall thickness shall be 8".
 - 8. The precast reinforced base shall be a minimum of 10" thick and be cast monolithically with the bottom section of manhole walls.
 - 9. Pre-cast sections shall be jointed with either an O-ring type joint or a tongue and groove joint complete with flexible plastic gasket. The O-ring type joints shall be round compression ring of neoprene material set in annular spaces cast into the spigot end of a bellspigot type joint. The ring shall be uniformly compressed between the positioned sections so as to form a watertight joint.

- After the sections are assembled, the remaining space in the joint shall be pointed up and filled with a dense cement mortar and finished so as to make a smooth, continuous surface inside and outside the wall sections. The tongue and groove joint shall be sealed with a flexible plastic gasket as manufactured by K.T. Snyder and Sons or approved equal. After the manhole sections have been assembled, the gasket shall completely fill the joint.
10. If the Owner feels the precast sections do not meet the Specification, the Owner shall require the sections to be tested by a certified testing laboratory. The Owner shall pay for the test if the test shows the Specifications are met and the Contractor shall pay for the tests if the test shows the Specifications are not met.
- B. Base unit, reducer slabs and flat top slabs shall have steel reinforcement as shown in details.
- C. Openings for pipes larger than six (6) inches in diameter are to be precast. A minimum of six (6) inches between the circumference is to remain between any two holes.
- D. The Contractor will furnish the fabricator with the angle of alignment and size of all pipes to enter manhole and the height of structure.
- E. Base units shall have sufficient height to allow for minimum of six (6) inches of wall between top of highest opening for pipes and bottom of joint.
- F. Pipes are to be extended into structure wall a minimum of four (4) inches, but should not extend beyond interior wall of structure.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Pre-cast structures shall be constructed to the dimensions shown on the Drawings and as specified in these Specifications.
- B. Precast concrete sections shall be set so as to be vertical and with sections in true alignment with a 1/4" maximum tolerance to be allowed. The outside and inside joint shall be filled with a comparatively dry mortar (one part cement and two parts sand) and finished flush with the adjoining surfaces. Allow joints to set for 24 hours before backfilling. Backfilling shall be done in a careful manner, bringing the fill up evenly on all sides. If any leaks appear in the catch basins, the inside joints shall be caulked with lead wool. The Contractor shall install the precast sections in a manner that will result in a watertight joint.

- C. Holes in the concrete pipe sections required for handling or other purposes shall be plugged with a non-shrinking grout or by grout in combination with concrete plugs.
- D. Where holes must be cut in the precast sections to accommodate pipes, cutting shall be done prior to setting them in place to prevent any subsequent jarring which may loosen the mortar joints.
- E. The precast concrete base shall be placed on a gravel base as shown on the Drawings to provide even bearing and grade control.
- F. Pre-cast structure pipe connections:
 - 1. A tapered hole filled with non-shrink waterproof grout after the pipe is inserted is acceptable, providing the grout is placed carefully to completely fill all around the pipe. If this method is used, place concrete encasement around the stub.
- H. The inverts, or channels shall be so constructed as to permit a smooth transition between the up and downstream lines or pipes. The lines or pipes entering the manhole shall be laid to the grade shown on the Drawings. Channels shall be constructed of cement grout and shall be shaped as shown on the Drawings and troweled to render a smooth finish.

END OF SECTION

SECTION NO. 03600

GROUT

PART 1 - GENERAL

1.01 WORK OF THIS SECTION

- A. The Contractor shall provide grout in accordance with the Contract Documents.
- B. The following types of grout are covered in this Section.
 - 1. Nonshrink Grout: This type of grout shall be used wherever grout is shown in the Contract Documents, unless another type is specifically referenced.
 - 2. Cement Grout
 - 3. Epoxy Grout
 - 4. Pump and Motor Grout
 - 5. Topping Grout and Concrete Fill

1.02 RELATED SECTIONS

- A. The Work of the following Sections applies to the Work of this Section. Other Sections, not referenced below, shall also apply to the extent required for proper performance of this Work.
 - 1. Section 03455 – Precast Concrete Manholes
 - 2. Section 03300 - Cast-in-Place Concrete

1.03 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

- A. Except as otherwise indicated, the current editions of the following standards apply to the work of this Section.
 - 1. Commercial Standards:
 - a. CRD-C 621 - Corps of Engineers Specification for Non-shrink Grout
 - 2. ASTM Standard in Building Codes:
 - a. ASTM C 109 - Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in or 50-mm Cube Specimens)
 - b. ASTM C 531 – Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical- Resistant Mortars, Grouts, and Monolithic Surfacing
 - c. ASTM C 579 – Test Methods for Compressive Strength of Chemical-Resistant Mortars, Grouts, and Monolithic Surfacing
 - d. ASTM C 827 – Test Method for Change in height at Early Ages of Cylindrical Specimens from Cementitious Mixture

- e. ASTM C 881 – Specification for Epoxy-Resin-Base Bonding System for Concrete
- f. ASTM C 882 – Standard Test for Bond Strength of Epoxy-Resin Systems Used with Concrete
- g. ASTM C 884 – Standard Test Method for Thermal Compatibility between Concrete and an Epoxy-Resin Overlay
- h. ASTM D 638 – Standard Test Methods for Tensile Properties of Plastics
- i. ASTM D 696 – Test Method for Coefficient of Linear Thermal Expansion of Plastics
- j. ASTM D 2471 – Standard Test Methods for Gel Time and Peak Exothermic Temperature of Reacting Thermosetting Resins

1.04 CONTRACTOR SUBMITTALS

- A. The Contractor shall submit certified test results verifying the compressive strength, shrinkage, and expansion requirements indicated herein; and manufacturer's literature containing instructions and recommendations on the mixing, handling, placement and appropriate uses for each type of nonshrink and epoxy grout used in the Work in accordance with the requirements of Section 01300 – Submittals.

1.05 QUALITY ASSURANCE

A. Field Tests:

1. Compression test specimens will be taken during construction from the first placement of each type of grout, and at intervals thereafter as selected by the Construction Manager to ensure continued compliance with these Specifications. The specimens will be made by the Construction Manager.
2. Compression tests and fabrication of specimens for cement grout and nonshrink grout will be performed as specified in ASTM C 109 at intervals during construction as selected by the Construction Manager. A set of three specimens will be made for testing at 7 days, 28 days, and each additional time period as appropriate.
3. Compression tests and fabrication of specimens for epoxy grout will be performed as specified in ASTM C 579, Method B, at intervals during construction as selected by the Construction Manager. A set of three specimen will be made for testing at 7 days, and each earlier time period as appropriate.
4. All grout, already place, which fails to meet the requirements of these Specifications, is subject to removal and replacement at no additional cost to the Owner.
5. The cost of all laboratory tests on grout will be borne by the owner, but the Contractor shall assist the Construction Manager in obtaining specimens for testing. However, the Contractor shall be responsible, without additional cost to the Owner, for the cost of any additional tests and investigation on work performed which does not comply with the Specifications. The Contractor shall supply all materials necessary for fabricating the test specimens.

B. Construction Tolerances:

1. Construction tolerances shall be as specified in the Section 03300- Cast-in-Place Concrete, except as modified herein and elsewhere in the Contract Documents.

PART 2 - PRODUCTS

2.01 CEMENT GROUT

A. Cement Grout:

1. Cement grout shall be composed of one part cement, three parts sand, and the minimum amount of water necessary to obtain the desired consistency. Where needed to match the color of adjacent concrete, white portland cement shall be blended with regular cement as needed. The minimum compressive strength at 28 days shall be 4,000 psi.

- B. Cement grout materials shall be as specified in Section 03300 – Cast-in-Place Concrete.

2.02 PREPACKAGED GROUTS

A. Nonshrink Grout:

1. Nonshrink grout shall be a prepackaged, inorganic, nongas-liberating, nonmetallic, cement-based grout requiring only the addition of water. The manufacturer's instructions shall be printed on each bag or other container in which the materials are packaged. The specific formulation for each class of nonshrink grout indicated herein should be that recommended by the manufacturer for the particular application. Manufacturers shall be Sika, Master Builders, Burke, or approved equal.
2. Class A nonshrink grouts shall have a minimum 28 day compressive strength of 5,000 psi; shall have no shrinkage (0.0 percent) and a maximum 4.0 percent expansion in the plastic state when tested in accordance with ASTM C 827; and shall have no shrinkage (0.0 percent) and a maximum of 0.2 percent expansion in the hardened state when tested in accordance with CRD C 621.
3. Class B nonshrink grouts shall have a minimum 28-day compressive strength of 5,000 psi and shall meet the requirements of CRD C 621.
4. Application:
 - a. Class A nonshrink grout shall be used for the repair of all holes and defects in concrete members which are water bearing or in contact with soil or other fill material, grouting under all equipment base plates, and at all locations where grout is indicated; except, for the applications for Class B nonshrink grout and epoxy grout indicated herein. Class A nonshrink grout may be used in place of Class B nonshrink grout for all applications.
 - b. Class B nonshrink grout shall be used for the repair of all holes and defects in concrete members which are not water-bearing and not in contact with soil or other fill material, grouting under all base

plates for structural steel members, and grouting railing posts in place.

B. Epoxy Grout or Nonshrink Epoxy Grout:

1. Epoxy grout shall be a pourable, nonshrink,, and 100 percent solids system. The epoxy grout system shall have three components: resin, hardener, and specially blended aggregate, all premeasured and prepackaged. The resin component shall not contain any nonreactive diluents. Resins containing butyl glycidyl ether (BGE) or other highly volatile and hazardous reactive diluents are not acceptable. Variation of component ratios is not permitted unless specifically recommended by the manufacturer. Manufacturer's instructions shall be printed on each container in which the materials are packaged. Epoxy grout shall be BurkEpoxy Anchoring Grout by the Burke Company, or equivalent system as manufactured by Sika or Master Builders.
2. The chemical formulation of the epoxy grout shall be that recommended by the manufacturer for the particular application.
3. The mixed epoxy grout system shall have a minimum working life of 45 minutes at 75 degrees F.
4. The epoxy grout shall develop a compressive strength of 5,000 psi in 24 hours and 10,000 psi in 7 days when tested in accordance with ASTM C 579, Method B. There shall be no shrinkage (0.0 percent) and a maximum 4.0 percent expansion when tested in accordance with ASTM C 827.
5. The epoxy grout shall exhibit a minimum effective bearing area of 95 percent. This shall be determined by a testing consisting of filling a 2-inch diameter by 4-inch high metal cylinder mold covered with a glass plate coated with a release agent. A weight shall be placed on the glass plate. At 24 hours after casting, the weight and plate shall be removed and the area in plan of all voids measured. The surface of the grout shall be probed with a sharp instrument to locate all voids.
6. The peak exotherm of a 2-inch diameter by 4-9inch high cylinder shall not exceed 95 degrees F when tested with 75 degree F material at laboratory temperature. The epoxy grout shall exhibit a maximum thermal coefficient of 30×10^{-6} inches/inch/degree F when tested according to ASTM C 531 or ASTM D 696.
7. Application:
 - a. Epoxy grout shall be used to embed all anchor bolts and reinforcing steel required to be set in grout, and for all other applications in the Contract Documents where grout type is not specifically indicated.
8. For crack repair, the Contractor shall use pressure injection epoxy grout as recommended by manufacturer and approved by the Construction Manager.

C. Grout for Pumps and Motors:

1. Grout for pumps and motors shall be epoxy grouts as manufactured by Sika, Master Builders, or Burke meeting the following minimum requirements:

- a. Creep shall be less than 0.005 in/in when tested by ASTM C 881 method. The test shall be at 70 degrees F and 140 degrees F with a load of 400 psi.
 - b. Linear shrinkage shall be less than 0.080 percent and thermal expansion less than 17×10^{-6} in/in/degree F when tested by ASTM C 531.
 - c. The compressive strength shall be a minimum of 12,000 psi in 7 days when tested by ASTM C 579 Method 8, modified.
 - d. Bond strength of grout to portland cement concrete shall be greater than 2,000 psi when using ASTM C 882 test method.
 - e. Grout shall pass the thermal compatibility test when overlaid on portland cement concrete using test method ASTM C 884.
 - f. Tensile strength and modulus of elasticity shall be determined by ASTM D 638. The tensile strength shall not be less than 1,700 psi and the modulus of elasticity shall not be less than 1.8×10^6 psi.
 - g. Gel time and peak exothermic temperature shall be determined by ASTM D 2471. Peak exothermic temperature shall not exceed 110 degrees F when a specimen 6 inches in diameter by 12 inches high is used. Gel time shall be at least 150 minutes.
 - h. The grout shall be suitable for supporting precision machinery subject to high impact and shock loading in industrial environments while exposed to elevated temperatures as high as 150 degrees F, with a load of 2,000 psi.
2. Primer, if required, shall conform to the written recommendations of the grout manufacturer.
 3. Surface preparations shall conform to the written recommendations of the grout manufacturer.
 4. Placement and Curing:
 - a. Placement and curing procedures shall be in accordance with the written recommendations of the grout manufacturer.
 - b. A grouting performance demonstration/training session shall be conducted by the grout manufacturer's representative prior to foundation and baseplate preparation and the first grouting on site. This training session shall demonstrate proper preparation and installation methods and that the grouting material meets the strength requirements.
 5. Grout shall be Escoweld, Chockfast Red Epoxy Grout as manufactured by Philadelphia Resin Corp., Five Start DP Epoxy Grout as manufactured by Five Star Products, Inc., or equal.

2.03 TOPPING GROUT AND CONCRETE FILL

- A. Grout for topping of slabs and concrete fill for built-up surfaces of tank, channel, and basin bottoms shall be composed of cement, fine aggregate, coarse aggregate, water, and admixtures proportioned and mixed as specified herein.

All materials and procedures specified for normal concrete in Section 03300-Cast-in-Place Concrete, shall apply except as noted otherwise herein.

- B. Topping grout and concrete fill shall contain a minimum of 564 pounds of cement per cubic yard with a maximum water cement ratio of 0.45. Where concrete fill is thicker than 3 inches, sitework concrete, as specified in Section 03300 – Cast-in-Place Concrete, may be used when accepted by the Construction Manager.
- C. Coarse aggregate shall be graded as follows:

<u>U.S. Standard Sieve Size</u>	<u>Percent by Weight Passing</u>
1/2"	100
3/8"	90 – 100
No. 4	20 – 55
No. 8	5 – 30
No. 16	0 – 10
No. 30	0

- D. Final mix design shall be as determined by trial mix design under supervision of the approved testing laboratory.
- E. Strength:
 - 1. Minimum compressive strength of topping grout and concrete fill at the end of 28 days shall be 4,000 psi.

2.04 CURING MATERIALS

- A. Curing materials shall be as specified in Section 03300 Cast-in-Place Concrete for cement grout and as recommended by the manufacturer of prepackaged grouts.

2.05 MEASUREMENT OF INGREDIENTS

- A. Measurements for cement grout shall be made accurately by volume using containers. Shovel measurement shall not be allowed.
- B. Prepackaged grouts shall have ingredients measured by means recommended by the manufacturer.

PART 3 - EXECUTION

3.01 GENERAL

- A. All surface preparation, curing, and protection of cement grout shall be as indicated in Section 03300 Cast-in-Place Concrete. The finish of the grout surface shall match that of the adjacent concrete.

- B. The manufacturer of Class A nonshrink grout and epoxy grout shall provide onsite technical assistance to Contractor upon request.
- C. Base concrete or masonry must have attained its design strength before grout is placed, unless authorized by the Construction Manager.
 - D. The consistency of grouts shall be that necessary to completely fill the space to be grouted for the particular application. Dry pack consistency is such that the grout is plastic and moldable but will not flow. Where "dry pack" is called for in the Contract Documents, it shall mean a grout of that consistency; the type of grout to be used shall be as indicated herein for the particular application, otherwise dry packing will not be allowed without Construction Manager approval.
- E. The slump for topping grout and concrete fill shall be adjusted to match placement and finishing conditions but shall not exceed 4 inches.
- F. Place grout as shown and in accordance with manufacturer's instructions. If manufacturer's instructions conflict with the Specifications do not proceed until Construction Manager provides clarification.
- G. Manufacturers of proprietary products shall make available upon 72 hours notification the services of a qualified, full time employee to aid in assuring proper use of the product under job conditions.
- H. Placing grout shall conform to temperature and weather limitations in Section 03300, and installation procedures in Section 04200.
- I. Surface to be grouted is to be adequately cured, cleaned dampened and roughened per manufacturer recommendations to ensure adequate bonding.

3.02 GROUTING PROCEDURES

A. Prepackage Grouts:

1. All mixing, surface preparation, handling, placing, curing and other means of execution for prepackaged grouts shall be done according to the instructions and recommendations of the manufacturer.

B. Base Plate Grouting:

1. For base plates, the original concrete shall be blocked out or finished off a sufficient distance below the plate to provide for a minimum 1-inch thickness of grout or a thickness as indicated on the Drawings.
2. After the base plate has been set in position at the proper elevation by steel wedges or double nuts on the anchor bolts, the space between the bottom of the plate and the original pour of concrete shall be filled with non-shrink-type grout. The mixture shall be of a trowelable consistency and tamped or rodded solidly into the space between the plate and the base concrete. A backing board or stop shall be provided at the back side of the space to be filled with grout. Where this method of placement is not

practical or where required by the Construction Manager, alternate grouting methods shall be submitted for acceptance by the Construction Manager.

C. Topping Grout and Concrete Fill:

1. All mechanical, electrical, and finish Work shall be completed prior to placement of topping or concrete fill. The base slab shall be given a roughened textured surface by sandblasting or hydroblasting exposing the aggregates to ensure bonding to the base slab.
2. The minimum thickness of grout topping and concrete fill shall be one inch unless otherwise specified on drawings. Where the finished surface of concrete fill is to form an intersecting angle of less than 45 degrees with the concrete surface it is to be placed against, a key shall be formed in the concrete surface at the intersection point. The key shall be a minimum of 3-1/2 inches wide by 1-1/2 inches deep.
3. The base slab shall be thoroughly cleaned and wetted prior to placing topping or concrete fill. No topping or concrete fill shall be placed until the slab is completely free from standing pools or ponds of water. A thin coat of neat Type II cement grout shall be broomed into the surface of the slab just before topping or concrete fill placement. The topping or concrete fill shall be compacted by rolling or tamping, brought to established grade, and floated. Grouted concrete fill for tank and basin bottoms where scraping mechanisms are to be installed shall be screeded by blades attached to the revolving mechanism of the equipment in accordance with the procedures outlined by the equipment manufacturer after the grout is brought to the established grade.
4. Topping grout placed on sloping slabs shall proceed uniformly from the bottom of the slab to the top, for the full width of the placement.
5. The surface shall be tested with a straight edge to detect high and low spots that shall be immediately eliminated. When the topping or concrete fill have hardened sufficiently, it shall be steel troweled to a smooth surface free from pinholes and other imperfections. An approved type of mechanical trowel may be used as an assist in this operation, but the last pass over the surface shall be hand-troweling. During finishing, no water, dry cement or mixture of dry cement and sand shall be applied to the surface.

D. Grout for Dowelling and Anchor Bolts:

1. Epoxy grout shall be introduced at the bottom of the drill holes using a caulking tube or other injection means. The hole shall be blown out or pumped dry prior to the introduction of grout into the hole. Care shall be taken to adequately fill the hole with grout before the dowel or anchor rod is inserted, to ensure complete contact with the anchor for its full length.
2. A plug shall be placed in the top of the hole to hold the bars securely until the grout sets. Special care shall be taken to ensure against any movement of the bars that have been placed.

E. Patchwork at Demolition Areas:

1. Furnish and install non-shrink, non-metallic grout for dry packing as required to patch all mechanical, electrical and miscellaneous penetrations which are either designated to be patched or are the result of abandoned, removed or relocated material and equipment. Prepare surface and place grout as recommended by manufacturer and as specified. Finish grout off flush with existing surface.
2. Reinforce with approved wire mesh and use approved structural concrete for penetrations larger than 1/2 square feet. Conform to requirements of Sections 03100, 03200 and 03300.

3.03 COMPLETE FILL

- A. Grout shall be placed in such a manner, for the consistency necessary for each application so as to assure that the space to be grouted is completely filled.

END OF SECTION

SECTION NO. 05120

STRUCTURAL STEEL

PART 1 - GENERAL

1.01 SCOPE

- A. This section covers the work necessary to furnish and install, complete, the structural steel, and shall include all metal parts required for permanent connection of the structural steel.
- B. Like items of materials provided hereunder shall be the end products of one manufacturer in order to achieve standardization for appearance, maintenance, and replacement.
- C. Related Work Specified Elsewhere:
 - 1. Section 03600, Grout.
 - 2. Section 05500, Miscellaneous Metal.
 - 3. Section 09900, Painting.

1.02 SUBMITTALS

- A. Submittals during construction shall be made in accordance with Division 1 of these Specifications.
- B. Shop Drawings, complete with all information and sections.
- C. Prime coating certification.

1.03 QUALITY ASSURANCE

- A. Reference Standards: Comply with the current provisions of the following, except as otherwise indicated:
 - 1. AISC "Code of Standard Practice for Steel Buildings and Bridges."
 - 2. AISC "Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings" and including the "Commentary of the AISC Specification."
 - 3. AISI "American Iron and Steel Institute Specification for the Design of Cold-Formed Steel Structural Members."
 - 4. AISC "Specifications for Structural Joints Using ASTM A 325 or A 490 Bolts" approved by the Research Council on Structural Connections of the Engineering Foundation, August 14, 1985; endorsed by the American Institute of Steel Construction and the Industrial Fasteners Institute.
 - 5. AWS Structural Welding Code AWS D1.1-90 and "Standard Qualification Procedure."

6. ASTM A 36/A 36M-88c, Structural Steel.
7. ASTM A 53-83, Pipe, Steel, Black and Hot-Dipped, Zinc Coated Welded and Seamless.
8. ASTM A 325-83, High Strength Bolts for Structural Steel Joints (Rev. C) (*A325M-83).
9. AWS D1.1-90 (83), Structural Welding Code - Steel.

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery: Load structural members in such a manner that they may be transported and unloaded without being excessively stressed, deformed, and otherwise damaged.
- B. Material Storage:
 1. Protect structural steel members and packaged materials from corrosion deterioration. Material shall be stored in a dry area and shall not be placed in direct contact with the ground.
 2. Do not place materials on the structure in a manner that might cause distortion or damage to the members or the supporting structures. Repair or replace damaged materials or structures as directed.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Rolled Plates, Shapes, and Bars: ASTM A 36 unless otherwise shown.
- B. Structural Steel Pipe: ASTM A 501, or ASTM A 53, Type E or S, Grade B.
- C. Steel Joists: Steel joists shall be manufactured by a Steel Joist Institute Member and be in accordance with the standard specifications for open web steel joists.
- D. Bolts for Connections: ASTM A 325 or A 490; use A 325 unless otherwise shown.
- E. Welded Studs: Welded anchor studs shall be headed concrete anchor studs (HAS), or deformed bar anchors (DBA), or threaded anchor studs (TAS), as indicated on the Drawings and as supplied by Nelson Stud Welding Company, Lorain, OH; Omark Industries, KSM Fastening Systems Division, Seattle, WA, or Portland, OR, or equal.
- F. Shop Paint Primer: Structural steel shall be cleaned and coated with shop paint primer. Surface preparation and primer shall be as specified in Section 09900 - Painting. Shop prime coat shall be applied within 8 hours after surface preparation.

PART 3 - EXECUTION

3.01 WORKMANSHIP

- A. Measurement: The Contractor shall verify all dimensions and shall make any field measurements necessary and shall be fully responsible for accuracy and layout of work. The Contractor shall review the Drawings and any discrepancies shall be reported to the Construction Manager for clarification prior to starting fabrication.
- B. Shop Drawings: Shop drawings shall conform to AISC recommendations and specifications and shall show all holes, etc., required for other work. Include complete details showing all members and their connections, anchor bolt layouts, schedules for fabrication procedures, and diagrams showing the sequence of erection.

3.02 FABRICATION

- A. General
 - 1. Fabricate items of structural steel in accordance with the Drawings, AISC Specifications, and as indicated on the final reviewed shop drawings.
 - 2. Properly mark and matchmark materials for field assembly.
 - 3. Where finishing is required, complete the assembly, including bolting and welding of units, before start of finishing operations.
- B. Connections: Weld or bolt shop connections. Bolt field connections, except where welded connections or other connections are shown or specified. All connections unless shown otherwise shall develop full strength of members joined and shall conform to AISC standard connections.
- C. Welded Construction:
 - 1. Comply with AWS Current D1.1-90 Code for procedures, appearance, and quality of welds and welders, and methods used in correcting welding work.
 - 2. Submit welder certifications for shop and field welders in triplicate, directly to the Construction Manager from a recognized testing laboratory, with copies to the Contractor and others as required.
 - 3. Unless otherwise shown, all butt welds are complete penetration.
- D. Holes for Other Work: Provide holes as necessary or as indicated for securing other work to structural steel framing, and for the passage of other work through steel framing members. Provide threaded nuts welded to framing, and other specialty items to receive other work. Torch cut holes are not permitted.

- E. Shop Paint Primer: Apply shop paint primer in accordance with Division 9 - Finishes. Omit at welds, bolts, and where embedded in concrete. Remove all slag from welds before painting.
- F. Inspection: Shop inspection may be required by the Construction Manager at his own expense (except for weld inspection as mentioned herein). The Contractor shall give ample notice to the Construction Manager prior to the beginning of any fabrication work so that inspection may be provided. The Contractor shall furnish all facilities for the inspection of materials and workmanship in the shop and inspectors shall be allowed free access to the necessary parts of the work. Inspectors shall have the authority to reject any materials or work which does not meet the requirements of these Specifications. Inspection at the shop is intended as a means of facilitating the work and avoiding errors, but it is expressly understood that it will in no way relieve the Contractor from his responsibility for furnishing proper materials or workmanship under these Specifications.

3.03 ERECTION

- A. General: Comply with the AISC Specifications and Code of Standard Practice, and with specified requirements.
- B. Anchor Bolts:
 - 1. Furnish anchor bolts and other connectors required for securing structural steel to in-place work.
 - 2. Furnish templates and other devices for presetting bolts and other anchors to accurate locations.
- C. Setting Bases and Bearing Plates:
 - 1. Clean concrete surfaces of bond reducing materials and roughen to improve bond to surfaces. Clean the bottom surface of base and bearing plates.
 - 2. Set loose and attached baseplates and bearing plates for structural members on wedges, leveling nuts, or other adjustable devices.
 - 3. Tighten the anchor bolts after the supported members have been positioned and plumbed.
 - 4. Grouting of baseplates shall be as specified in Section 03600 - Grout. Grout prior to placing loads on structure.

3.04 FIELD ASSEMBLY

- A. Set structural frames accurately to the lines and elevations indicated. Align and adjust the various members forming a part of a complete frame or structure before permanently fastening. Clean bearing surfaces and other surfaces which will be in permanent contact before assembly. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

- B. Level and plumb individual members of the structure within specified AISC tolerances. Contractor shall provide and install all temporary bracing required until structure is complete.
- C. Establish required leveling and plumbing measurements on the mean operating temperature of the structure.

3.05 MISFITS AT BOLTED CONNECTIONS

- A. Where misfits in erection bolting are encountered, the Construction Manager shall be immediately notified and shall select an industry acceptable method to remedy such as:
 - 1. Ream holes that must be enlarged to admit bolts and use oversized bolts.
 - 2. Plug weld misaligned holes and redrill holes to admit standard size bolts.
 - 3. Drill additional holes in the connection, conforming with AISC Standards for bolt spacing, and end and edge distances and add additional bolts.
 - 4. Reject the member containing the misfit, miss-sized, or misaligned holes and fabricate a new member to ensure proper fit.
- B. Miss-sized or misaligned holes in members shall not be enlarged by burning or by the use of drift pins.

3.06 MISFITS AT ANCHOR BOLTS

- A. Any misalignment between anchor bolts and bolt holes in steel members shall be resolved by submitting a request to the Construction Manager for review. The request shall show an industry acceptable method to remedy the misalignment. Flame cutting to enlarge holes shall not be acceptable.

3.07 GAS CUTTING

- A. Do not use gas cutting torches in the field for correcting fabrication errors in the structural framing, except on secondary members which are not under stress and will be concealed in the finished structure and when approved by the Construction Manager. Finish gas-cut sections equal to a sheared appearance.

3.08 TOUCHUP PAINTING

- A. Immediately after erection, clean field welds, bolted connections, and abraded areas of the shop paint primer. Apply touchup paint primer by brush or spray which is the same thickness and material as that used for the shop coat.

3.09 QUALITY CONTROL TESTING

- A. The Construction Manager may engage inspectors to inspect bolted connections and welded connections and to perform tests and prepare test reports.

- B. Weld Inspection:
1. All butt welds shall be 100 percent tested in accordance with AWS D1.1-90, Part B, Radiographic Testing of Welds.
 2. The examination, report, and disposition of radiographs shall be in accordance with Section 6.12 of AWS D1.1-90. Payment of this work shall be included in the lump sum bid. All reports shall be submitted to the Construction Manager for review prior to completion of the work in this section.
 3. Welds that are required by the Construction Manager to be corrected shall be corrected or redone and retested as directed, at the Contractor's expense and to the satisfaction of the Construction Manager and/or approved independent testing lab.
- C. Finish Painting:
1. Finish painting of all exposed structural steel shall be as specified in Section 09900-Painting.

END OF SECTION

SECTION NO. 05300

STAIRS AND PLATFORMS

PART 1 - GENERAL

1.01 REFERENCES.

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.
1. The Aluminum Association, Incorporated (AA)
 - a. AA 30 (1986) Aluminum Structures Construction Manual.
 - b. AA 45 (1980) Aluminum Finishes.

 2. American Society for Testing and Materials (ASTM)
 - a. ASTM B 221 (1993) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes.
 - b. ASTM B241/B241M (1992; Rev. A) Standard Specification for Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube.
 - c. ASTM D 1187 (1995) Asphalt-Base Emulsions for Use as Protective Coatings for Metal.
 - d. ASTM E 488 (1990) Standard Test Methods for Strength of Anchors in Concrete and Masonry Elements.

 3. American Welding Society, Inc. (AWS)
 - a. AWS D1.2 (1990) Structural Welding Code Aluminum.

1.02 RELATED WORK

- A. Related work specified elsewhere:
1. Aluminum Handrails – Section 05520.
 2. Aluminum Gratings – Section 05530.

1.03 SUBMITTALS

- A. Detail drawings indicating material thickness, type, grade, and class; dimensions; and construction details. Drawings shall include catalog cuts, erection details, manufacturer's descriptive data and installation instruction, and templates.
- B. Submit fabrication drawings showing layout(s), risers and tread dimensions connections to structural system, and anchoring details as specified.
- C. Materials list for fabricated items shall be submitted at the time of submittal of detail drawings.

- D. Schedules of welding processes for aluminum fabrications shall be submitted and approved prior to commencing fabrication.
- E. Certifications for welders and welding operators shall be submitted prior to commencing fabrication.
- F. Samples
 - 1. Aluminum surfaces
 - 2. Safety nosings
 - 3. Samples may be installed in the work, provided each sample is clearly identified and its location recorded.

1.04 QUALIFICATION OF WELDERS

- A. The Contractor shall certify that the welders, welding operators and tack welders who will perform structural steel welding have been qualified for the particular type of work to be done in accordance with the requirements of AWS D1.1, Section 5 or ASME BPV IX, Section IX, prior to commencing fabrication. The certificate shall list the qualified welders by name and shall specify the code and procedures under which qualified and the date of qualification. Prior qualification will be accepted if welders have performed satisfactory work under the code for which qualified within the preceding three months. The Contractor shall require welders to repeat the qualifying tests when their work indicates a reasonable doubt as to proficiency. Those passing the requalification tests will be recertified. Those not passing will be disqualified until passing. All expenses in connection with qualification and requalification shall be borne by the Contractor.

1.05 DELIVERY, STORAGE, AND PROTECTION

- A. Protect from corrosion, deformation, and other types of damage. Store items in an enclosed area free from contact with soil and weather. Remove and replace damaged items with new items.

1.06 GENERAL REQUIREMENTS

- A. The Contractor shall verify all measurements and shall take all field measurements necessary before fabrication. Exposed fastenings shall be compatible materials, shall generally match in color and finish, and shall harmonize with the material to which fastenings are applied. Materials and parts necessary to complete each item, even though such work is not definitely shown or specified, shall be included. Poor matching of holes for fasteners shall be cause for rejection. Fastenings shall be concealed where practicable. Thickness of metal and details of assembly and supports shall provide strength and stiffness. Joints exposed to the weather shall be formed to exclude water.

1.07 WORKMANSHIP

- A. Miscellaneous metalwork shall be well formed to shape and size, with sharp lines and angles and true curves. Drilling and punching shall produce clean true lines

and surfaces. Welding shall be continuous along the entire area of contact except where tack welding is permitted. Exposed connections of work in place shall not be tack welded. Exposed welds shall be ground smooth. Exposed surfaces of work in place shall have a smooth finish, and unless otherwise approved, exposed riveting shall be flush. Where tight fits are required, joints shall be milled. Corner joints shall be coped and mitered, well formed, and in true alignment. Work shall be accurately set to established lines and elevations and securely fastened in place. Installation shall be in accordance with manufacturer's installation instructions and approved drawings, cuts, and details.

1.08 ANCHORAGE

- A. Anchorage shall be provided where necessary for fastening miscellaneous metal items securely in place. Anchorage not otherwise specified or indicated shall include slotted inserts made to engage with the anchors, expansion shields, and power-driven fasteners when approved for concrete; toggle bolts and through bolts for masonry; machine and carriage bolts for steel; and lag bolts and screws for wood.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Aluminum Platform Products
 - 1. Structural Aluminum Fabrication - Laying out and cutting of aluminum shall be in accordance with the AA SAS-30, Section 6.
 - 2. Pipes and Tubes - ASTM B 241/B 241M, Alloy 6063, size 1-1/2 inches in diameter and schedule number 40.
 - 3. Bolts, Nuts, and Washers. - Bolts, nuts, and washers shall be of the material, grade, type, class, style and finish indicated or best suited for intended use.
 - 4. Railings – See Section 05520
 - 5. Aluminum Floor Gratings and Frames – See Section 05530.
- B. Bolted Aluminum Connections
 - 1. Punching, drilling, reaming and bolting for bolted aluminum connections shall conform to the requirements of AA SAS-30, Section 6.
- C. Dimensional Tolerances for Structural Work
 - 1. An approved calibrated steel tape of approximately the same temperature as the material being measured shall measure dimensions. The overall dimensions of an assembled structural unit shall be within the tolerances indicated on the drawings or as specified in the particular section of these specifications for the item of work. Where tolerances are not specified in other sections of these specifications or shown, an allowable variation of 1/32 inch is permissible in the overall length of component members with

both ends milled and component members without milled ends shall not deviate from the dimensions shown by not more than 1/16 inch for members 30 feet or less in length and by more than 1/8 inch for members over 30 feet in length.

2.02 FINISHES

A. Aluminum Surfaces

1. Before finishes are applied, remove roll marks, scratches, rolled-in scratches, kinks, stains, pits, orange peel, die marks, structural streaks, and other defects which will affect uniform appearance of finished surfaces.
2. Unless otherwise specified, aluminum items shall have anodized finish. Submit samples to Construction Manager. Owner will make finish selection.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. All parts to be installed shall be thoroughly cleaned. Packing compounds, rust, dirt, grit and other foreign matter shall be removed. Holes and grooves for lubrication shall be cleaned. Enclosed chambers or passages shall be examined to make sure that they are free from damaging materials. Where units or items are shipped as assemblies they will be inspected prior to installation. Disassembly, cleaning, and lubrication will not be required except where necessary to place the assembly in a clean and properly lubricated condition. Pipe wrenches, cold chisels, or other tools likely to cause damage to the surfaces of rods, nuts, or other parts shall not be used for assembling and tightening parts. Bolts and screws shall be tightened firmly and uniformly but care shall be taken not to overstress the threads. When a half nut is used for locking a full nut the half nut shall be placed first and followed by the full nut. Threads of all bolts except high strength bolts, nuts and screws shall be lubricated with an approved lubricant before assembly. Threads of corrosion-resisting steel bolts and nuts shall be coated with an approved antigalling compound. Driving and drifting bolts or keys will not be permitted.
- B. Alignment and Setting. The use of shims or other approved methods shall accurately align each machinery or structural unit so that no binding in any moving parts or distortion of any member occurs before it is fastened in place. The alignment of all parts with respect to each other shall be true within the respective tolerances required. Machines shall be set true to the elevations shown.

3.02 ANCHORAGE, FASTENINGS, AND CONNECTIONS

- A. Provide anchorage where necessary for fastening metal items securely in place. Include for anchorage not otherwise specified or indicated slotted inserts, expansion shields, and powder-driven fasteners, when approved for concrete; toggle bolts and through bolts for masonry; machine and carriage bolts for steel; through bolts, lag bolts, and screws for wood. Do not use wood plugs in any material. Provide non-ferrous attachments for non-ferrous metal. Make exposed fastenings of compatible materials, generally matching in color and finish, to which fastenings are applied. Conceal fastenings where practicable.

3.03 WELDING OF ALUMINUM

- A. Welding of aluminum shall conform to AA SAS-30 or AWS D1.2, Sections 1 through 7, 9 and 10. The welding process and welding operators shall be prequalified as required by AWS D1.2, Section 5 or AA SAS-30, Subsection 7.2.4 in accordance with the methods described in ASME BPV IX, Section IX. A certified report giving the results of the qualifying tests shall be furnished for approval. A complete schedule of the welding process for each aluminum fabrication to be welded shall be furnished for approval.

3.04 FINISHES

- A. Dissimilar Materials
 - 1. Where dissimilar metals are in contact, protect surfaces with non-corrosive protective coating to prevent galvanic or corrosive action. Where aluminum is in contact with concrete, mortar, masonry, wood, or absorptive materials subject to wetting, protect with ASTM D 1187, asphalt-base emulsion.
- B. Field Preparation
 - 1. Machined surfaces shall be thoroughly cleaned of foreign matter. All finished surfaces shall be protected by suitable means. Unassembled pins and bolts shall be oiled and wrapped with moisture resistant paper or protected by other approved means.
- C. Environmental Conditions
 - 1. Do not clean or paint surface when damp or exposed to foggy or rainy weather, when metallic surface temperature is less than 5 degrees F above the dew point of the surrounding air, or when surface temperature is below 45 degrees F or over 95 degrees F, unless approved by the Construction Manager.
- D. Aluminum
 - 1. Aluminum that shall be in contact with grout or concrete shall be protected from galvanic or corrosive action by being given a coat of bituminous paint or a coat of zinc-chromate primer and a coat of aluminum paint. Aluminum in contact with structural steel shall be

protected against galvanic or corrosive action by being given a coat of zinc-chromate primer and a coat of aluminum paint. The aluminum paint shall consist of an aluminum paste, spar varnish, and thinner compatible with the varnish. The aluminum paint shall be field mixed in proportion of two pounds of paste, not more than one gallon of spar varnish and not more than one pint of thinner.

END OF SECTION

1.04 COORDINATION

- A. The work of this Section shall be completely coordinated with the work of other Sections. Verify at the site both the dimensions and work of other trades adjoining items of work in this Section before fabrication and installation of items herein specified.
- B. Furnish to the pertinent trades all items included under this Section that are to be built into the work of other Sections.

1.05 FIELD MEASUREMENTS

- A. Field measurements shall be taken at the site to verify or supplement indicated dimensions and to insure proper fitting of all items.

1.06 WARRANTY

- A. Provide a warranty against defective equipment and workmanship in accordance with the requirements of the General Conditions of the Contract Documents.

PART 2 - PRODUCTS

2.01 ANCHORS, BOLTS, AND FASTENING DEVICES

- A. Anchor Bolts
 1. All anchor bolts are to be 316 stainless steel supplied by the manufacturer or fabricator of the specific material or equipment to be installed unless otherwise specified.
 2. Design Criteria for Anchor Bolts
 - a. When the size, length or load carrying capacity of an anchor bolt, expansion anchor, or concrete insert is not shown on the Drawings, provide the size, length and capacity required to carry the design load times a minimum safety factor of four.
 - b. Determine design loads as follows:
 - 1) For equipment anchors, use the design load recommended by the manufacturer and approved by the Construction Manager.
 - 2) For pipe hangers and supports, use one half the total weight of pipe, fittings, valves, accessories and water contained in pipe, between the hanger or support in question and adjacent hangers and supports on both sides.
 - 3) Allowances for vibration are included in the safety factor specified above.
 - 4) Anchors shall develop ultimate shear and pull-out loads of not less than the following values in concrete:

<u>Bolt Diameter</u> <u>(Inches)</u>	<u>Min. Shear</u> <u>(Pounds)</u>	<u>Min. Pull-Out Load</u> <u>(Pounds)</u>
1/2	4,500	6,300
5/8	6,900	7,700
3/4	10,500	9,900

c. Embedment depth to be 6 inches for epoxy anchors and 6 inches for steel expansion anchors, unless noted otherwise on the Drawings.

3. Anchor Type and Manufacturer

- a. Where epoxy anchors are noted on the Drawings, provide ANSI type 316 stainless steel threaded rod with Hilti HVA Adhesive Anchor System or equal.
- b. For all other applications, provide ANSI type 316 steel expansion anchors from one of the following manufacturers.
 - 1) Hilti, Incorporated.
 - 2) Ramset, Incorporated.
 - 3) or equal.
- c. Install anchors per manufacturer's recommendations and this Section.
 - 1) Drilled anchorage holes are to be blown out with compressed air before installing anchor.

B. The bolts used to attach the various members to the anchors shall be the sizes shown or required. Aluminum and stainless steel shall be attached to concrete by means of stainless steel machine bolts and iron or steel shall be attached with steel machine bolts unless noted otherwise.

C. For structural purposes, unless otherwise noted, expansion bolts shall be Wej-it "Ankr-Tite," Phillips Drill Co. "Wedge Anchors," HILTI Kwik Bolts or equal. When length of bolt is not called for on the Drawings, the length of bolt provided shall be sufficient to place the wedge portion of the bolt a minimum of 1-inch behind the reinforcing steel within the concrete.

2.02 ALUMINUM ITEMS

A. Structural shapes and extruded items shall conform to the detail dimensions or the plans within the tolerances published by the American Aluminum Association. Where structural items are load bearing and dimensions of member sizes are not otherwise indicated, size members to provide a maximum deflection of L/300 with given loads plus a superimposed load of 100 psf over entire tributary area to member. Submit calculations.

2.03 MISCELLANEOUS STEEL ITEMS

- A. All miscellaneous lintels and closures not shown on the Drawings shall be galvanized steel and shall be provided as a part of this Section.
 - 1. Provide galvanized loose steel lintels for openings and recesses in masonry walls. Weld adjoining members together to form a single unit. Provide not less than 8" bearing at each side of openings.
- B. Miscellaneous steel shall be fabricated and installed in accordance with the Drawings and shall include: beams, angles, support brackets, splice plates, anchor bolts, lintels and any other miscellaneous steel called for on the Drawings and not otherwise specified.
- C. Galvanizing
 - 1. Iron and Steel. ASTM A123, with average weight per square foot of 2.0 ounces and not less than 1.8 ounces per sq. ft.
 - 2. Ferrous Metal Hardware Items. ASTM A153 with average coating weight of 1.3 ounces per sq. ft.
 - 3. Touch-up Material for Galvanized Coatings. Galvanized coatings marred or damaged during erection or fabrication shall be repaired by use of DRYGALV as manufactured by the American Solder and Flux Company, Galvalloy, Galvion, Rust-Oleum 7085 Cold Galvanizing Compound, or approved equal, applied in accordance with the manufacturer's instructions.
- D. Welding Electrodes. Welding Electrodes shall conform with AWS D1.1, except E7024 rods or electrodes shall not be used.

2.04 HATCHES AND SCUTTLES

- A. Cover shall be 11 gauge (minimum) aluminum with a 3" beaded flange with formed reinforcing members. Cover shall have a heavy extruded thermoplastic rubber gasket fitted into a retainer that is mechanically fastened to the cover interior to assure a continuous seal when compressed to the top surface of the curb. Provide minimum 1" copper pipe gutter drains, embed in concrete where applicable, connected to hatch gutter and route to drain away from structure. Hatches and covers used outside near or at grade shall be traffic rated. Use Halliday Products access door hatches or equivalent product.
- B. Verify and make any adjustments necessary to the location and size of hatches with equipment to be accessed through the hatch openings.
- C. For vault retro-fit installations curb shall be 12" in height and of 11 gauge aluminum. The curb shall be formed with a 3-1/2" flange with 7/16" holes for securing to the vault deck.
- D. Precast and cast-in-place Installations. When installed in precast, the vault hatch shall be delivered to the precast manufacturer's plant prior to casting of structure. Hatches shall be cast into precast or cast-in-place structures and not installed after casting.

Include gutter drains. This type of installation shall be used where the hatch is shown to be installed flush with the top of the vault.

- E. Lifting mechanisms. Manufacturer shall provide compression pneumatic spring operators enclosed in telescopic tubes to provide, smooth, easy, and controlled cover operation throughout the entire arc of opening and closing. The upper tube shall be the outer tube to prevent accumulation of moisture, grit, and debris inside the lower tube assembly. The lower tube shall interlock with a flanged support shoe through bolted to the curb assembly.
- F. Hardware.
 - 1. Heavy pintle hinges shall be provided.
 - 2. Cover shall be equipped with a spring latch with interior and exterior turn handles.
 - 3. Roof scuttle shall be equipped with interior and exterior padlock hasps.
 - 4. The latch strike shall be a stamped component bolted to the curb assembly. If cover is 7'-0" or greater along the hinge side, manufacturer shall provide an enclosed two point spring latch.
 - 5. Cover shall automatically lock in the open position with a rigid hold open arm equipped with a 1" diameter red vinyl grip handle to permit easy release for closing.
 - 6. All hardware shall be 316 stainless steel.
 - 7. Cover hardware shall be bolted into heavy gauge channel reinforcing welded to the underside of the cover and concealed within the insulation space.
- G. Finishes. Factory finish shall be mill bright finish aluminum.

PART 3 - EXECUTION

3.01 FABRICATION

- A. All miscellaneous metal work shall be formed true to detail, with clean, straight, sharply defined profiles and smooth surfaces of uniform color and texture and free from defects impairing strength or durability.
- B. Connections and accessories shall be of sufficient strength to safely withstand stresses and strains to which they will be subjected. Steel accessories and connections to steel or cast iron shall be steel, unless otherwise specified. Threaded connections shall be made so that the threads are concealed by fitting.
- C. Welded joints shall be rigid and continuously welded or spot welded as specified or shown. The face of welds shall be dressed flush and smooth. Exposed joints shall be close fitting and jointed where least conspicuous.
- D. Welding of parts shall be in accordance with the Standard Code for Arc and Gas Welding in Building Construction of the AWS and shall only be done where shown, specified, or permitted by the Construction Manager. All welding shall be done only by welders certified as to their ability to perform welding in accordance

with the requirements of the AWS Code. Component parts of built-up members to be welded shall be adequately supported and clamped or held by other adequate means to hold the parts in proper relation for welding.

- E. Welding of aluminum work shall be on the unexposed side as much as possible in order to prevent pitting or discoloration.
- F. All aluminum finish exposed surfaces shall have manufacturer's standard mill finish. A coating of methacrylate lacquer shall be applied to all aluminum before shipment from the factory.
- G. All steel finish work shall be thoroughly cleaned, by effective means, of all loose mill scale, rust, and foreign matter before shipment and shall be given one shop coat of primer compatible with finish coats specified in Painting Section after fabrication but before shipping. Paint shall be applied to dry surfaces and shall be thoroughly and evenly spread and well worked into joints and other open spaces. Abrasions in the field shall be touched up with primer immediately after erection. Final painting is specified in Section 09900: Painting.
- H. Galvanizing, where required, shall be the hot-dip zinc process after fabrication. Following all manufacturing operations, all items to be galvanized shall be thoroughly cleaned, pickled, fluxed, and completely immersed in a bath of molten zinc. The resulting coating shall be adherent and shall be the normal coating to be obtained by immersing the items in a bath of molten zinc and allowing them to remain in the batch until their temperature becomes the same as the bath. Coating shall be not less than 2 oz. per sq. ft of surface. The galvanized coating shall be chromate treated.

3.02 INSTALLATION

- A. Install all items furnished except items to be embedded in concrete which shall be installed under Division 3. Items to be attached to concrete or masonry after such work is completed shall be installed in accordance with the details shown. All dimensions shall be verified at the site before fabrication is started.
- B. All steel surfaces to come in contact with exposed concrete or masonry shall receive a protective coating of an approved heavy bitumastic troweling mastic applied in accordance with the manufacturer's instructions prior to installation.
- C. Where aluminum contacts a dissimilar metal, apply a heavy brush coat of zinc-chromate primer followed by two coats of aluminum metal and masonry paint to dissimilar metal.
- D. Where aluminum contacts concrete, apply a heavy coat of approved alkali resistant paint to the concrete.

END OF SECTION

SECTION NO. 05510

MANHOLE FRAMES AND COVERS

PART 1 - GENERAL

1.01 SCOPE OF WORK

Furnish all labor, materials, equipment and incidentals required and install all miscellaneous metal as shown on the drawings and specified herein.

1.02 COORDINATION

- A. The work of this Section shall be completely coordinated with the work of other sections. Verify at the site both the dimensions and work of other trades adjoining items of work in this section before fabrication and installation of items herein specified.
- B. Furnish to the pertinent trades all items included under this section that are to be built into the work of other sections.

1.03 SHOP DRAWINGS

Detail drawings, as provided showing sizes of members, method of assembly, anchorage, and connection to other members shall be submitted for approval before fabrication.

1.04 FIELD MEASUREMENTS

Field measurements shall be taken at the site to verify or supplement indicated dimensions and to insure proper fitting of all items.

PART 2 - PRODUCTS

2.01 FABRICATED ITEMS

- A. Manhole Frames and Covers:
 - 1. Manhole frames and cover castings shall be good quality, strong, tough, even-grained, cast iron, smooth, free from scale, lumps, blisters, sand holes and defects of any kind which render them unfit for the service for which they are intended. Castings shall be thoroughly cleaned and subject to hammer inspection. Manhole covers and frame seats shall be machined true to a plane surface. Before shipment from the factory, casting shall be given one coat of coal tar pitch varnish which shall present a coating which is smooth and tough, but not brittle. Sizes shall be as shown on the drawings. Cast iron shall be grey iron casting conforming to the AASHTO Designation M-105 and shall be Class No. 30.
 - 2. Frames and covers shall have a minimum total weight of 460 pounds. Covers shall have a weight not less than 150 pounds.

3. Frames and covers shall be of the "Type W" unless noted otherwise on the drawings. All covers shall have the words "STORM SEWER" in raised 2 inch letters cast into the top. Type "W" shall be the waterproof frame and cover with bolted lid, 1/8 inch neoprene gasket and sufficient counter sunk hexagonal-head cap screws cover to frame to produce a waterproof seal.
4. All manhole frames and covers shall have a minimum of 22 inches clear opening between the innermost ring. The lower flange of the frame shall be at least 6 to 8 inches. The lower flange of the frame shall be at least 6 inches in width. All covers shall be supplied with two concealed watertight pick holes.

B. Manhole Steps:

1. Manhole steps shall be Clow Corporation F-3650 or approved equal.

PART 3 - EXECUTION

3.01 FABRICATION

All miscellaneous metal work shall be formed true to detail, with clean, straight, sharply defined profiles and smooth surfaces of uniform color and texture and free from defects impairing strength or durability.

3.02 INSTALLATION

- A. Install all items furnished except items to be imbedded in concrete or other masonry which shall be installed under Division 3 and Division 4 respectively. Items to be attached to concrete or masonry after such work is completed shall be installed in accordance with the details shown. Fastening to wood plugs in masonry will not be permitted. All dimensions shall be verified at the site before fabrication is started.
- B. All steel surfaces to come in contact with exposed concrete or masonry shall receive a protective coating of an approved heavy bituminous troweling mastic applied in accordance with the manufacturer's instructions prior to installation.

END OF SECTION

SECTION NO. 05520

ALUMINUM HANDRAILS

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. The work covered by this Section includes furnishing all labor, equipment, and materials required to furnish and install all aluminum handrails including all accessories, as shown on the Drawings and specified herein.
- B. Handrails and/or guard chains shall be furnished and installed where shown on the Drawings and at the edge of all walking or working surfaces where the distance from the surface to the adjacent floor, ground, or slab exceeds 30 inches.
- C. Toe boards shall be provided where shown on the Drawings.

1.02 RELATED WORK

- A. Division 1: General Requirements
- B. Section 05500: Metal Fabrications
- C. Section 05530: Aluminum Gratings

1.03 REFERENCE STANDARDS

- A. Aluminum Association (AA)
- B. American Society for Testing and Materials (ASTM)

1.04 SUBMITTALS

- A. Shop drawings and product data submittals in accordance with Sections 01340 and 01630 are required for items specified under this Section.
- B. Items for which shop drawings and product data submittals are not herein before required shall have one copy submitted for information only prior to installation of the work.

1.05 TRANSPORTATION AND HANDLING

- A. All aluminum pipe and fittings shall be packed and shipped in individual plastic film to protect the anodized finish.

PART 2 - PRODUCTS

2.01 DESIGN CRITERIA

- A. Hand Railings: Horizontal force of 50 pounds per linear foot on top rail.
- B. Stair Railings: Horizontal force of 20 pounds per linear foot on top rail.
- C. 200 pounds point load applied at any point in any direction on either type of rail.

2.02 ALUMINUM HANDRAIL

- A. Aluminum handrail vertical and horizontal members shall be seamless aluminum alloy pipe. Aluminum fittings shall be of wrought material of the same composition as rails and posts or cast aluminum of aluminum alloy No. 214. Aluminum fittings shall have a minimum thickness of 1/4-inch. All screw connectors and bolts shall be of stainless steel or 2024-T4 aluminum alloy. The maximum post spacing shall be in accordance with the details shown on the Drawings.
- B. Aluminum handrails and exposed fittings shall have a clear anodized finish, Aluminum Association Designation AA-M35C11A41.
- C. Aluminum pipe railings shall be of all welded construction or assembled with flush type fittings and concealed or nonprojecting pins and fasteners.
- D. Welded joints shall be made by inert-gas welding (MIG) using aluminum welding rods of aluminum alloy X5356. All welded joints shall be cleaned of flux and weld spatter and the weld bead shall be ground smooth, rubbed, and polished to provide a flush and neat uniform appearance.
- E. Slip joints to facilitate removal of pipe railing shall be provided at all intersections, changes in direction, or at intervals not to exceed 25 feet in straight runs of railing. The slip joint shall be designed and constructed to provide strength equivalent to a straight section of pipe.
- F. Stainless steel eye bolts shall be furnished and installed on stanchions where guard chains will be attached.
- G. Guard chains shall be provided across all pipe railing openings where shown, specified, or required. Two chains shall be provided at each opening to coincide with the top and middle rails in the handrailing. Chain links shall be 1/4-inch stainless steel construction, 12 links to the foot. One end shall be connected to a 1/4-inch stainless steel eye bolt in the stanchion and the other end shall be connected by means of a heavy, bronze, swivel eye, snap hook to a similar eye bolt in the opposite stanchion. As an alternate, chain and fastenings shall be of anodized welded aluminum. Chain and fastenings shall be capable of withstanding a tension of 600 pounds.

- H. Toeboards shall be as shown in the standard details on the Drawings, shall conform to ASTM B-221, aluminum alloy 6063-T6.

2.03 FINISH

- A. Aluminum surfaces shall be anodized with color and texture to be selected by the owner. Coordinate with grating, stairs and platforms.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Aluminum railings shall be erected plumb, straight, and true at the locations and elevations shown on the Drawings. Prefabricated aluminum handrail shall be assembled and installed in strict compliance with the manufacturer's instructions.
- B. Horizontal members of aluminum railings shall be fastened into concrete or masonry walls with flush type flange fitting anchors with a minimum diameter of 3-1/2 inches. Anchor screws shall be flat-head stainless steel screws with a minimum length of 3 inches.
- C. Vertical members of aluminum railings shall be embedded in sleeves in concrete, or suitably anchored to a floor flange for bolted anchorage, as shown on the Drawings.
- D. Aluminum pipe sleeves to be embedded in concrete shall be given one shop coat of zinc chromate primer on all surfaces followed by one heavy coat of alkali-resistant bituminous paint on all exterior surfaces. That portion of vertical handrail members to be embedded in pipe sleeves shall be given one shop coat of zinc chromate primer..
- E. Pipe sleeves shall be thoroughly cleaned of all dust and foreign material prior to placing handrails. Vertical railing members shall be centered in the pipe sleeves and the annular space filled to overflowing with a handrail setting cement, "Leadite", "Basolite", "Hydrotite", or equal. Excess setting shall be cleaned off, leaving a 1/8-inch buildup sloping away from the post.
- F. Toeboards shall be anchored with clamps and bolts to the posts. A 1/4-inch space shall be provided between bottom of toeboard and floor surface.
- G. All portions of the erected railing system shall be rigid and free of play at all joints and attachments.
- H. Provide weep holes or other measures to drain water from the railing system, at low points of vertical bends in rails, and in posts at the lowest functional elevation.

- I. Following installation, aluminum handrail shall be cleaned using soap and clean water. Acid solutions, steel wool, or harsh abrasives shall not be used. If stains remain after cleaning, remove finish and restore in accordance with the manufacturer's recommendations.
- J. Surfaces of aluminum materials to be in contact with concrete or dissimilar metals shall be given one shop coat of zinc chromate primer followed by one heavy coat of alkali-resistant bituminous paint.
- K. All defective, damaged, or otherwise improperly installed handrail shall be removed and replaced with material that satisfies the requirements of this Section.

END OF SECTION

SECTION NO. 05530

ALUMINUM GRATINGS AND CHECKED PLATE

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. The work covered by this Section includes furnishing all labor, equipment and materials required to furnish and install all aluminum gratings and treads, including all supporting angles, anchors, and incidental fastenings as shown on the Drawings and specified herein.
- B. Unless specifically designated otherwise on the Drawings, all gratings and treads shall be aluminum.

1.02 RELATED WORK

- A. Division 1: General Requirements
- B. Section 05520: Aluminum Handrails
- C. Section 05500: Metal Fabrications

1.03 REFERENCE STANDARDS

- A. Aluminum Association (AA)
- B. American Society for Testing and Materials (ASTM)

1.04 SUBMITTALS

- A. Shop drawings and product data are required for items specified under this Section. Also should substitute items be proposed in place of those items specified, shop drawings and product data shall be submitted in accordance with Sections 01300 and 01630.

PART 2 - PRODUCTS

2.01 DESIGN CRITERIA

- A. Aluminum grating shall be designed for an extreme fiber stress in bending of not more than 10,000 psi and a deflection of not more than 1/300 of the span length under a uniform live load of 100 pounds per square foot.
- B. The depth and thickness of the main bearing bars shall be 1-1/2 inches and the clear spacing between main bearing bars shall not exceed 1-1/8 inches.

2.02 ALUMINUM GRATINGS

- A. Aluminum gratings shall be fabricated of I-shaped or rectangular 6061-T6 or 6063-T6 aluminum alloy bars welded or pressure locked together into rigid panels. Grating and banding bars shall be machine cut. Top surfaces of main bearing bars shall be grooved or serrated to provide a non-slip surface.
- B. Grating panels shall be supported by shelf angles on two sides of the opening and shall be reversible. The gratings shall be of the type that can be made in panels of the widths and lengths appropriate to the openings shown on the Drawings, and no gratings will be accepted which require individual panels to be made up by binding narrow panels together with end or intermediate binding strips welded thereto. The ends of all grating panels and the edges of all openings shall be provided with banding strips of the same depth and thickness of the main bars, welded thereto, and neatly finished at the intersections with the bars. After installation, there shall not be more than 1/4-inch clearance between ends of adjacent panels.
- C. The top surface of all bars shall be flush and all gratings shall lie flat with no tendency to rock when installed. Cross bars and edge bars of adjacent panels shall align for neatness. All main bearing bars shall be parallel.
- D. Grating panels shall be securely anchored in place with stainless steel "J" bolts or aluminum saddle or hook clamps. Galvanized hardware will not be acceptable.
- E. Main bearing bars shall be supported by aluminum shelf angles of the size and thickness as shown on the Drawings. There shall not be more than 1/4-inch clearance between the sides of the grating panels and the inside vertical face of the shelf angle.
- F. Grating panels shall be within 3/16-inch plus or minus of the detailed length and width and shall have a maximum difference in length of opposite diagonals of 3/16-inch. Spacing of bearing bars shall be within 1/32 inch of detailed spacing.
- G. All surfaces shall be sound, smooth, clean, and free from defects. Completed sections shall be level and true so as to rest firmly on the bearing angles along the entire contact surface. Openings, where required, shall be neatly and accurately made to the dimensions required as shown on the Drawings. Poorly fitted or damaged grating shall be replaced.
- H. Aluminum surfaces to be embedded in concrete or otherwise placed in contact with masonry construction shall be given one shop coat of zinc chromate primer on all surfaces followed by one heavy shop coat of an alkali-resistant bituminous paint. The paint shall be applied as received from the manufacturer without the addition of any thinner.

1. Where changes in channel direction, openings for gates, ends of grating runs, etc., prohibit adequate support for grating, additional cross angles shall be furnished to provide a seating surface.
- J. Unless otherwise shown, openings to be covered with grating shall be bound on all four sides with a continuous shelf angle frame having welded corners and sufficient strap anchors for anchorage into the concrete.
- K. Gratings shall be laid out so openings in the grating are centered on a joint between adjacent panels. Where joints occur normal to the direction of span, they shall be centered on structural support with not more than 1/8 inch between ends of adjoining panels.

2.03 ALUMINUM STAIR TREADS

- A. Aluminum stair treads shall be grating type treads fabricated from 6061-T6 aluminum alloy grating having 1-1/2 inch by 3/16 inch bearing bars.
- B. Stair treads shall be furnished with an extruded or cast aluminum nosing. Nosings shall have internal anchors and an anti-slip filler of abrasive grit.
- C. Aluminum carrier plates shall be welded to the ends of stair treads. Carrier plates shall have slotted holes so as to be adjustable. Carrier plates shall be fastened to steel stair stringers with stainless steel bolts.
- D. Outside faces of carrier plates to be in contact with steel shall be given a heavy shop coat of bituminous paint to prevent direct contact between the dissimilar metals.
- E. Stair treads shall be 10-1/2 inches wide.

2.04 FINISH

- A. Coordinate finish with handrails. Submit samples. Finish selection to be made by owner.

2.05 CHECKERED PLATE

- A. Checkered plate shall conform to ASTM B632, diamond pattern, constructed of type 6061-T6 aluminum. Plates shall be 1/4" minimum thickness and supplied in maximum widths of 4 feet.
- B. Checkered plate thickness shall be designed to withstand a uniform live load of 100 pounds per square foot with a maximum deflection of 1/300 of span length.
- C. Unless shown otherwise, frames for aluminum checkered plate openings shall be aluminum angles of minimum 1-1/2" by 1-1/2" by 1/4" angles having 3/8" dia. by 6" long anchors spaced at 2 feet maximum with a minimum of two anchors per side.

Drill and tap frame to receive 3/8" dia. aluminum cap screws at not more than 2 feet on centers with a minimum of two screws per side.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Gratings shall be installed in accordance with the manufacturer's recommendations and instructions.
- B. Gratings shall have no tendency to shift or rock and shall not exhibit excessive deflection under normal foot traffic.
- C. Stair treads shall be installed at the proper spacing and alignment and shall be level.

END OF SECTION

SECTION NO. 08310

FLOOR ACCESS DOORS

PART 1 - GENERAL

1.1 SUMMARY

- A. Work Included: Provide factory-fabricated floor access doors.

1.2 SUBMITTALS

- A. Product Data: Submit manufacturer's product data.
- B. Shop Drawings: Submit shop drawings including profiles, accessories, location, adjacent construction interface, and dimensions.
- C. Warranty: Submit executed copy of manufacturer's standard warranty.

1.3 QUALITY ASSURANCE

- A. Manufacturer: A minimum of 5 years experience manufacturing similar products.
- B. Installer: A minimum of 2 years experience installing similar products.
- C. Manufacturer's Quality System: Registered to ISO 9001:2008 Quality Standards including in-house engineering for product design activities.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Deliver products in manufacturer's original packaging. Store materials in a dry, protected, well-vented area. Inspect product upon receipt and report damaged material immediately to delivering carrier and note such damage on the carrier's freight bill of lading.

1.5 WARRANTY

- A. Manufacturer's Warranty: Provide manufacturer's standard warranty. Materials shall be free of defects in material and workmanship for a period of twenty-five years from the date of purchase. Should a part fail to function in normal use within this period, manufacturer shall furnish a new part at no charge.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Type FPG - Fall Protection Grating System by The Bilco Company, Type S1R or S2R Access Covers by Halliday Products, Inc., or approved equal.

2.2 FALL PROTECTION GRATING SYSTEM

- A. Furnish and install on vault access doors, where indicated on plans, fall protection grating system. Door manufacturer shall install the grating system when the door is fabricated or field install (by others) on existing doors already in use. If field installation is necessary, grating system shall be installed per the manufacturer's instructions.
- B. Performance characteristics:
 - 1. Grating panel(s) shall be high visibility safety yellow in color.
 - 2. Grating panel(s) shall lock automatically in the full open position.
 - 3. Grating system shall have a twenty-five year warranty.
 - 4. Grating panel(s) shall have a provision for locking to prevent unauthorized opening.
- C. Grating: Panels shall be aluminum with a powder coat paint finish and designed to meet OSHA 29 CFR 1910.23 requirements for fall protection.
- D. Hold open feature: A Type 316 stainless hold open device shall be provided to lock the cover in the fully open 90 degree position.
- E. Hardware: All hardware shall be Type 316 stainless steel.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and openings for compliance with requirements for installation tolerances and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install products in strict accordance with manufacturer's instructions and approved submittals. Locate units level, plumb, and in proper alignment with adjacent work.
 - 1. Test units for proper function and adjust until proper operation is achieved.
 - 2. Repair finishes damaged during installation.
 - 3. Restore finishes so no evidence remains of corrective work.

3.3 ADJUSTING AND CLEANING

- A. Clean exposed surfaces using methods acceptable to the manufacturer which will not damage finish.

END OF SECTION

SECTION NO. 09900

PAINING

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. The work covered by this Section includes furnishing all materials, equipment and labor to accomplish all surface preparation, painting and related work for satisfactory completion of the project.
- B. The terms "paint" or "painting" as used in this section, includes the use of emulsions, enamels, paints, sealers and other coatings organic or inorganic whether used as prime, intermediate, or finish coats.
- C. Unless otherwise specified in the detailed equipment specifications, shop painting shall conform to the requirements of this Section.
- D. It is the intent of these Specification to field paint the following:
 - 1. All miscellaneous metals except as noted, structural steel, equipment, piping, fitting, valves and specials.
 - 2. Work under this Section shall also include touch-up or repair of any damaged or defective painted surface.
 - 3. Building surfaces in accordance with the schedule in the Drawings.
- E. Aluminum and stainless steel shall not be painted unless specifically indicated.
- F. Mechanical equipment and electrical equipment on which a baked-on enamel finish is specified will not require field painting. Any damage or injury to such finishes shall be repaired to the satisfaction of the Engineer by the Contractor at no additional cost to the Owner prior to final acceptance.
- G. The omission of minor items in the schedule of work shall not relieve the Contractor of his obligation to include such items where they come within the general intent of the Specifications.
- H. Surfaces to be painted that presently have a coating of paint that is not deteriorated or damaged as determined by the Engineer will not be required to have a prime coat.

1.02 RELATED WORK

Division 1: General Requirements

1.03 REFERENCE STANDARDS

Steel Structures Painting Council (SSPC)

1.04 SUBMITTALS

- A. Product data and samples shall be submitted in accordance with Section 01340. The submission shall include but not be limited to the following:
 - 1. A painting schedule listing the manufacturer, type of paint, and the manufacturer's recommendations for surface preparation, application and dry film thickness.
 - 2. A complete specification for each component used.
 - 3. Color chart.

- B. Operation and maintenance data shall be submitted. The data shall include, but not be limited to, the following:
 - 1. Product name and number.
 - 2. Name, address and telephone number of the manufacturer and the local distributor.
 - 3. Detailed procedures for routine maintenance and cleaning.
 - 4. Detailed procedures for light repairs such as dent, scratches and staining.

1.05 WORKMANSHIP

- A. It is intended that all painting work shall be of good quality. Materials shall be evenly spread without runs or sags. There shall be an easily perceptible difference in shades of successive coats of paint.
- B. The painter shall examine the Specifications for the various other trades whose work is to be finished under this Section. Any materials requiring painting, which are left unfinished by the requirements for such other trades, shall be painted to completion under this Section unless specifically excluded. Any defects in such work which would have an adverse effect on the finish shall be corrected before any painting is started.

1.06 DELIVERY, STORAGE AND HANDLING

- A. All materials shall be brought to the job site in the original sealed and unbroken, labeled containers of the paint manufacturer and shall be subject to inspection by the resident engineer on the job.
- B. All materials used in the work shall be stored in an approved location. Such storage space shall be kept neat and clean and all damage thereto or to its surroundings shall be repaired prior to completion of the work. Oily rags, waste and similar articles shall be removed every night. The storage space shall be heated to the extent necessary to prevent damage to the materials by freezing. Every precaution shall be taken to avoid danger of fire. An approved fire extinguisher shall be provided in this storage area. Proper outside containers shall be provided by the Contractor to be used for disposing of painting wastes. No plumbing fixtures shall be used for this purpose.

1.07 JOB CONDITIONS

- A. The manufacturer's recommendations concerning environmental conditions under which a material can be applied shall be strictly followed. No finishes shall be applied in areas where dust is being generated.
- B. The Contractor shall cover or otherwise protect the finished work of other trades, surfaces not being painted concurrently, and/or surfaces which are not to be painted. Any injury or damage to such surfaces shall be remedied to the satisfaction of the Engineer at the expense of the Contractor before final acceptance, and no separate payment therefor will be made.
- C. Adequate ventilation shall be provided in all areas where painting is being conducted to protect workers against injurious or explosive concentrations of fumes, gases, dusts, or mists.

1.08 TESTING EQUIPMENT

- A. The Contractor shall furnish and make available to the Engineer the following

items of testing equipment for use in determining if the requirements of this Section are being satisfied. The following specified equipment shall be available for use at all times when field painting or surface preparation is in progress.

1. Wet film gauge.
2. Surface thermometer.
3. Keane-Tator surface profile comparator.
4. Set of National Association of Corrosion Engineers (NACE) visual standards.
5. Holiday (pin hole) detector.
6. Sling-Psychrometer.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. The paints and paint products shall be as manufactured by Tnemec Company, Inc. or approved equal. Paint applied to gypsum board substrates shall be as manufactured by Benjamin Moore, Duron, Kelly-Moore, Frazee or approved equal.
- B. Products of manufacturers other than those named, which are comparable in quality to that specified, will be considered if said paints are offered by the Contractor with satisfactory data on past performance of similar applications, composition, direction for use and other information required.
- C. The painting schedule lists finishes acceptable for use in the work. The schedule is for identification as to type and quality of materials, and shall be strictly followed unless the Contractor submits an alternate schedule to the Engineer for review. A painting schedule shall be submitted for review. Paint applied contrary to the specified schedule shall be corrected as directed by the Engineer. All rejected paint shall be removed from the job, and surfaces shall be repainted in strict accordance with the schedule and such other directions, as deemed necessary by the Engineer. Unless noted otherwise, each coat of paint shall be applied by appropriate methods to obtain the minimum dry film thickness recommended by the manufacturer for the intended use. The submitted schedule shall contain the manufacturers' recommendations for wet and dry film thickness.

2.02 PAINTING SCHEDULE

- A. The following paint systems are intended to include surfaces to be painted. Any surface or item not specifically named herein but obviously required to be painted, shall be included under the system selected by the Engineer or otherwise painted as directed by the Engineer. The dry film thicknesses shall be within the limits indicated in the manufacturer's specifications. Surface preparation shall be as specified herein and in accordance with the manufacturer's recommendations.
- B. Metal Submerged, Subject to Splash or Buried in Ground: These items require surface preparation SSPC-SP10, "Near White Blast Cleaning" as recommended by the paint manufacturer. Non-submerged metal brackets used to hold grating require SSPC-SP5, "White Blast Cleaning".

1. Primer: Tnemec – Series 161-1211 @ 4-6 mils
 2. 1st Coat:
 - a. Tnemec Series 69-Color @ 4-6 mils**
 - b. Tnemec Series 120 @ 12-18 mils (for metal brackets)** For potable water contact, use Series 20 Pota-Pox in lieu of Series 69.
 3. Field Finish:
 - a. Tnemec Series 69-Color @ 4-6 mils**
 - b. Tnemec Series 120 @ 12-18 mils** For potable water contact, use Series 20 Pota-Pox in lieu of Series 69.
- C. All Non-Submerged Metal: Machinery, above ground piping, fittings and valves.
1. Primer: Tnemec – Series 161-1211 @ 3-4 mils
 2. 1st Coat: Tnemec Series 69 @ 2-3 mils
 3. Finish: Tnemec Series 73 @ 2-3 mils
- D. Submerged Concrete Surfaces:
1. Finish: 2 coats of Tnemec Series 104 @ 6-8 mils per coat
- E. Exposed Galvanized, Aluminum and other Non-Ferrous Metals: Interior piping, fittings, valves, stands. These items require surface preparation SSPC-SP1, “Solvent Cleaning” as recommended by the paint manufacturer. Surfaces must be clean, dry and free of all contaminants.
1. 1st Coat: Tnemec Series 69 @ 3 mils minimum
 2. Finish: Tnemec Series 73 @ 2-3 mils dry
- F. Interior Concrete and Concrete Block Surfaces: Surfaces must be clean and dry.
1. Block Fill: Tnemec Series 130 @ 90-120 sf per gallon
 2. Finish: 2 coats of Tnemec Series 73 @ 2-3 mils per coat
- G. Exterior Above-Grade Concrete Block: Surfaces must be clean and dry.
1. Block Fill: Tnemec Series 54-562 Masonry Filler @ 90- sf per gallon
 2. Finish: Tnemec Series 52 Tneme-Crete @ 90- sf per gallon
- H. Exterior Below-Grade Concrete: Surface must be clean and dry.
1. Finish: 2 coats of 46-465 Tnemecol @ 80-90 sf per gallon
- I. Concrete Floors: Acid Etch or Brush-Off Blast Cleaning.
1. Finish: 2 coats of Tnemec Series 161 @ 2-3.5 mils
- J. Insulated Pipe: Surface must be clean and dry.
1. Finish: 2 coats of Series 6-Color Tneme-Cryl @ 250-330 sf per gallon
- K. Doors and Frames – Where Miscellaneous Shop Primer Exists: SSPC-SP3, “Power Tool Cleaning” surface preparation required.
1. 1st Coat: Standard Manufacturer Primer
 2. 2nd Coat: Series 135 – Color Chembuild @ 4-6 mils
 3. Finish: Series 73 – Color Endura-Shield III @ 2-4 mils
- L. Gypsum Board Substrates:
Latex System: MPI INT 9.2A.
1. 1st Coat: Standard Manufacturer Latex Primer
 2. Topcoat: Interior flat latex.

2.03 MAINTENANCE MATERIAL

The Contractor shall provide the Owner at final inspection one gallon of each type and final color of paint used on the project.

PART 3 - EXECUTION

3.01 PREPARATION OF SURFACE

- A. All surfaces to be painted shall be prepared with the objective of obtaining a smooth, clean and dry surface. Surfaces which are not shop painted or which were improperly shop painted, and all abraded or rusted shop painted surfaces, which are to be painted shall be prepared as specified herein and shall be dry and clean before painting. Blast cleaning, where required, shall be done in a manner that will not contaminate other work. Blast cleaning is not required of any surfaces which have been properly shop painted previously. No painting shall be done in the field before the prepared surfaces are approved by the Engineer.
- B. Non-submerged ferrous metal surfaces to be painted shall be thoroughly cleaned using SSPC SP-6 Commercial Blast Cleaning in accordance with the Specifications of the Steel Structures Painting Council. Motors and like items that may be damaged by blast cleaning shall be prepared by other approved means.
- C. Equipment and Metal Submerged, Subject to Splash or Buried in the Ground:
 1. Surface preparation and special coatings shall be done only by crews experienced in this work and who have been approved by the Engineer. A representative of the paint company shall be present when work begins to instruct personnel in sandblasting and application techniques; that instruction shall be made in the presence of the Engineer.
 2. Surfaces to be coated shall be sandblasted to the equivalent of "SSPC-SP-10, Near-White Metal Blast Cleaning" of the Steel Structures Painting Council. The Contractor shall furnish the Engineer a Sample No. 10 blast cleaning plate, suitably sealed in plastic and purchased from the Steel Structures Painting Council, to be used as a field guide. Under no circumstances shall sandblasted surfaces be permitted to rust or have condensation to form thereon prior to coating. Surfaces sandblasted shall be coated the same day; if surfaces are allowed to remain uncoated overnight or longer, they shall be re-sandblasted before coating. All cleaning and coating application shall be performed only during daylight hours. No coating shall be applied when the temperature is below 50 degrees F, nor when the relative humidity is greater than 75 percent, nor when condensation is present on base and coated surfaces, nor when ambient air temperature is falling.
 3. The following items subjected to the environments herein described shall receive the surface preparation specified in this subparagraph.
 - a. All submerged pumping equipment.
 - b. All flow and level control equipment.
 - c. All exposed pipe, valves and fittings.
 - d. All ferrous metal gates and/or appurtenances.
 - e. All buried valves.
 4. This does not include ductile iron piping in sewage or buried in the ground.
- D. Metals coated with tar or bituminous products to be painted shall be clean and

- dry and free of oil and grease and shall be given two coats of Koppers Tar Stop or Tnemec No. 707 Tar Bar before application of the specified finish coat.
- F. Concrete and grout surfaces to be painted shall have all uneven work, sharp corners and projections smoothed down. All defective surfaces showing aggregate or visible holes shall be cut out and coated with a special bonding coat and filled with grout. Surfaces shall be dry and cleaned from all dust, form oil, curing compounds and other objectionable matter.
 - F. Galvanized metal surfaces to be painted shall be thoroughly cleaned using SSPC-SP-1 Solvent Cleaning in accordance with Specifications of Steel Structures Painting Council.
 - G. Metal windows, doors, and frames shall have all rust and loose scale removed with a wire brush and surfaces shall be wiped clean. Caulk around frames and trim, allow to set, then smooth up for primer coat.
 - H. Use special care to leave all nameplates and non-ferrous finished trim unpainted. Complete instructions as to equipment requiring painting shall be obtained from the Engineer before starting the work. Control centers, meter panels, and pump control panels shall not be painted in the field. The painter shall apply clear plastic by spray can or brush to all metallic nameplates.
 - I. Equipment, such as motors, pumps and other such items, which when installed, become an integral part of a system and which may be delivered fully factory-finished, that is, having finish coats in addition to the prime coating, shall be patch painted where damaged, sanded to a dull gloss and then painted with two coats of the specified finish material or as directed.
 - J. All copper piping shall be cleaned and polished to a bright uniform sheen and then painted with two coats of clear vinyl. Polishing shall be performed using an approved type of copper polish compound which will not abrade or scratch the surface of the pipe. The use of sandpaper or emery cloth will not be permitted for polishing.

3.02 PRIMING

Each coat of paint, as well as the required surface preparation, shall be considered as an essential part of a complete system of surface treatment. The painting work specified herein shall include spot-priming, shop-priming and other initial treatments necessary as recommended by the manufacturer of the finishing paint. In all cases, the priming material shall be compatible with the finishing material as recommended by the paint manufacturer. Prime coats specified herein will not be required on items which are delivered with prime or shop coats already applied; however, the Contractor shall determine that such primers are compatible with the specified finish coats. Where the priming material is not specifically indicated, and where a finishing material different from the specified material is approved for use in the work, then the primer shall be of the type recommended by the manufacturer for such material as applied to the particular surface. If any item, which is to be painted under this Contract, is delivered to the site bearing a prime coat which is incompatible with the specified finishing material or is improper for the purpose, then such prime coat shall be removed and the surface prepared for painting as recommended by the manufacturer and reviewed by the Engineer.

3.03 APPLICATION OF PAINT

- A. On metal surfaces the painter shall apply each coat of paint at the rate specified by the manufacturer to the minimum dry film thickness required by the manufacturer. If material has thickened or must be diluted for application by spray gun, the coating shall be built up to the same film thickness achieved with undiluted material. In other words, one gallon of paint as originally furnished by the manufacturer must not cover a greater square foot area when applied by spray gun than when applied unthinned by brush. Deficiencies in film thickness shall be corrected by the application of additional coats of paint. On porous surfaces, it shall be the painter's responsibility to achieve a protective and decorative finish either by increasing the coverage rate or by applying additional coats of paint.
- B. Paint shall not be applied when the temperature of the air or of the surface is below 50 degrees F. or above 95 degrees F. nor when the relative humidity is greater than 75 percent, nor when condensation is present on base and coated surfaces, nor when ambient temperature is falling.
- C. Drying time shall be construed to mean "Under normal conditions." Where conditions are other than normal because of the weather or because painting must be done in confined spaces, longer drying time will be necessary. Additional coats of paint shall not be applied, nor shall units be put in service until paints are thoroughly dry.
- D. Where thinning is necessary, only the products of the manufacturer furnishing the paint, and for the particular purpose, shall be allowed and all such thinning shall be done strictly in accordance with the manufacturer's instructions as well as with the full knowledge of the Engineer.

3.04 CONTRACTOR'S INSPECTION

- A. The Contractor shall use a wet film gauge to check each application, about every 15 minutes in order to correct low or heavy film build immediately.
- B. A dry film gauge shall be used to check each coat when dry, and the total system when completed.
- C. The Contractor shall use a holiday or pin hole detector on metal systems to detect and correct voids.
- D. A sling-psychrometer shall be used for periodic checks on relative humidity and temperature.
- E. The temperature of the substrate shall be checked at regular intervals to be certain the surface is 5 degrees F above the dew point.

3.05 CLEAN-UP

At the completion of the work, the Contractor shall remove all paint spots and oil or grease stains caused by this work from floors, walls, fixtures, hardware and equipment, leaving their finishes in a satisfactory condition. All materials and debris shall be removed and the site of the work left in a clean condition so far as this work is concerned.

3.06 FINAL INSPECTION

The Contractor shall protect all painted surfaces against damage until the date of final acceptance of the work. The Engineer will conduct a final inspection of all work and the Contractor will be required to repaint or retouch any areas found which do not comply

with the requirements of this Section.

END OF SECTION

SECTION NO. 10522

FIRE EXTINGUISHERS

PART 1 – GENERAL

1.01 DESCRIPTION

- A. Base Bid:
 - 1. Fire extinguisher and accessories.

1.02 RELATED WORK

- A. Specified elsewhere.

1.03 REFERENCES

- A. NFPA 10 - Portable Fire Extinguishers.

1.04 QUALITY ASSURANCE

- A. Provide fire extinguisher cabinets and accessories by one manufacturer for entire project to the greatest extent possible.

1.05 SUBMITTALS

- A. Submit in accord with Section 01300.
- B. Product Data:
 - 1. Portable fire extinguishers: Submit manufacturer's technical data and installation instructions for fire extinguisher cabinets including rough-in dimensions, and details showing mounting methods, relationships to surrounding construction, door hardware, cabinet type and materials, trim style and door construction, style and materials.
 - 2. Where color selections are specified, include color charts showing full range of manufacturer's standard colors and designs available.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS/PRODUCTS

- A. Fire Extinguisher Cabinets:
 - 1. J.L. Industries, Ambassador
 - 2. Larsen's Manufacturing Company, Architectural Series
 - 3. Amerex
 - 4. Kidde
 - 5. Ansul

2.02 FIRE EXTINGUISHER CABINETS

- A. General: Provide fire extinguisher cabinets where show, of suitable size for housing fire extinguisher of type and capacity shown.
- B. Construction: Manufacturer's standard enameled steel box, with trim, frame, door and hardware to suit cabinet type, trim style, and door style specified. Weld all joints and grind smooth. Miter and weld perimeter door frames.
- C. Cabinet type: surface mounted.

- D. Trim:
 - 1. Trim Style: Fabricate trim in one piece with corners mitered, welded and ground smooth.
 - 2. Exposed Trim: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).
 - a. Flat Trim: Square edges with backbend of dimension required by extinguisher size and dimension available for cabinet recess.
 - b. Trim Metal: Same metal as door.
- E. Cabinet Door
 - 1. Door Material and Construction: Manufacturer's standard door construction, of material specified, coordinated with cabinet types and trim styles specified.
 - a. Enameled Steel: Manufacturer's standard flush, hollow steel door construction with tubular stiles and rails.
 - b. Solid Panel: Full flush opaque panel.
 - i. Provide silk screen lettering.
 - ii. Color selected by Contracting Officer from manufacturer's standards.
 - 2. Door Hardware: Manufacturer's standard door operating hardware of proper type for cabinet trim style, door material and style specified. Provide either lever handle with cam action, latch; or door pull, exposed or concealed, and friction latch. Provide concealed or continuous type hinge permitting door to open 180 degrees.

2.03 FACTORY FINISHING OF FIRE EXTINGUISHER CABINETS

- A. General
 - 1. Comply with NAAMM "Metal Finishes Manual" for finish designations and application recommendations except as otherwise indicated.
 - 2. Apply finishes in factory after products are assembled.
 - 3. Protect cabinets with plastic or paper covering.
- B. Preparation:
 - 1. Clean surfaces of dirt, grease, and loose rust or mill scale.
 - 2. Apply finish to surfaces of fabricated and assembled units, whether exposed to concealed when installed; except those surfaces specified to receive another finish.
- C. Painted Finishes:
 - 1. Baked Enamel Finish: Immediately following cleaning and pretreatment, apply manufacturer's standard baked enamel coating.

- a. Color: Selected by Contracting officer from manufacturer's standard colors.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install fire extinguisher cabinets at locations and mounting heights shown on drawings. Where not indicated, install at heights complying with regulations of governing authorities.
 - 1. Prepare openings in walls for fire extinguisher cabinets required by type and size of cabinet and style of trim. Comply with manufacturer's instructions.
 - 2. Securely fasten fire extinguisher cabinets to structure, square and plumb, to comply with manufacturer's instructions.

3.02 IDENTIFICATION

- A. Identify fire extinguisher in cabinet with lettering "FIRE EXTINGUISHER" painted on door by silk-screen process with lettering selected by Contracting Officer from manufacturer's standard sized, styles, colors, and layouts.

END OF SECTION

SECTION NO. 11100

CAST IRON SLUICE GATES

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. This section specifies sluice gates of cast iron construction for isolation of channels, tanks or pipes. The Contractor shall assign unit responsibility as specified in paragraph 11000, 1.02 C to the sluice gate manufacturer for the combined equipment consisting of sluice gate and operator.
- B. Sluice gate types:
 - 1. Type A: Sluice gates shall be of cast iron construction with full metal wedges, flat frames, and wall thimbles.
 - 2. Type B: Sluice gates shall be of cast iron construction with sliding resilient seals, flat frames, and wall thimbles.
- C. Operating Requirements

Equipment Number	Size, Inches	Gate Type	Opening Direction	Bottom Seating	Frame Type	Operator Type	Mounting Surface
Mk. 3	14x30	A	U	S	C	I	FLG
Mk. 2	36x72	A	U	S	C	I	FLG
Mk. 1	48x48	A	U	S	C	I	FLG

- Contractor shall field verify exact type of sluice gate required prior to submittal.

*Abbreviations:

U = upward opening; D = downward opening; FB = flush bottom;
S = standard; SC = self-contained (yoke-type); C = conventional
FLG = Flanged, FMS = Flat mounting surface

^bDesign heads are measured from gate centerline.

- D. Component Sizing:
 - 1. Operating forces used for determining the strength of gate components comprising of yokes, frames, disc, stems, disc nut pockets, and other load-bearing members shall be based on the sum of the guide friction force (computed using an opening breakway friction factor of 0.70) and the weight of disc and stem.
 - 2. When the gate is in motion, the operating forces shall be based on the sum of the frictional force (using a guide friction factor of 0.35) and the weight of the disc and stem.

1.2 REFERENCES

This section contains references to the following documents. They are a part of this section as specified and modified. In case of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail. American Society for Testing and Materials (ASTM):

A126-84	Gray Iron Casting for Valves, Flanges, and Pipe Fittings
A276-84A	Stainless and Heat-Resisting Steel Bars and shapes
B98-84	Copper-Silicone Alloy Rod, Bar and Shapes
B103-81	Phosphor Bronze Plate, Sheet, Strip and Roller Bar
B139-83	Phosphor Bronze Rod, Bar and Shapes
B584-85A	Copper Alloy Sand Castings for General Applications
AWWA C501-80	AWWA Standard for Sluice Gate.

1.3 SUBMITTALS

- A. Shop drawings and product data shall be submitted in accordance with Section 01300.
- B. A copy of this specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate requested deviations from specifications requirements. If deviation from the specifications are indicated and, therefore requested by the Contractor, the submittal shall be accompanied by a detailed, written justification for each deviation. Failure to include a copy of the marked-up specification sections, along with justification for any requested deviations to the specification requirements, with the submittal shall be cause for rejection of the entire submittal with no further consideration.
- C. Fabrication drawings with full dimensions.
- D. Plan, cross section, and details showing proposed mounting for each size and application of gate.

PART 2 – PRODUCTS

2.01 Acceptable Products: Cast iron Sluice Gates shall be Rodney Hunt, Waterman or approved equal.

2.02 EQUIPMENT

A. Sluice Gates:

- 1. Sluice gates shall meet the requirements of AWWA C501 except as

otherwise specified. Sluice gates shall be of the heavy-duty type. Frames shall be Flat back.

2. Sluice gates shall be provided, unless otherwise specified, with one-piece F-section cast iron wall thimbles. The vertical centerline shall be shown by permanent marks at the top and bottom of the machined face with the word "top" marked near the top center of the thimble opening.
3. Stems and stem guides shall be provided in accordance with AWWA C501, Sections 3.11 and 3.12. Unless otherwise specified, gates shall have single rising stems. Stems shall have 29-degree acme threads and be turned straight and true and honed to a smooth 63 micro-inch or better finish. Stem couplings, where required, shall be of the stem material. Stem guides shall be of the split, bronze bushed, adjustable

B. Type A Sluice Gate:

1. Materials:

<u>Component</u>	<u>Material</u>
Gate, guide and frame	ASTM A126, Class B, cast iron
Seating faces	ASTM B103 or B139, bronze
Wall thimbles	ASTM A126, Class B, cast iron
Stems	ASTM A276, stainless steel, Type 304
Wedges, thrust nut, stem couplings	ASTM B584, bronze, CA872
Fasteners and adjusting	ASTM A276, stainless steel, hardware Type 304
Yoke	ASTM A276, Class B, cast iron
Flush bottom seal	Neoprene
Flush bottom retainer bar	ASTM A276, stainless steel, Type 304

C. Type B Sluice Gate:

1. Materials: Same as Type A, except as follows:

<u>Component</u>	<u>Material</u>
Guide bar	ASTM B98A, CA655, bronze
Gate disc seal	Neoprene
Frame seat	PVC

2. Seating: The seating surface shall be PVC strips, permanently attached to the iron frame. The seating face on the disc shall be a special shaped neoprene seal, bonded into a grove in the cast iron. The sealing pressure between the neoprene seal and the PVC strip shall be increased or decreased by means of an adjustable bronze guide bar attached to the cast iron frame. Adjustment shall be by means of adjusting screws with locking nuts to secure the bronze bar in place once it has been set. Sealing surfaces shall be at an angle to the vertical to create wedging action under full closure.

2.03 OPERATORS:

A. General:

1. Operators specified include hand-crank, handwheel, and T-wrench. Operators shall meet AWWA C501 specifications, except as otherwise specified, and shall be designed to meet the operating requirements specified in paragraph 11100-1.01 C. A portable powered operator shall be provided as an accessory to crank-operated and handwheel-operated units. Plastic stem covers shall be provided as specified in AWWA C501, Section 3.14.5.
2. On both the crank and handwheel manual operators, gears and bearings shall be enclosed in weather proof cast iron housing, and pressure type fittings shall be provided for grease lubrication of the bearings and gears. A maximum effort of 40 pound pull on the crank or handwheel shall operate the gate under the specified operating conditions.

B. Type I:

1. Operator shall be the manual, geared, crank type. The operator shall be either pedestal or bench mounted as specified. Pedestal type floor stands shall be the offset type or the standard type with wall mounting bracket. The crank shall be 15 inches long and removable from the operator.
2. The geared floor or bench stand shall have a weatherproof, cast iron housing, with a bronze operating nut, mounted on a high-strength cast iron pedestal baseplate. The operating nut shall be internally threaded with 29-degree acme threads corresponding to stem threading. Tapered roller bearing or ball bearings shall be located above and below the bronze operating nut to support the output thrust of the floor stand. The pinion shaft shall be mounted on tapered roller or needle bearings to resist axial and radial thrust. Mechanical seals shall be provided around the operating nut and the pinion shaft to prevent lubrication from leaving the unit and moisture from entering the sealed housing. The reduction gear case shall be precision machined and equipped with tapered roller or needle bearings and sealed about the reduction shafts.
3. Operators shall be self-locking at any position of stem travel. The input shaft shall be fitted with an AWWA nut.

C. Type II:

1. Operator shall be the manual handwheel type. The operator shall be either pedestal or bench mounted as specified. Pedestal type floor standards shall be the offset type or the standard type with wall mounting bracket. Pedestal or bench stands shall be cast iron. The head of the pedestal or bench stand operator shall have a solid bronze internally threaded operating nut. The operator shall be mounted on antifriction roller bearings. Handwheels shall be removable from the operator.

D. Type III:

1. Operator shall be the T-wrench type, including floor box, thrust bearings, and lift nut. Floor box shall be of fabricated steel, with galvanized steel hinged cover and embedded in the floor or mounted on a wall bracket as shown on the drawings. Floor box depth shall be such that the gate stem and operating nut does not protrude above the floor under any condition. Wall brackets shall be

cast iron or fabricated steel. Thrust bearings shall be roller or ball bearing type, replaceable and protected by seals. Accessible pressure type grease fitting shall be provided for bearing lubrication. Operating nuts shall be AWWA standard 2-inch square head nuts. T-wrenches shall be 4 feet long, aluminum, with socket to match the operating nut.

E. Portable Operators:

1. Operator shall be the portable, pneumatic/service air driven, tripod type suited for operation of Type 1 and 2 manual operators. The operator shall be mounted on an adjustable tripod base. The operator shall be equipped to drive the manual operators by means overload release clutch designed to release instantly upon reaching a preset torque. The operator shall be reversible and shall be suitable for operation with a maximum are demand of 20 scfm at 85 psig and shall be furnished with a 50-foot length of service air hose.

2.04 COATING SYSTEM

- A. Sluice gates shall be shop coated with coating system CTE as specified in Section 09900.

2.05 PRODUCT DATA

- A. The following information shall be provided in accordance with Section 01300.
 1. Product information, calculations, charts, or graphs to verify that he product provided meets the requirements set forth in this specification.
 2. Affidavits of compliance with accordance with AWWA C501.
 3. Applicable operation and maintenance information as specified in Section 01730.

PART 3 – EXECUTION

3.1 INSTALLATION

- A. Unless otherwise specified, sluice gates shall be installed in accordance with manufacturer's instructions.

3.2 TESTING

- A. Shop seat clearance and operating tests shall be performed as per Section 9.2 of the AWWA Specification C501, and field operating and leakage test shall be conducted as specified in Section 6.03 of the AWWA Specification C501.

END OF SECTION

SECTION 11420

ELECTROMAGNETIC FLOWMETER

PART 1 - GENERAL

1.01 SYSTEM DESCRIPTION

1. System consists of all field and panel mounted instrumentation devices as noted, complete with all necessary signal converters, isolators, amplifiers, power supplies, and other appurtenances necessary for interfacing with other components.
2. Flow meter must record and totalize in English units.

1.02 SUBMITTALS

1. Submit product data with panel layout and schematic diagrams.

PART 2 – PRODUCTS (MAG-100)

2.01 ELECTROMAGNETIC FLOWMETER

1. DESCRIPTION

- A. Electromagnetic flow meter suitable for fixed-site measurement of bi-directional flow in a full pipe. The flow meter shall consist of a flow tube and a flow transmitter, which shall indicate, totalize and transmit flow. The flow tube shall use a spool piece configuration with field-interchangeable sensors containing coils and electrodes.

2. PRIMARY FLOW HEAD

- A. Each meter shall have a stainless steel metering tube and a non-conductive liner suitable for the liquid being metered. End connections shall be steel flanged for sizes 1/2" and greater, ANSI Class 150#, for meter sizes up to 24" and AWWA Class B or D for meters larger than 24". The housing shall be epoxy coated steel, welded at all joints. Bolted coil enclosures shall not be acceptable.
- B. The field coils of the meter shall be supplied with a precisely adjusted bi-polar direct current.
- C. There shall be no electronic components on the primary flow head. Coil drive power shall be supplied by an integral or remote signal converter. Output signal from the primary shall be fed through 'DS' proprietary cable supplied with the meter to the signal converter.
- D. The Primary Flowhead shall have a housing rated for:
 - i. Complete Submergence NEMA 6P (IP68).
- E. Electrode material shall be compatible with the process fluid.
- F. Liner material will be hard rubber.

- G. Meter will have field replaceable electrodes with access ports.
 - H. The instrument shall be manufactured in an ISO 9001 approved facility.
 - I. When installed in lined or non-metallic piping, the meter shall be provided with corrosion resistant grounding rings. Grounding electrodes shall not be acceptable.
 - J. Meter calibration shall be performed by a direct volumetric comparison method. A calibration certificate shall accompany each meter. Calibration facility shall be certified to 0.03% accuracy, and be traceable to national standards.
 - K. The meter shall be Krohne Model ENVIROMAG series, Rosemount, Endress & Hauser, ABB Automation, or equal.
2. SPOOL PIECE FLOW TUBE AND SENSORS
- A. The nominal diameter of the flow tube shall be as shown on the Drawings.
 - B. The spool piece flow tube shall be made of carbon steel and shall be powder coated with a corrosion resistant electrostatic epoxy finish inside and outside, and shall include Type 316 stainless steel bolts. O ring seals shall be made of Viton, and standpipe gaskets shall be made of nitrile rubber.
 - i. The flow tube shall require an insulating liner. The flow tube liner shall be AWWA approved epoxy enamel that conforms to National Sanitation Foundation Standard 61 for use with potable water and American Water Works Association Standard C652-86 for use with potable water. Accuracy shall not be affected by cuts or scratches in the flow tube liner.
 - ii. The flow tube shall be supplied with raised face carbon steel flanges to ANSI 150rf.
 - C. Each flow sensor shall contain a coil, a pair of sensing electrodes, and an integral grounding electrode. External grounding rings and straps shall not be necessary. The sensors shall use solid state design, with the coils, electrodes, and other sensor components encapsulated in Kynar polyurethane that conforms to National Sanitation Foundation Standard 61 for use with potable water for nominal diameters of 16 in. (400 mm) and above. The sensors shall be field-replaceable and field-interchangeable without the need for recalibration.
 - i. The electrodes shall be made of Type 316 stainless steel.
 - ii. The flow tube shall use unipolar pulsed AC electromagnetic excitation, with typical magnetizing current of not less than 1 A base to peak, and frequency of not less than 2/3 of power supply

frequency (40 Hz for a 60 Hz power supply frequency), to ensure a high signal-to-media noise ratio.

- D. The minimum media conductivity shall be 0.5 microS/cm.
- E. The maximum media temperature shall be 175 degrees F (80 degrees C).
- F. The flow meter shall include multiple sensors to measure mean velocity in full pipes.
 - i. The mean velocity measurement range shall be from 0 to 2 feet per second (0 to 0.6 meters per second) to 0 to 50 feet per second (0 to 15 meters per second).
 - ii. The minimum detectable mean velocity shall be 0.02 feet per second (0.006 meters per second).
 - iii. The mean velocity shall be measured with a maximum error of +/- 0.005 feet per second (+/- 0.0015 meters per second) over a range of less than 1 foot per second (0.3 meters per second), and +/-0.5% of flow rate over a range of 1 to 50 feet per second (0.3 to 15 meters per second). A mean velocity of 0.1 foot per second (0.03 meters per second) shall be measured with a maximum error of +/-5% of reading. Accuracy shall be traceable to the US National Institute of Standards and Technology (NIST), and shall be guaranteed on-site for applications such as drinking water, raw sewage, and similar media, even with a permanent coating of raw sewage or similar on the electrodes, provided that specification parameters and installation recommendations are met. A NIST traceable calibration certificate shall be provided with each flow meter.
 - iv. The temperature coefficient shall be less than 0.05% per 10 degrees F (0.09% per 10 degrees C).
 - v. A non-full pipe condition shall be indicated by a user-supplied signal into one of the contact inputs on the flow transmitter.
 - vi. Maximum pressure shall be 150 psi (10 bar).
 - vii. The flow tube shall be capable of including a sealed differential pressure transducer to measure the pressure of the liquid. The maximum pressure measurement range of the pressure transducer shall be from 0 to 150 psi (0 to 10 bar). Pressure shall be measured with a maximum error of +/-0.5% of full scale.
- G. The wiring from the flow transmitter to the sensors shall be 2 separate 2-conductor cables, 16 gauge, twisted and shielded. The wiring from the flow transmitter to the sensors shall be a minimum of 30 feet (9 m) long or longer to reach the pump station control panel.

- H. The flow tube and sensors shall exceed the **NEMA 6P (IP68)** submersibility standard, and shall be indefinitely submersible to 33 feet (10 m).
 - I. The flow tube shall have a 10-year warranty and the sensors a 5-year warranty.
 - J. The flow tube assembly shall be certified to conform with UL and CSA standards for use in ordinary locations, and in Class 1 Division 2 explosive areas, with the transmitter to be located in the safe area.
3. FLOW TRANSMITTER
- A. The flow transmitter shall be microprocessor-based, and shall contain a local graphical display (back-lit white), 128 x 64 pixels with three separate display pages; pages 1 and 2 shall each allow viewing from 1 to 3 lines of measured values (user assignable) in engineering units or with 0-100% bar graph. User selectable measurements (i.e. flow rate, counter 1 and/or 2 (+, -, or sum), diagnostics, etc.) on either display page and display line. Display page 3 shall show all diagnostics that are currently active or occurred since last acknowledgement. The LCD shall display flow rate and/or total flow in user-selectable units of measure. The flow transmitter shall be capable of displaying forward, reverse, net and grand total flows, and the totalizers shall be password protect able to prevent unauthorized resetting. The counters shall maintain their accumulated values even with power loss, and continue counting when power resumes.
 - B. The flow transmitter shall include 2 isolated contact inputs, activated by contact closure or transistor, programmable to acknowledge alarms, reset totalizers, select the current flow rate range in forward flow/multi range mode, or indicate non-full pipe condition, rated 25 volts DC, 15 mA.
 - C. The flow transmitter shall include an isolated, internally powered 4 to 20 mA output into a maximum of 500 ohms. The 4 to 20 mA output shall be programmable to operate in either forward flow rate, forward flow rate/multi range, bidirectional flow rate, or bidirectional flow rate/split range mode.
 - i. In forward flow rate mode, 4 mA shall represent zero flow rate, and 20 mA shall represent the programmable maximum forward flow rate.
 - ii. In forward flow rate/multi range mode, up to 3 different flow rate ranges shall be programmable, with the current range selected by user-supplied signals applied to the contact inputs.
 - iii. In bidirectional flow rate mode, independent maximum forward and reverse flow rates shall be programmable, with flow direction indicated by a relay output.
 - iv. In bidirectional flow rate/split range mode, 4 mA shall represent the programmable maximum reverse flow rate, 12 mA shall

represent zero flow rate, and 20 mA shall represent the programmable maximum forward flow rate.

- D. The flow transmitter shall include a 2 wire solid state pulse output, internally powered, rated 25 volts DC, 80 mA. The pulse output shall be programmable to operate in either scaled or frequency mode.
 - i. Scaled mode shall be used for totalizing, with a programmable maximum frequency of 5, 10 or 100 Hz and a corresponding pulse width of 100, 50 or 5 ms, respectively.
 - ii. Frequency mode shall be used for rate indication, with a square wave output programmable from 0 to 1,000 Hz to 0 to 10,000 Hz.
- E. The flow transmitter shall include 2 isolated, normally open relay contacts, activated based on reverse flow, high or low flow rate, total flow, or diagnostic errors, rated 60 volts DC, 30 volts AC RMS, 3 A resistive.
- F. The flow transmitter shall be Factory Mutual (FM) Approved for use in ordinary locations.
- G. The flow transmitter shall operate on 120 VAC, 60 Hz line power. Typical power consumption shall be 10 W, including the sensors.
- H. The flow transmitter shall be housed in a rugged, watertight, dust-tight, corrosion resistant (NEMA 4X and IP65) cast aluminum, epoxy painted enclosure suitable for conduit connections. The enclosure shall include a polycarbonate window for viewing the LCD without opening the enclosure. Flow transmitter shall be provided with enough cable to be installed inside the pump station electrical room.
- I. The flow transmitter shall have a 2-year warranty.
- J. Acceptable Manufacturers: Khrono Model OptiFlux 2000 IFC300, Rosemount, Endress & Hauser, or ABB Automation.

PART 3 - EXECUTION

3.01 INSTALLATION

- 1. Instrument Tagging
 - A. Provide stainless steel identification tags attached with stainless steel wire or screws for all field instruments.

3.02 FIELD QUALITY CONTROL

- 1. Tests and Calibration

- A. Perform continuity and insulation resistance tests on instrumentation conductors.
- B. Calibrate each instrument to its published accuracy. Submit calibration sheets including the instrument tag number or name, the date, name of individual performing calibration, procedures and equipment used, and results obtained.

END OF SECTION

SECTION NO. 11500

DRY PIT SUBMERSIBLE WASTEWATER PUMPS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes requirements for submersible wastewater pumps.
Pump types included in this section are:

- Dry pit submersible.

- B. Unit Responsibility:

1. The work requires that the equipment specified herein shall be complete with all accessories and appurtenances, and shall be the end product of one responsible system manufacturer or responsible system supplier.
2. The Contractor shall obtain each system from the responsible supplier of the equipment. The Supplier shall furnish all Components and accessories of the system to enhance compatibility, ease of operation and maintenance, and as necessary to place the equipment in operation in conformance with the specified performance, features, and functions.
3. The Contractor is responsible for ensuring that new equipment is fully compatible with existing equipment to remain, including existing controls, and that the entire facility is fully functional.

- C. Related Sections include the following:

1. Division 01 Section "Closeout Procedures" for warranty submission requirements.
2. Division 01 Section "Project Record Documents" for post construction requirements.
3. Division 13 Process Integration sections for instrumentation equipment.
4. Division 16 Electrical sections for electrical requirements.
5. Division 16 Variable Frequency Drives

1.03 DEFINITIONS/STANDARDS

- A. Ensure products and installation of specified products are in conformance with recommendations and requirements of the following organizations:
1. Hydraulic Institute (HI)
 2. National Sanitation Foundation (NSF).
 3. American Society of Mechanical Engineers (ASME).
 4. National Electrical Manufacturers' Association (NEMA).
 5. Underwriters Laboratories (UL).
 6. National Electrical Code (NEC)
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by testing agency acceptable to authorities having jurisdiction.

1.04 SUBMITTALS

- A. Product Data: Complete engineering data including, but not limited to, descriptive data, material specifications, pump performance curves, mass moment of inertia calculations for the impeller, motor performance data, piping diagrams, and wiring diagrams. Differentiate between manufacturer installed and field installed wiring.
- B. Characteristic pump performance curves: Submit to the Engineer for approval prior to beginning fabrication of the pumping units.
- C. Certified pump performance curves: Submit to the Engineer for approval prior to shipping the units.
- D. Characteristic and certified performance curves shall depict, at a minimum, the following information:
 - 1. Head (Ft.) vs. Capacity (GPM).
 - 2. Pump Speed (RPM).
 - 3. Impeller diameter (In.)
 - 4. Diameter (In.) of largest spherical solid that can be passed.
 - 5. Area (Sq. In.) of the eye of the impeller.
 - 6. Clearly marked operating points.
 - 7. Power requirements (HP).
 - 8. Shut-off head (Ft.).
 - 9. Kilowatt (kW) usage at design conditions.
 - 10. Net positive suction head (NPSH) requirements.
 - 11. Efficiency (%) at design conditions.
 - 12. Combined weight of pump & motor.
- E. Shop Drawings:
 - 1. Complete layout and connection drawings for pumping systems, including plan, elevation, sections, and details. Include setting drawings with templates, directions for installing foundation and anchor bolts, and other anchorages.
 - 2. Control panel schematics and layout drawings.
 - 3. Descriptive literature and catalog cut sheets.
 - 4. The Contractor shall, in writing, call to the Engineer's attention any deviations that the submittal has from the requirements of the Contract Drawings and Specifications.
- F. Operation and Maintenance Data: Provide O&M manuals for pumps as specified in Division 01 and in "Operation and Maintenance Manuals" article of this specification.
- G. Manufacturer's Certification: Provide a certification by a qualified representative of the pumping system manufacturer that the equipment is installed properly, operating within the design parameters, and will be warranted as specified herein. Certification shall be based on a detailed inspection of the installation following the successful start-up of the systems.

1.05 QUALITY ASSURANCE

- A. All pumps shall be of approved design and products of manufacturers who have built equipment of similar type, size, and capacity.

- B. The supplier shall furnish a completely automated, operable pumping system, including submersible pumps and motors, submersible power and monitoring cables, pump discharge elbows, pump guide rail systems, control systems and all appurtenances and accessories as shown on the Drawings and specified hereinafter.
- C. A pressure transducer style pump control system is provided, an emergency ultrasonic system shall also be provided.
- D. The Contractor shall provide all labor, materials, equipment, and method of installation necessary to complete the work.
- E. The work shall be complete with installation of pumps, electrical and instrumentation work, connecting piping, and appurtenances, as shown on the Drawings and specified hereinafter.
- F. Telemetry system connection is required as part of the work, provisions shall be made for connection to the existing telemetry system.
- G. Product Options: Drawings indicate size, profiles, connections, and dimensional requirements of pumps and are based on specific manufacturer type and model indicated.
- H. Additional Submittals: The Contractor shall submit, upon request, any additional information that the Engineer may deem necessary to determine the ability of the proposed manufacturer to produce the specified equipment.
- I. Pump Performance Testing:
 - 1. Notify Engineer at least 30 days prior to date scheduled for performance tests.
 - 2. Perform certification tests on the actual assembled pumps to be supplied.
 - 3. Perform factory tests on each pumping unit in the manufacturer's facility and in accordance with applicable standards of the Hydraulic Institute to demonstrate compliance with specified requirements.
 - 4. Certification tests shall be performed over an operating range from shut-off head to a minimum of 20 percent beyond the specified design performance capacity. Certification tests shall be conducted on each pump being supplied.
 - 5. A pump curve shall be generated showing actual flow, head, BHP, and hydraulic efficiency for each pump being supplied.
 - 6. A registered Professional Engineer shall certify each pump curve.
 - 7. Engineer to witness all pump performance tests.
- J. Materials, pumps and installation shall comply with federal, state and local code requirements, including any requirements of authorities having jurisdiction.
- K. Verify that specified equipment does not exceed space allocation, and provide the manufacturer Plans as necessary.
- L. Replacement Parts Capability: Pump station components shall be the products of manufacturers who can produce evidence of their ability to promptly furnish any and all interchangeable replacement parts as may be needed at any time within the expected life of the components.
 - 1. Upon request, the Contractor shall submit full details of the proposed component manufacturer's ability to promptly fill replacement orders.
- M. Manufacturer Information: All manufacturer information required by the specifications shall be submitted by the Contractor within thirty (30) calendar days of the date of receipt of the Notice to Proceed.

1. Any additional information or data, specifically requested by the Engineer, concerning manufacturer's capabilities (especially relating to requirements described hereinbefore), shall be submitted by the Contractor within fourteen (14) calendar days of the receipt of the written request therefore, unless otherwise specified.
 2. Approval of manufacturers will not be given until all information required by the specifications or requested by the Engineer has been submitted and acceptable.
- N. Disqualification of Manufacturer:
1. Failure to successfully comply with the provisions of this paragraph will constitute grounds for disqualification of the pump manufacturer.
 2. Poor performance of similar pumps in operation under the specified conditions of service, constitute grounds for disqualification of the pump/pump station manufacturer unless such poor performance has been corrected.
- O. Experience:
1. The pump(s) shall be the product of a recognized manufacturer whose personnel have been regularly engaged in the design and manufacturing of such equipment. The manufacturer must be able to demonstrate experience with the design, fabrication, supply and successful operation of pumps of similar size and capacity. The manufacturer/supplier shall demonstrate upon the request of the engineer that:
 - a. They maintain a reasonable stock of spare parts for this equipment.
 - b. They employ sufficient qualified technical personnel to insure adequate servicing and operational control advice covering hydraulic, mechanical, and electrical optimization of pump station procedures and practices.
- P. Alternate Manufacturers:
1. The Drawings and Specifications use ITT Flygt as the "basis of design equipment". Additional acceptable pump manufacturers include Fairbanks Morse, ABS, Wilo FA, or approved equal. This is not intended to restrict competition or rule out comparable competitive alternate pumps that may have certain superior or inferior features not affecting the basic operation of the equipment, but is for the purpose of establishing the desired standard of quality and features.
 2. The Engineer will not provide new Drawings for construction showing alternate pumps. Manufacturers of alternate pumps shall provide revised Drawings to the Contractor. Change Orders will not be issued to pay the cost of the changes necessary for use of an alternate pump. No additions to contract time or funds will be allowed for the use of an alternate pump.
- 1.06 DELIVERY, STORAGE, AND HANDLING
- A. Retain shipping flange protective covers and protective coatings during storage.
 - B. Protect bearings and couplings against damage.
 - C. Comply with pump manufacturer's rigging instructions for handling.
- 1.07 WARRANTIES AND BONDS
1. Provide a warranty against defective or deficient materials and workmanship in accordance with the requirements of Division 01.

2. The equipment manufacturer warranty shall be against defective or deficient equipment, workmanship and materials under normal use, operation and service. The warranty shall end five years from the date of Substantial Completion. The warranty shall be in printed form and apply to all similar units.

PART 2 – PRODUCTS

2.01 GENERAL

- A. Supports and Thrust Blocks: All pipes connected to the pump station shall be supported to prevent piping loads from being transmitted to the pumps. Pump station discharge force main piping shall be anchored with thrust blocks and supports where shown on the Contract Drawings.
- B. Pipe, Fittings, and Valves: All inside (pumping station and valve vault) piping shall be flanged ductile iron with threaded flanges in accordance with ANSI A21.15, latest revision, or seamless schedule 40 carbon steel with malleable iron fittings. All piping shall be rated for a minimum of 150 psi and shall have ring gaskets, 1/8 inch thick. Ductile iron pipe and fittings shall be in accordance with Division 15 Section "Ductile Iron Pipe and Fittings".
 1. Swing Check valves shall be provided on the discharge line between the pumps and plug valves as shown on the Drawings.
- C. Running Time Meters: A running time meter shall be supplied for each pump to show the number of hours of operation. The meter shall be enclosed in a dust and moisture-proof molded plastic case. The flush mounted dial shall register in hours and tenths of hours up to 99999.9 hours before repeating. The meter shall be suitable for operation on 120V AC supply.
- D. Gauges: Each sewage pump shall be equipped with 4-inch indicating gauges to be mounted in the inlet and discharge lines per the Construction Drawings. The gauges shall have graduated scale reading from 0 to 250 feet. The gauges shall be provided with cutoff cocks and brass pipe connections. Gauges shall have C510 Grade A phosphor bronze bourdon tubes with silver bronzed brass tipped, black and white illuminated phenol dials, micrometer adjustment of pointers shall be liquid filled, and shall be diaphragm sealed. They shall be the first grade of the manufacturer, and shall be Ashcroft "Dura-Gauge Type 1379", or approved equal.

2.02 PUMP CRITERIA

- A. Provide complete pumping units designed to comply with the following pump criteria:
 1. Duty Point: 3000 GPM @ 201 Feet TDH
 2. Maximum Pump Speed: 1780 RPM
 3. Maximum Motor Horsepower: 105 HP
 4. Minimum Shut-off Head: 215 Feet
 5. NPSH Required at Duty Point: Max 21.1 Feet
 6. Minimum Pump Efficiency at Duty Point: 66.9 %
 7. Minimum Impeller Eye Diameter: 15 Inches
 8. Cooling Jacket: Yes, see 2.05B
 9. Number of Pumps Required: 4

- B. Pumps shall be model NP 3301.185 HT, dry pit submersible pumps as manufactured by ITT Flygt, or approved equal per 1.05P of this specification, modified as required to meet the specified requirements.
 - C. Duty point shall fall within 70% to 120% of the pump Best Efficiency Point capacity.
- 2.03 SUBMERSIBLE WASTEWATER PUMPS, GENERAL
- A. Description: Factory-assembled and -tested, heavy-duty, centrifugal dry pit units, close-coupled (as applicable) with submersible electric motors, capable of pumping raw, unscreened sewage and wastewater, fully guaranteed for the application, and constructed for permanent installation.
 - B. The entire pumping system, including the pump, motor and power cable, shall be approved for use in areas classified as hazardous locations in accordance with the NEC Class 1, Div. 1, Group C and D service as determined and approved by a U.S. nationally recognized testing laboratory (e.g. U.L., FM, CSA) at the time of the bidding of the project. As required by Factory Mutual (FM) the motor shall be capable of operating in pumped media up to 104 degrees Fahrenheit. Motor thermal switches shall monitor and protect the motor from excessive temperature.
 - C. Pumps shall operate at specific speeds below the "Upper Limits of Specific Speeds" established by the Hydraulic Institute to minimize the potential for cavitation.
 - D. Pumping system components shall not contain asbestos.
- 2.04 PUMPING SYSTEM DESIGN
- A. Submersible power cable shall be of adequate length to accommodate the pumping system installation as shown on the Drawings, sized according to NEC and ICEA standards, P-MSHA approved.
 - B. Each pump shall be provided with adequate length of lifting chain or stainless steel cable. The capacity of the lifting system shall be a minimum of 50 percent greater than the combined weight of the pump and motor assembly.
 - C. Power and pilot cable supports shall be provided and shall consist of a wire braid sleeve with attachment loops or tails to connect to the under- side of the access frame.
 - D. Manufacturer's Preparation for Shipping: Clean flanges and exposed machined metal surfaces and treat with anticorrosion compound after assembling and testing. Protect flanges, pipe openings, and nozzles with wooden flange covers or with screwed-in plugs.
- 2.05 PUMPING SYSTEM CONSTRUCTION
- A. Pumps:
 - 1. Major pump components, including pump casing, impeller, intermediate housing, and motor housing, shall be of gray cast iron, ASTM A-48, Class 30 or Class 35B, with smooth surfaces devoid of blow holes or other casting irregularities.
 - 2. All exposed nuts or bolts shall be ASTM A-276 Type 316 stainless steel.
 - 3. All metal surfaces coming into contact with the pumped media, other than stainless steel, shall be protected by a factory applied spray coating of

- acrylic dispersion zinc phosphate primer with a polyester resin paint finish on the exterior of the pump.
4. Sealing design shall incorporate metal-to-metal contact between machined surfaces. Pump/motor unit mating surfaces shall be machined and fitted with Nitrile or Viton rubber O-rings. Joint sealing will be the result of controlled compression of rubber O-rings in two planes and O-ring contact on four sides without the requirement of a specific bolt torque limit. Rectangular cross-sectioned rubber, paper or synthetic gaskets that require specific torque limits to achieve compression shall not be considered adequate or equivalent to specified requirements. Secondary sealing compounds, elliptical O-rings, grease or other devices are unacceptable.
- B. Cooling System:
1. Each pump/motor unit shall be provided with an integral, closed loop/self-contained cooling system (closed loop, of glycol, food-grade oil, or equivalent). No pumped fluid, or external water or oil source shall be used to cool the motors.
 2. The motor cooling jacket shall encircle the stator housing and shall be made of cast iron, ASTM A-48, Class 35B.
 3. The cooling jacket shall provide heat dissipation for the motor regardless of whether the motor unit is submerged in the pumped media or surrounded by air.
 4. Impeller back vanes shall provide the necessary circulation of the cooling liquid through the cooling system. Two cooling liquid supply pipes, one discharging low and one discharging high within the jacket, shall supply the cooling liquid to the jacket. An air evacuation tube shall be provided to facilitate air removal from within the jacket. Any piping internal to the cooling system shall be shielded from the cooling media flow allowing for unobstructed circular flow within the jacket about the stator housing. Two cooling liquid return ports shall be provided. The internals to the cooling system shall be non-clogging by virtue of their dimensions. Drilled and threaded provisions for external cooling and seal flushing or air relief are to be provided. The cooling jacket shall be equipped with two flanged, gasketed and bolted inspection ports of not less than four inches in diameter located 180 degrees apart. The cooling system shall provide for continuous submerged or completely non-submerged pump operation in liquid or in air having a temperature of up to 40 degrees Celsius (104 degrees Fahrenheit), in accordance with NEMA standards. Restrictions limiting the ambient or liquid temperatures to less than 40 degrees Celsius are unacceptable.
- C. Cable and Cable Entry Seal:
1. The power cable shall be suitable for submersible pump and motor applications and sized according to NEC and ICEA standards.
 2. The power cable provided shall be of sufficient length to extend from the pumping unit to the terminal junction box without being spliced and shall include enough slack to allow it to be routed and secured out of the way of any equipment in the dry well. It shall be the Contractor's responsibility to ensure that the cable provided by the system supplier is of adequate length to comply with the specified requirements.

3. The outer jacket of the power cable shall be oil resistant chloroprene rubber.
 4. The cable seal design shall preclude specific torque requirements to insure a watertight and submersible seal. The cable entry shall consist of dual cylindrical elastomer grommets, flanked by Type 316 stainless steel washers, all having a close tolerance fit against the cable outside diameter and the cable entry inside diameter. The grommets shall be compressed by the cable entry unit, thus providing a strain relief function. The assembly shall provide ease of changing the cable when necessary using the same entry seal. The cable entry junction chamber and motor shall be sealed from each other, which shall isolate the stator housing from foreign material gaining access through the pump top. Epoxies, silicones, or other secondary sealing systems are unacceptable.
- D. Motor:
1. The motor shall be suitable for 460-volt, 60 Hertz, 3-phase electric power. Motor horsepower shall be as specified in this Section.
 2. The pump motor shall a NEMA B (3 phase) design, induction type with a squirrel cage rotor, shell type design, housed in an air filled, watertight chamber. The stator windings shall be insulated with moisture resistant Class H insulation rated for 180 degrees Celsius (356 degrees Fahrenheit). The stator insulated by the trickle impregnation method using Class H monomer-free polyester resin resulting in a winding fill factor of at least 95 percent. The motor shall be inverter duty rated. Inverter duty rated motors shall be in accordance with NEMA MG1, Part 31. The stator shall be heat-shrink fitted into the cast iron stator housing. The use of multiple step dip and bake-type stator insulation process is unacceptable. The use of bolts, pins or other fastening devices requiring penetration of the stator housing is unacceptable. The motor shall be specifically designed for submersible pump usage and designed for continuous duty pumping media of up to 40 degrees Celsius (104 degrees Fahrenheit) with an 80 degrees Celsius temperature rise and capable of at least 15 evenly spaced starts per hour. The rotor bars and short circuit rings shall be made of cast aluminum. Thermal switches shall be embedded in the stator end coils to monitor the temperature of each phase winding. The thermal switches shall be used in conjunction and supplemental to external motor overload protection and shall be connected to the control panel. The junction chamber shall be sealed off from the stator housing and shall contain a terminal board for connection of power and pilot sensor cables using threaded compression type terminals. The use of wire nuts or crimp-type connectors is unacceptable. The same manufacturer shall produce the motor and the pump.
 3. The combined service factor (combined effect of voltage, frequency and specific gravity) shall be a minimum of 1.15. The motor shall have a voltage tolerance of plus or minus 10 percent. A performance chart shall be provided in the submittal showing curves for torque, current, power factor, input/output kW, efficiency, and data on starting and no-load characteristics.

4. The motor and cable shall be capable of continuous submergence underwater without loss of watertight integrity to a depth of 65 feet while operating.
 5. The motor horsepower shall be adequate so that the pump is non-overloading throughout the entire pump performance curve from shutoff through run-out.
- E. Pilot Cable:
1. The pilot cable shall be designed specifically for use with submersible pumps and shall be type SUBCAB (Submersible Cable). The cable shall be shielded, multi-conductor type with a chloroprene outer jacket and the tinned copper conductors insulated with ethylene-propylene rubber. The conductors shall be arranged in twisted pairs. The cable shall be rated for 600 volts and 90 degrees Celsius (194 degrees Fahrenheit) with a 40 degrees Celsius (104 degrees Fahrenheit) ambient temperature and shall be approved by Factory Mutual (FM). The cable length shall be adequate to reach the junction box without the need for splices.
- F. Bearings:
1. The pump shaft shall rotate on at least 2 grease-lubricated bearings. The upper bearing, provided for radial forces, shall be a single roller bearing. The lower bearing shall consist of at least one roller bearing for radial forces and one or two angular contact ball bearings for axial thrust.
 2. The minimum L10 bearing life shall be 100,000 hours at any point along the usable portion of the pump curve at maximum product speed.
- G. Mechanical Seal:
1. Each pump shall be provided with a tandem mechanical shaft seal system consisting of two totally independent seal assemblies. The lower seal shall be independent of the impeller hub. The seals shall operate in a lubricant reservoir that hydro-dynamically lubricates the lapped seal faces at a constant rate. The lower, primary seal unit, located between the pump and the lubricant chamber, shall contain one stationary and one positively driven rotating corrosion resistant tungsten-carbide seal ring. The upper, secondary seal unit, located between the lubricant chamber and the motor housing, shall contain one stationary and one positively driven rotating corrosion resistant tungsten-carbide seal ring. Each seal interface shall be held in contact by its own spring system. The seals shall require neither maintenance nor adjustment and shall be capable of operating in either clockwise or counter clockwise direction of rotation without damage or loss of seal.
 2. Should both seals fail and allow fluid to enter the stator housing, a port shall be provided to direct that fluid immediately to the stator float switch to shut down the pump and activate an alarm. In the event of fluid intrusion, fluid shall not come into contact with the lower bearings.
 3. The following seal types are not considered acceptable equivalents or alternates to the dual independent seal specified: (a) shaft seals without positively driven rotating members, and (b) conventional double mechanical seals containing either a common single or double spring acting between the upper and lower seal faces. Systems requiring a pressure differential to offset pressure and to affect sealing shall not be used.

4. Each pump shall be provided with a lubricant chamber for the shaft sealing system. The lubricant chamber shall be designed to prevent overfilling and to provide lubricant expansion capacity. The drain and inspection plug, with positive anti-leak seal shall be easily accessible from the outside. The seal system shall not rely upon the pumped media for lubrication. The motor shall be able to operate continuously while non-submerged without damage while pumping under load.
- H. Pump Shaft:
1. Pump and motor shaft shall be a solid, continuous shaft. The pump shaft shall be an extension of the motor shaft. Couplings shall not be acceptable. The pump shaft shall be of stainless steel and shall be completely isolated from the pumped liquid.
- I. Impeller
1. Impellers shall be of gray cast iron, Class 35B, dynamically balanced, multiple vaned, double shrouded non-clogging design having long through lets without acute turns. The impellers shall be capable of handling solids, fibrous materials, heavy sludge and other matter found in wastewater. Impellers shall be keyed to the shaft, retained with an expansion ring and shall be capable of passing a minimum four inch diameter solid. All impellers shall be coated with an acrylic dispersion zinc phosphate primer.
- J. Wear Rings:
1. A wear ring system shall be incorporated into the pump design to provide efficient sealing between the volute and suction inlet of the impeller. Each pump shall be equipped with a Nitrile rubber coated steel or brass ring insert that is drive fitted to the volute inlet.
 2. This pump shall also have a stainless steel impeller wear ring heat shrink fitted onto the suction inlet of the impeller.
- K. Volute:
1. Pump volutes shall be single-piece gray cast iron, ASTM Class 30 or Class 35B, non-concentric design with smooth passages large enough to pass any solids that may enter the impeller. Minimum inlet and discharge size shall be as shown on the Plans.
- L. Protection:
1. All stators shall incorporate thermal switches in series to monitor the temperature of each phase winding. Should high temperature occur, the thermal switches shall open, stop the motor and activate an alarm.
 2. A lower bearing temperature sensor shall be provided. The sensor shall directly contact the outer race of the thrust bearing providing for accurate temperature monitoring.
 3. A leakage sensor shall be provided to detect water in the stator chamber. The Float Leakage Sensor (FLS), a small float switch, shall be used to detect the presence of water in the stator chamber. When activated, the FLS will stop the motor and activate an alarm. Use of voltage sensitive solid state sensors shall not be allowed.
 4. The thermal switches, FLS and the lower bearing temperature monitor shall be connected to a CAS (Control and Status) monitoring unit. The CAS design shall be such to allow it to be mounted in the control panel.
- M. Spare Parts: Provide the following spare parts for each pump unit:

1. One (1) O-ring kit.
 2. One (1) Upper Mechanical Seal.
 3. One (1) Lower Mechanical Seal.
 4. One (1) Upper Bearing.
 5. Two (2) Lower Bearings.
 6. One (1) Volute Wear Ring.
 7. One (1) Impeller Wear Ring.
- N. Painting: The pump shall be painted after assembly and testing, with a water reducible air dry enamel. The paint shall be applied in one coat covering all exterior surfaces. The pump shall be air dried after testing and before painting.

2.06 ACCESSORIES

- A. Chain Holder: Chain holder shall be Type 316 stainless steel and of the size recommended by the pumping system manufacturer.
- B. Anchor Bolts:
1. Anchor bolts shall be Type 316 stainless steel. Pump manufacturer shall provide the size and layout dimensions for all anchor bolts for railings, pump supports, pumps, and accessories.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Examine pumping system installation areas, equipment foundations, and conditions with Installer present to verify compliance with requirements for installation and other conditions affecting installation and performance of pumping systems before beginning pump installation.
- B. Examine rough-in for piping systems to verify actual locations of piping connections prior to installation.

3.02 INSTALLATION

- A. Install pumping systems and accessories in accordance with manufacturer's written installation and alignment instructions and shop drawings.
- B. Support piping such that pumps do not support weight of piping.

3.03 CONNECTIONS

- A. Install pressure gages on the inlet and discharge pipe of each pump.
- B. Install electrical connections for power, controls, and instrumentation devices. Electrical power components, wiring, and connections are specified in Division 16 Sections. Control and instrumentation devices are specified elsewhere in this Section.
- C. Ground Equipment:
1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.04 ADJUSTING

- A. Pump Controls: Set pump controls for automatic start, stop, and alarm operation as required for system application.

3.05 COMMISSIONING

- A. Final Checks before Starting: Perform all preventive maintenance operations and checks before start-up in strict conformance with manufacturer's written instructions.
- B. Starting Procedure: Perform start-up for each pumping unit in strict conformance with the manufacturer's written instructions and in the presence of the Owner and Engineer. Provide manufacturer's certification of installation and operation as specified.
- C. Factory Service
 - 1. The equipment manufacturer shall provide factory service for installation inspection, equipment start-up, and operator training. Length of service shall be as required to fully train the Owner's personnel in the operation and maintenance of the equipment.
 - 2. At any time within six months of the date of start-up, provide, at Owner's request and at no additional cost, the services of equipment manufacturer's representative(s) on the site for a period not to exceed two days.

3.06 OPERATION AND MAINTENANCE MANUALS

- A. Initial Manual Submittal: Submit draft copy of each manual at least 30 days before commencing initial testing. Engineer will comment on whether general scope and content of manual are acceptable.
- B. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing initial testing. Engineer will return copy with comments.
- C. Correct or revise each manual to comply with Engineer's comments. Submit copies of each corrected manual within 15 days of receipt of Engineers comments and prior to commencing initial testing.
- D. Furnish, prior to substantial completion, eight copies of final maintenance manuals. All corrections shall have been made necessary to comply with Engineer's comments in the final manuals. Final manuals shall be indexed and composed of suppliers' maintenance manuals on all equipment and suppliers' brochures on all specialty equipment, including performance curves with size, model, figure number, etc., indicated to identify unit furnished.
- E. Maintenance manuals are to be of a hardback, loose-leaf type and of a durable quality. In addition, a complete electronic copy shall be provided in MS-Word or searchable Adobe PDF format.
- F. Manuals are to be for the specific equipment provided. Manuals describing general equipment lines will not be accepted. Where non-relevant information is present in the manual, it shall be neatly marked out with a single "X" through non-relevant portions.
- G. Include in each set of manuals the following:
 - 1. Manufacturer's parts list identified with the make, model and serial number of the equipment furnished.
 - 2. Control and wiring diagrams.
 - 3. Installation, operation (including start up and shut down procedures), lubrication and maintenance instructions.
 - 4. Manufacturers recommended spare parts list.

- H. If an Owner's representative is assigned to the project either through the Owner or the Engineer, the Contractor shall make a copy of all instruction manuals available to the Representative. Manuals on specific items shall be available prior to installation of the item. This requirement in no way relieves the Contractor of his other responsibilities.

END OF SECTION

SECTION 11800

ALUMINUM SLIDE GATES

PART 1 - GENERAL

1.4 SCOPE OF WORK

- E. Furnish all labor, materials, equipment and incidentals required and install, in the locations indicated, manually or electrically operated aluminum slide gates, including frames, seals, actuators, electrical controls and control panels as specified herein.
- F. The Contractor's shall insure that the aluminum slide gate(s) and appurtenances furnished and installed shall be compatible with and have the necessary operating clearances to the structural elements and associated equipment shown on the Contract Drawings.

1.5 REFERENCES

American Society for Testing and Materials (ASTM):

- | | |
|-------------|---|
| A276-04 | Standard Specification for Stainless Steel Bars and Shapes |
| B221 | Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes |
| D707-05 | Standard Specification for Cellulose Acetate Butyrate Molding and Extrusion Compounds |
| D3935-94 | Standard Specification for Polycarbonate (PC) Unfilled and Reinforced Material |
| F593/594-02 | Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs |

1.6 SUBMITTALS

- E. Shop drawings and product data shall be submitted in accordance with Section 01300.
- F. Submit to the Engineer within thirty (30) days after Notice to Proceed a list of materials to be furnished, the names of suppliers and the date of delivery of materials to the site.
- G. Shop drawings shall indicate a layout in plan and elevation. Drawings shall be completely dimensioned. The drawings shall include a complete schedule of all equipment, specials and supports. Special castings shall be clearly detailed showing all pertinent dimensions.

- H. The Contractor shall furnish the Engineer with lists, in duplicate, of all items in each shipment received. These lists shall give the serial or mark number, manufacturer, model, and description of each item received.

1.7 QUALIFICATIONS

- A. The slide gates and associated controls covered by these specifications are intended to be standard equipment of proven reliability and as designed and manufactured by a reputable company having experience in the production of such equipment. The equipment furnished shall be designed, constructed and installed in accordance with the best practices and methods and shall operate satisfactorily when installed as shown on the Contract Drawings and operated per manufacturer's recommendations.
- B. The manufacturer shall submit an installation list for the equipment quoted verifying to the Owner that they have designed and manufactured slide gates and controls of similar type, size and configuration for the same or similar service, which has been operating satisfactorily for a minimum period of two (2) years and that such equipment has been manufactured at the same facilities being used to manufacture the equipment being quoted.

PART 2 – PRODUCTS

Aluminum Slide Gates shall be Rodney Hunt Series 700, Waterman, or approved equal.

- 2.1 General: The gates shall be either self-contained or the non self-contained type with the guides designed to mount on the face of the concrete wall or embedded in the channel wall. The gates shall be designed and sealed by a professional engineer registered in the state where the gates will be designed and manufactured. Manufacturers shall have a minimum of five years experience in the design and manufacture of equipment of this type.
- 2.2 Discs: The disc or sliding member shall be of aluminum plate ASTM B221 6061-T6 and will be reinforced with U-shaped aluminum extrusions welded to the plate. The disc will be designed to limit deflection of the gate to 1/360th of its span under the design head. The working design stresses shall not exceed the lesser of 40% of the yield strength or 25% of the ultimate strength of the material. All disc components shall have a minimum material thickness of 0.250".
- 2.3 Guides: The guides and inverts shall be of extruded aluminum ASTM B221 6061-T6. The guides shall be designed for maximum rigidity and shall have a weight of not less than 3.0 pounds per linear foot. The guides shall be designed to embed in or mount to the face of the concrete and shall be provided with keyways to lock them into the concrete. The invert of the frame shall be welded to the lower ends of the guides. The guides will incorporate an ultrahigh molecular weight double-winged polymer strip on both the upstream and downstream side of the disc. The polymer strips will be held in dovetailed grooves. The guides shall be designed for maximum rigidity and will be provided with keyways to lock it into the concrete. The invert of the frame will be an

aluminum extrusion welded to the lower ends of the guides to form a seating surface for the resilient seal. Where the guides extend above the operating floor, they shall be sufficiently strong so that no further reinforcing will be required. On the self-contained gates, the yoke to support the operating benchstand will be formed by two angles or channels welded at the top of the guides to form a one-piece rigid frame. The design of the yoke will be such to limit its deflection to 1/360th of its span under full operating load.

- 2.4 Seals: A specially extruded resilient neoprene seal will be mounted on the bottom of the disc or installed into the invert member to provide flush-bottom closure. The shape of the seal will produce a seating surface having a minimum width of 3/4" and the seal will extend into the secondary slot of the vertical guide. The vertical face of the seal will be in contact with the seating surface of the guide to provide a proper seal at the corners.
- A. Under a design seating head of less than 20 ft. (measured from gate invert) the leakage shall not exceed 0.1 gallons per minute per foot of seating perimeter.
 - B. Under a design unseating head of less than 10 ft. (measured from gate invert) the leakage shall not exceed 0.2 gallons per minute per foot of seating perimeter.
- 2.5 Stems: Stems shall be ASTM A276 Type 304 stainless steel. Stem threads shall be of the machine-cut Acme type. Stems shall be designed to transmit in compression a minimum of two times the rated output of the hoist at 40lbs. effort on the crank or hand wheel. The L/r ratio of the unsupported stem shall not exceed 200. Stem guides, where required to limit the unsupported stem length, shall have polymer or bronze bushings. The stems shall be connected to the disc by means of a cast aluminum stem connector bolted to the stem and welded to the disc.
- 2.6 Stem Covers: Rising stem gates shall be provided with clear polycarbonate stem covers (ASTM D3935/D707) to provide visual indication of gate position, permit inspection of the stem threads, and to protect the stem from contamination. Vent holes shall be provided to prevent condensation.
- 2.7 Actuator: The hoist shall be sized to permit operation of the gate under the full operating load with a maximum effort of 40 pounds pull on the crank or hand wheel. The hoist nut shall be manganese bronze, conforming to ASTM8584 C86500. The hoist nut shall be supported on roller bearings. A lubrication fitting shall be provided for lubrication of the hoist bearings without disassembly of the hoist. Suitable seals shall be provided to prevent entry of foreign matter. The direction of hand wheel or crank rotation to open the gate shall be clearly and permanently marked on the hoist. Where the actuators are to be interconnected it shall be by means of a flexible coupling and stainless steel tubing.
- 2.8 Fasteners: All necessary attaching bolts, studs, and anchors shall be Type 304 stainless steel per ASTM A276 and shall be furnished by the slide gate manufacturer.

PART 3 – EXECUTION

3.3 FABRICATION

- A. Slide gates shall be fabricated at the nearest practical manufacturing facility of the chosen manufacturer. Slide gates shall be manufactured in a facility certified ISO 9002 compliant. Documentation shall be available upon request.

3.4 SHIPPING

- A. Slide gates shall be shipped in as few pieces as practical to facilitate a timely installation and avoid damage during on-site assembly.

3.5 INSTALLATION

- B. General: The equipment shall be installed properly to provide a complete working system. Installation shall follow the supplier's recommendations.
- C. Manuals: The equipment supplier shall furnish operation and maintenance manuals in accordance with Section 01730 which will be retained at the installation site to assist plant operators. The manual shall include, at a minimum, the supplier's erection and assembly recommendations, a complete parts list, and a list of recommended spare parts.
- D. Shop Assembly: Any equipment specified herein shall be completely factory assembled and inspected prior to shipment.
- E. Field Service: The equipment supplier shall provide the service of a qualified representative for one trip and two days to inspect the equipment installation, assist in start-up, and instruct plant personnel in the proper operation and maintenance of the equipment.
- F. Slide gates shall be installed in accordance with the contract documents and any manufacturer's instructions.
- G. Slide gate mechanical components shall be installed plumb and true.
- H. Control components (where required) shall be installed in a location as shown in the construction documents.

END OF SECTION

SECTION 13105

SURGE PROTECTION

PART 1 - GENERAL

1.03 SECTION INCLUDES

- A. Comprehensive surge protection for all instrumentation devices supplied- as part of these Specifications.

1.04 SUBMITTALS

- A. Submit detailed product data.

1.05 QUALITY ASSURANCE

- A. It is the responsibility of the System Manufacturer to provide appropriate protection against transients and surges for all field instruments, field wiring, and devices interfacing with control panels. All instrument signal wiring, control wiring, telephone wiring and data transmission wiring which enters or exits buildings shall be protected against lightning spikes, and other transient surges at all control panel termination points. All instrument signal wiring, control wiring, telephone wiring and data transmission wiring which terminates in outdoor control panels shall be protected against lightning spikes, and other transient surges at all control panel termination points. All AC control power wiring shall be protected against lightning spikes, and other transient surges at all control panel termination points. Lightning and surge devices shall protect the system from induced surges in analog, discrete and control circuitry and power supply lines. The protective devices shall not interfere with the normal operation of the panel hardware and shall be designed not to have a maximum clamping voltage in excess of what the protected device is capable of withstanding.
- B. All field instruments located indoors or out-of-doors provided by the System Manufacturer under this contract shall be supplied with surge protection for 120 VAC power to the instrument.
- C. Surge protectors shall include a combination of surge suppression technologies including, metal oxide varistors, gas discharge tubes, diodes, and 3AG size fuses for line-to-line and line-to-ground protection.
- D. Surge protectors in controls panels shall be DIN rail-mounted with plug-in modules.
- E. Where the length of the wire or cable with surge protection is greater than 90 feet, provide surge protection on each end.
- F. All surge and lightning protection shall have UL or FM approval, Manufacturer shall verify approvals. System Manufacturer shall verify approvals.

PART 2 - PRODUCTS

2.02 EQUIPMENT

- A. Field Instruments - Analog Signals
 - 1. Direct mounted surge protectors for analog signals shall screw directly into the unused conduit entry hub of the instrument. The surge protector housing shall be 304 stainless steel minimum. Surge protectors shall be specifically manufactured for protecting field instruments.
 - 2. Where direct mount is not possible, the surge protectors for analog signals shall be located as close to the field instrument as practical. The surge protector shall be rated NEMA 4X, or shall be mounted in a stainless steel NEMA 4X enclosure.
- B. Field Instruments - Discrete Signals
 - 1. Surge protectors for discrete signals wiring shall be located as close to the field instrument as practical. The surge protector shall be NEMA 4X, or shall be mounted in a 304 stainless steel NEMA 4X enclosure.
- C. Control Panels
 - 1. All instrument analog and discrete signal wiring, data transmission wiring and 120 VAC power supply wiring which enters or exits buildings or which terminates in outdoor control panels shall be individually protected against lightning spikes, and other transient surges at all control panel termination points.
 - 2. Provide surge protectors for all power wiring to control panels whether located indoors or out-of-doors.
 - 3. Provide surge protection for all telephone connections.
- D. Instrument Power Wiring
 - 1. Provide surge protectors for all power wiring to individual instrument devices whether located indoors or out-of-doors. For instrument devices, protection shall be located as close to the device as practical. The surge protector shall be NEMA 4X, or shall be mounted in a NEMA 4X enclosure. Enclosures shall be NEMA 4X, stainless steel.
- E. Antennas
 - 1. Provide RF surge protectors for all antennas.
- F. Miscellaneous Digital Equipment

1. Provide surge protection for all computers, printers, uninterruptible power supplies, digital equipment power supplies, PLCs, fiber optic modems, telephone modems, digital signal converters and other miscellaneous digital hardware to include communications wiring and 120 VAC power supply wiring for each device.

2.03 ACCESSORIES

A. Spare Parts

1. Provide 50 percent spare surge protectors of each type used with a minimum of 20 of each type used.

2.04 SOURCE QUALITY CONTROL

A. Acceptable Products

1. Surge protection shall be equal to the following:

Surge Protector Acceptable Model Numbers		
	Telematic	Phoenix Contact
Field Instrument Analog Signals Direct Mounted	TP48	S-PT1-2PE-24VDC
Field Instrument Analog Signals Remote Mounted	SD Series	UFBK-M2-PE Series
Analog Signals Control Panel	SD Series	UFBK-M2-PE Series
120 VAC Power Control Panel	MA Series	UAK2-PE/S Series
Discrete Inputs/Outputs Control Panel	SD Series	UFBK-2/2 Series
RS-232	NP Series	MT Series, D-UFB Series
RS-485	NP Series	MT Series, D-UFB Series
Telephone Line	DP200 Series	TELETRAB-4X Series
Ethernet	NP Series	D-ETH Series
Antenna Cable	CA Series	COAXTRAB Series

2. Protection on 120 VAC power circuits may be also by Isolatrol (Model "Elite").

PART 3 - EXECUTION

3.03 INSTALLATION

- A. Install all surge protection equipment in strict accordance with manufacturer's guidelines.

- B. For surge protectors located out-of-doors and for antenna surge protectors, surge protector grounding shall use individual ground rods located as close to the surge protector as possible. The grounding conductor shall be sized in accordance with manufacturer's recommendations and be routed via the shortest path possible. Bends in the grounding conductor shall be avoided. If bends in the grounding conductor are unavoidable then the number of bends shall be kept to an absolute minimum.
- C. Provide installation for all field mounted surge protection equipment. Provide for all wiring terminations for surge protection equipment.
- D. If a particular piece of equipment is protected by two surge protectors in series, ensure that the resulting equipment protection is not diminished.

END OF SECTION

SECTION NO. 13129

PREFABRICATED METAL BUILDINGS AND SHELTERS

PART 1 - GENERAL

1.06 SECTION INCLUDES

- B. Prefabricated Aluminum Shelters

1.07 RELATED SECTIONS

- A. Section 03300 – Cast-in-Place Concrete: Concrete pad, foundations and anchor bolts
- B. Section 02870 – Bollards: Metal, concrete and stone bollards.
- C. Section 05500 – Metal Fabrications.
- D. Section 08710 – Door Hardware.
- E. Section 07900 – Joint Sealers.
- F. Division 16 – Electrical: Electrical power service and wiring connections.

1.08 RELATED SECTIONS

- A. ASTM A 513 - Standard Specification for Electric-Resistance-Welded Carbon and Alloy Steel Mechanical Tubing.
- B. ASTM A 653/A - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- C. ASTM A 1008/A - Standard Specification for Steel Bars, Carbon and Alloy, Cold-Finished.
- D. ASTM B 209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
- E. ASTM B 221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
- F. ASTM B 632/B 632M - Standard Specification for Aluminum-Alloy Rolled Tread Plate.
- G. ASTM C-578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.
- G. ASTM C 1048 - Standard Specification for Heat-Treated Flat Glass - Kind Hs, Kind Ft Coated and Uncoated Glass.

- H. ASCE 7 - Minimum Design Loads for Buildings and Other Structures
- J. APA PRP-108 or PFS PRP-133 - Performance Standards and Policies for Structural-Use Panels.
- K. ICC/ANSI A117.1 - Accessible and Usable Buildings and Facilities.
- L. NFPA 70 - National Electric Code.
- M. UL 752 - Standard for Bullet Resisting Equipment.
- N. IBC - International Building Code.
- O. NIJ National Institute of Justice (NIJ) Standard 0101.04 (Ballistic Resistance of Personal Body Armor).

1.09 DESIGN REQUIREMENTS

- A. Provide factory built prefabricated structures and shelters capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated.
- B. Wind Loads: Determine loads based on the following minimum design wind pressures:
 - 1. Uniform pressure of 50 lbf/sq ft, acting inward or outward (standard)
 - 2. Uniform pressure as indicated on Drawings.
 - 3. Wind Load:
 - a. Buildings: 120 mph (2000 INC Exp. C). (standard)
 - b. Shelters: 90 mph. (standard)
 - 4. Snow Loads: 50 lbf/sq ft. (standard)
- C. Seismic Performance: Provide factory built, prefabricated structures and shelters capable of withstanding the effects of earthquake motions determined according to:
 - 1. ASCE 7, "Minimum Design Loads for Buildings and Other Shelters", Section 9, "Earthquake Loads".
- D. Thermal Movements: Provide factory built, prefabricated structures and shelters that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculation of surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change (Range): 120 deg F (67 deg C); 180 deg F (100 deg C), materials surface.

- E. Electrical Devices: Devices UL listed with wiring bearing UL classification and conforming to current NEC

1.10 PERFORMANCE REQUIREMENTS

- A. Cooperate with regulatory agency or authority and provide data as requested by authority having jurisdiction.

1.11 SUBMITTALS

- A. Submit under provisions of Section 01300.
- B. Product Data: Manufacturer's data sheet on each product to be used, including:
 1. Construction details, material descriptions, dimensions of individual components and profiles, and finishes.
 2. Preparation instructions and recommendations.
 3. Storage and handling requirements and recommendations.
 4. Installation Methods.
- C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
- D. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.
- E. Certificates: Product certificates signed by the manufacture certifying material compliance with specified performance characteristics and criteria, and physical requirements.
- F. Warranty documents specified here in.

1.12 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing prefabricated structures and shelters with a minimum documented experience of twenty years and with a quality assurance program utilizing an independent third party quality control firm with a 5-stage, 35 step, quality inspection for each system.
- B. Preinstallation Meeting: Conduct meetings to verify project requirements, substrate conditions, utility connections, manufacturer's installation instructions, and warranty requirements. Comply with Division 1 requirements.

1.13 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Protect all components and accessories from corrosion, deformation, damage and deterioration when stored at job site. Keep materials free from dirt and foreign matter.

1.14 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside of manufacturer's absolute limits.

1.15 WARRANTY

- A. Provide the manufacturer's 5 year limited warranty on anodized aluminum surfaces against oxidation and the manufacturer's 20 year limited warranty against peeling, flaking and chipping of deck and fascia when properly maintained.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Acceptable Manufacturer's:
 - 1. Austin Mohawk and Company, Inc.
 - 2. Porta-King Building Systems
 - 3. Duo-Gard Industries Inc.
 - 4. Easy Rack
- B. Request for substitutions will be considered in accordance with provisions of Section 01600.

2.02 MATERIALS

- A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish specified, and as follows:
 - 1. Sheet: ASTM B 209
 - 2. Extruded Shapes: ASTM B 221
 - 3. Rolled Tread Plate: ASTM B 632/B 632 M, Alloy 6061-T4 or 6061-T6.
- B. Cold-Rolled Steel Sheet: ASTM A 1008/A, Commercial Steel (CS), Type B.
- C. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A, commercial quality, G90 (Z275) coating designation; mill phosphatized.
- D. Aluminum Treadplate: 1/8 inch aluminum plate conforming to ASTM B 209.
- E. Steel Mechanical Tubing: ASTM A 513, welded steel mechanical tubing.
- F. Expanded Polystyrene (EPS) Core; Minimum .95 pcf complying with ASTM C-578 Type 1.

- G. Oriented Strand Board (OSB): Standard Grade; minimum physical properties conforming to APA PRP-108.
- H. Clear Tempered Float Glass: ASTM C 1048, Kind FT, Condition A, Type I, Class 1, Quality q3.
- I. Ballistics-Resistant Glazing: Comply with requirements of UL 752 and/or NIJ.
- J. Anchorages: Anchor bolts, as specified in Section 03300.

2.03 PREFRABRICATED ALUMINUM SHELTERS

- A. Size: 16'-9" by 5'.
- B. Height: Nominal outside height 108 inches (2743.2 mm). Interior floor to ceiling height 96 inches (2438.4 mm).
- C. Prefabricated all aluminum shelters with snap-together extruded 6036-T6 aluminum alloy framing system. All connections internally fastened with no exposed fasteners on building exterior.
 - 1. Shelter Style:
 - a. Custom as indicated on Drawings.
 - 2. Roof Type: As indicated on Drawings.
 - a. Custom as indicated on Drawings.
 - 3. Roof Overhang: As indicated on Drawings.
 - a. Custom as indicated on Drawings.
- D. Frame Construction: Provide snap together structural framing of 6063-T6 aluminum alloy extrusions. Framing assembled using internally located mechanical fasteners. Exposed fasteners on shelter exterior are not acceptable. Standard 7-4/3 inch (197 mm) ventilation space at bottom of unit. Members shall have a manufacturer's finish as follows:
 - 1. Quaker Bronze
 - 2. Clear Anodized finish.
 - 3. Custom color as selected by the Architect.
- E. Glazed Window Panels: Glazed within wall panel system extrusions and not fastened to the exterior wall. Glass sealed with concealed gasket system:
 - 1. ¼ inch (6 mm) thick, clear polycarbonate.
- F. Lower Wall Panel: Overall thickness of panel shall be 3/8 inch (9.5 mm) with an exterior face of manufacturer's standard .032 aluminum, a 3/8 inch (9.5 mm) insulation core) and a .032 interior aluminum face.
 - 1. Quaker Bronze
 - 2. Clear Anodized finish.
 - 3. Custom color as selected by the Architect.

- G. Ceiling: Interior ceiling, form core panel system providing smooth flat interior. Fabricate of 24 gauge prefinished steel painted white with expanded polystyrene core.
- H. Roof: Galvanized steel, 20 to 24 gauge, G-60 zinc coating, interlocking pan sections, 3 inches (76.2 mm) high varying widths and capable of supporting a minimum of 40 psf (1915 Pa) live load. Roof drains into full perimeter gutter system.
- I. Anchoring: Shelter requires a 6 inch (152 mm) thick (minimum) concrete pad 12 inch (305 mm) (minimum) larger than the shelter in length and width. Shelter anchored to the pad using height adjustable aluminum boot with 2 inch by ¼ inch (51 mm to 6.3 mm) expansion anchors.

2.04 SHELTER ACCESSORIES

- A. Lighting Fixtures: Supplied only for wiring and installation by others.
 - 1. AZZ RIG-A-LITE CAT II SXPJ10_WGW, 120 V, LED
- B. Thru-wall Ventilation:
 - 1. 24"x24" aluminum louvre with insect screen installed in bottom and top panels.

2.05 FABRICATION

- A. Fabricate factory built, prefabricated structures and shelters completely in factory.
- B. Preglaze windows and doors at factory.
- C. Prewire factory built, prefabricated structures and shelters at factory, ready for connection to service at Project site
- D. Separate dissimilar materials using nonconductive tape, paint, or other material not visible in finished work.
- E. Fabricate factory built, prefabricated structures and shelters for forklift unloading under base of structure with forklift pockets in base of structure or welded in place concealed lifting lugs at roof that are suitable for placement of the structure on top of the existing foundation.

PART 3 - EXECUTION

3.04 EXAMINATION

- A. Examine supporting foundations for compliance with manufacturer's requirements, including installation tolerances and other conditions affecting performance of supporting members.
- B. Check installed anchor bolts for accuracy. Verify that bearing surfaces are ready to receive the work.

- C. Verify the rough-in of required mechanical and electrical services prior to placement of the structure.
- C. If preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding

3.05 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.06 INSTALLATION

- A. Install in accordance with manufacturer's instructions
- B. Separate dissimilar materials using nonconductive tape, paint, or other material no visible in finished work.
- C. Place on prepared concrete foundations and slabs provided as specified under Section 03300.
- D. Anchor securely in place, allowing for required movement, including expansion and contraction.
- E. Connect Electrical services as specified in Division 16.

3.07 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 13400

INSTRUMENTATION AND CONTROLS

PART 1 - GENERAL

1.16 SECTION INCLUDES

Instrumentation and control (I/C) system.

SCOPE OF WORK

- A. A pre-approved System Integrator (SI) shall furnish all services and equipment specified herein and in other specification sections as listed in Article 1.02 – Related Work. Sub-suppliers and/or manufacturers may provide components, and/or services to the SI, but the final product shall conform to this specification and shall be the sole responsibility of the SI.
- B. All materials, equipment, labor and services required to achieve a fully configured, integrated and operational process control system shall be provided by the SI. The SI shall design and coordinate the process control system for proper operation with related equipment and materials furnished by other suppliers under other sections of these specifications and with related existing equipment.
- C. Application software programming for the Programmable Logic Controllers (PLC) shall be provided by the SI. All programming, configuration and integration, including but not limited to loading of software on computers, operating system software configuration, “Mission” SCADA shall be provided by the SI.
- D. Auxiliary and accessory devices necessary for complete system operation or performance to interface with existing equipment or equipment provided by other suppliers under other sections of these specifications, shall be included whether or not they are shown on the drawings. These devices include but are not limited to, transducers, current isolators, signal conditioners or interposing relays.
- E. Substitution of functions or type of equipment specified shall not be acceptable, but the SI is encouraged to recommend changes in the design that will improve the overall process control system subject to approval by the Engineer. In order to ensure interchangeability of parts, maintain quality, interface between other subsystems, and establish minimums with regard to ranges and accuracy, strict compliance with the above requirements shall be maintained. System design shall allow removing devices from service without disrupting other devices in the process control system.
- F. Equipment shall be fabricated, assembled, installed and placed in proper operating conditions in full conformity with detail drawings, specifications, engineering data, instructions and recommendations by the equipment manufacturers as approved by the Engineer.
- G. To facilitate the Owner’s future operation and maintenance efforts, similar products shall be by the same manufacturer, as much as possible.

- H. The specified project work is located at the existing Chattahoochee III Pump Station, Georgia. The existing plant will continue to operate during construction of the new expansions. The SI shall coordinate its work throughout the project with operations and the Engineer to minimize an impact on the plants' existing production requirements.
- I. The Owner shall retain salvage rights to all materials and equipment removed in the course of this work. All materials and equipment retained by the Owner shall be delivered to a location designated by the Owner. Any material or equivalent not retained by the Owner shall be removed from the site and properly disposed of by the General Contractor in accordance with applicable regulations and laws.
- J. All equipment and installations shall be in accordance with Federal, State and Local codes, regulations and laws.
- K. Where applicable, the SI shall coordinate and provide with other suppliers under other sections of the specifications and drawings on the following:
 - 1. Interface requirements.
 - 2. PLC input and output (I/O) requirements.
 - 3. Consistency of instrumentation.
 - 4. PLC communication requirements.
 - 5. Transfer of data.
 - 6. Control requirements.
 - 7. Programming Logic
- L. All materials, equipment, labor and services necessary to achieve the monitoring, control and reporting functions described herein shall be provided in a timely manner so that the monitoring, control and reporting functions are available when the equipment or process is ready to be placed in service.
- M. The SI shall coordinate and schedule all required testing and training with the General Contractor, Engineer and Owner in a timely manner.
- N. The SI shall submit a monthly status report and updated project schedule to the General Contractor so that the General Contractor can integrate the SI work into the overall project schedule.
- O. The SI shall supply all necessary programming and configuration to demonstrate that the mission system is working during the Factory Acceptance Test (FAT).

1.17 RELATED SECTIONS

- A. Conductors: Discrete signal conductors, twisted pair analog signal conductors, and RTD conductors are furnished under Division 16. All other instrumentation and signal conductors, including digital data conductors, fiber optic cables, etc. are furnished under this Section. Special cables for a particular device (i.e., between sensing element and transmitter are to be furnished with that device.

- B. Raceways: All raceways and pulling of all conductors (including placement in cable trays) are furnished under Division 16.
- C. Terminations: All control and signal conductor terminations are provided under this Section, unless otherwise indicated in the Instrument Index. Exceptions: HVAC control terminations are provided under Division 15. Interconnections between equipment and integral equipment control panels (i.e., package air compressors) are, where noted, provided under the applicable equipment Section.
- D. Sections 11, 14, and 15

1.18 REFERENCES

- A. Instrument Society of America (ISA)
 - 1. ISA S5.2 – Binary Logic Diagrams for Process Operations
 - 2. ISA S5.3 – Graphic Symbols for Distributed Control / Shared Display Instrumentation Logic and Computer Systems
 - 3. ISA S5.4 – Instrument Loop Diagrams
 - 4. Display Instrumentation Logic and Computer Systems
- B. American National Standards Institute (ANSI)
 - 1. ANSI X3.5 – Flowchart Symbols and Their Usage in Information Processing
- C. National Electrical Manufacturers Association (NEMA)
- D. National Electric Code (NEC)
- E. Where reference is made to one of the above standards, the revision in effect at the time of bid shall apply.

1.19 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. Indicated: Shown on the Drawings.
- E. Noted: Indicated or specified elsewhere.

1.20 SYSTEM DESCRIPTION

- A. The SYSTEM INTEGRATOR shall be responsible for providing a complete and operative SCADA system for the existing pump station.

- B. The system shall contain all equipment required to monitor and control all of the plant's existing and new process equipment and instrumentation as specified and shown on the Drawings.
- C. Equipment and services the SYSTEM INTEGRATOR shall be responsible for shall include, but not be limited to, the following:
1. All field services and instrumentation as shown on the Contract Documents and called out in the Specifications. Detailed descriptions of equipment to be furnished and installation requirements are specified in Sections 13 of the Specifications and shown on the Instrumentation Drawings.
 2. All control panels shown on the Instrumentation Drawings shall be furnished by the SYSTEM INTEGRATOR and installed in accordance to Section 13430 of the Specifications.
 3. SYSTEM INTEGRATOR shall furnish all fiber-optic cable and other cable and wiring necessary to make the proper connections. SYSTEM INTEGRATOR shall be responsible for making sure all connections to instrumentation and control equipment and each supplier's equipment provided under Division 11 are made properly and that the system is functioning as shown on the Drawings and in the Specifications.
- D. SYSTEM INTEGRATOR shall refer to the Contract Drawings and the Specifications for complete information concerning all equipment and services to be furnished under this contract. All programming and application engineering shall be provided by the SYSTEM INTEGRATOR as specified under 13460.
- E. System Description
A complete new SCADA system including "Mission" system, Area Control Panels with PLCs and instrumentation shall be furnished as specified in the Contract Documents as specified in Section 13 and as shown on Drawing I-201 & I-202.
1. Instrumentation
A complete new instrumentation system will be furnished as specified in Divisions 11 and Section 13.

Provide any temporary provisions, relocation, wiring, etc. as required to maintain all critical functions required for Operations of the existing plant facility during the construction period.

At the Coordination Meetings, determine a plan of action and sequence of events that impacts Operations the least while the Contractor is performing all modifications and improvements required for the new Control Room layout as shown in the Contract Documents.

1.21 SUBMITTALS

- A. Provide shop drawings and product data in accordance with the requirements of

Section 01340. Provide O&Ms per Division 01 specifications. Divide submittals into separate volumes as listed below. Note: the list below gives only a general description of the contents of the individual volumes; refer to related sections for additional requirements. *

- B. Field Devices: This volume includes primary elements, transmitters, and analytical instruments. List all dimensions, enclosure types, ranges, and signal form or value. Provide data on special cables between sensing elements and electronics units.
- C. Digital System Hardware: Include the PLC equipment and conductors and interface devices.
- D. Digital System Software: This volume includes documentation on system software, standard software packages supplied, and custom software.
- E. Control Panels: This volume includes dimensions, terminal block designations, front panel arrangement, back panel layout, and ladder logic diagrams for both PLC based and discrete component type control panels. Provide cut sheets for all panel components, indicator ranges, nameplate schedule, and annunciator details. Any miscellaneous equipment not clearly falling into one of the above volumes should be included with the control panel submittal.
- F. Record Drawings
 - 1. Provide all information listed in Article 1.05 above, corrected to reflect the system as-built. Include also any instruction books, operation manuals, and other information pertaining to service and maintenance.
 - 2. Bind record drawings in three-ring, hardback notebooks complete with tabs and index. Include manufacturer's name, address, and telephone numbers to contact for service. For all major components, provide a recommended spare parts list.

1.22 QUALITY ASSURANCE

- A. The Contractor's attention is directed to the fact that the I/C system is an integrated system; and, as such, shall be furnished by one manufacturer who shall provide all of the equipment and appurtenances, regardless of manufacture, and be responsible to the Contractor for correct operation of the entire system.
- B. The system manufacturer shall be responsible for the detailed design and the proper functioning of the I/C system, programming all PLC's, preparation of required submittal data, including operations and maintenance manuals, tests, start-up, including calibration and operational demonstrations, providing technical supervision for installation and connections to equipment, and training of the Owner's operating personnel.
- C. The system manufacturer shall be regularly engaged in the type of work called for under these Specifications and must have capital facilities, personnel, plant and service capabilities required to successfully prosecute the work. The system

manufacturer shall have in employment, competent personnel experienced in the design, manufacture, and programming of equipment and systems required. The system manufacturer shall assign an experienced person who shall act as project manager. This person shall have responsible project experience on systems similar and of a comparable complexity to that specified.

- D. The system manufacturer shall have in employment, a permanent field service organization capable of providing service and maintenance of the system. The system manufacturer shall maintain a service center within 200 miles of the Project site, complete with factory authorized service technicians and spare parts inventory.
- E. Lead Integrator shall have a minimum of 10 years of experience wastewater treatment plants in state of Georgia.
- F. The SYSTEM INTEGRATOR shall be as follows:
 - 1. Global Control System
 - 2. Transdyne
 - 3. Southern Flow, Inc.
 - 4. M/R System, Atlanta, Georgia
 - 5. C2I – Control Instruments, Atlanta, Georgia.
 - 6. Revere Control Systems, Birmingham, Alabama.

Substitutes, alternates, and “or-equal” System Integrators are not acceptable.

1.23 DELIVERY, STORAGE, AND HANDLING

- A. After completion of shop assembly and tests, cabinets shall be enclosed in heavy polyethylene envelopes to provide complete protection from dust and moisture. Desiccant materials shall be placed inside the envelope prior to sealing. The equipment shall then be mounted on skids, enclosed in protective boxes and braced for final transport. Removable lifting rings shall be provided on all sections weighing more than 150 pounds to permit moving without removal of protective covering. Shipping weights shall be shown on shipping tags together with instructions for unloading, transporting, storing and handling on the job site. If practical, termination cabinets shall be delivered first to permit field wiring to be complete and checked out before receipt of remainder of equipment. None of the control center equipment shall be delivered until environmental services as required and approved on working drawings are available and operating in accordance with manufacturer's warranty.
- B. The Contractor shall be fully responsible for moving the equipment through new and existing facilities and setting it in the proper place.

1.24 PROJECT/SITE CONDITIONS

- A. The system shall be capable of operating between 40 degrees and 80 degrees F, 20 to 80 percent relative humidity. The control room will be air conditioned. The system manufacturer shall state, as part of the submittal, the BTU requirements of the equipment proposed and will be responsible for any additional air conditioning or cooling required. 120/208 VAC, 3-phase, 4-wire, 60 Hz power

source will be supplied through a regulated power supply with an assumed load of 5,000 watts. The system supplier shall state, as a part of the submittal, the power requirements and any other power conditioning equipment necessary to insure reliable operation of the system.

- B. Field Devices: Unless otherwise noted, field devices shall be housed in NEMA 4X enclosures and shall be suitable for installation out-of-doors in direct sunlight, provide sunshield. Ambient temperature rating shall be suitable for the Project locale.

1.25 WARRANTY

- A. Warranty Period: One year following the date of system acceptance.
- B. Warranty Requirements: In accordance with Division 1 and, in addition, the following:
 - 1. Corrective hardware maintenance shall be performed by factory trained service technician(s) specifically trained to service the equipment involved. Technician shall be available, on site, within 24 hours after notification by the Owner.
 - 2. Software maintenance shall be performed by suitably qualified individuals from the system manufacturer's software service staff. Representatives from third party software sources may additionally be involved, but the system manufacturer shall be represented at all on site services. Software service representative shall be available for consultation within four hours and, if required, on site within 16 hours after notification by the Owner.
 - 3. Provide a service technician for one, eight hour day on a bi-monthly basis during the warranty period for the purpose of preventive equipment maintenance.
 - 4. Deliver a copy of all service reports to the Owner on the day the work is performed.
- C. Extended Maintenance Agreement: Submit a proposal for maintenance agreement to extend the warranty services described above for a period of four additional years (five years total).

1.26 MAINTENANCE

- A. Spare Parts
 - 1. All spare parts specified in related specification sections shall be furnished.
 - 2. All spare parts shall be individually packaged and labeled.
 - 3. Spare parts shall be packed in a manner suitable for long-term storage and shall be protected against corrosion, humidity and temperature.

- B. Specialty Tools, Software and Licenses
 - 1. Any specialty tools, software and licenses used on the project shall be turned over to the Owner at the conclusion of the project.

PART 2 - PRODUCTS

2.05 MANUFACTURERS

The system components shall be manufactured by the Vendors listed in the related Sections of this Specification.

2.06 EQUIPMENT

A. Process Control System

1. All equipment and instrumentation supplied shall be of the manufacturer's latest design and shall produce or be activated by signals, which are established standards for the water and wastewater industry.
2. All electronic instrumentation shall be of the solid-state type and shall utilize linear transmission signals of 4 to 20 mA DC (milliampere direct current), however, signals between instruments within the same panel or cabinet may be 1 to 5 VDC (volts direct current), or the like.
3. Output of equipment, not of the standard signals as outlined above, shall have the output immediately raised and / or converted to compatible standard signals for remote transmission. Zero based signals shall not be allowed.
4. All instruments shall be provided with mounting hardware, floor stands, wall brackets or instrument racks as shown on the Drawings or as required.
5. Equipment installed in a hazardous area shall meet Class, Group and Division as shown on the Drawings to comply with the National Electric Code.
6. All indicators and recorder readouts shall be linear in process units, unless otherwise noted.
7. All transmitters shall be provided with either integral indicators or conduit mounted indicators in process units, accurate to two percent (2%).
8. Electronic equipment shall be of the manufacturer's latest design, utilizing printed circuitry and suitably coated to prevent contamination by dust, moisture or fungus. Solid-state components shall be conservatively rated for their purpose to assure optimum long-term performance and dependability over ambient atmosphere fluctuations and 0 to 95 % relative humidity. Field mounted equipment and system components shall be designed for installation in dusty, humid and slightly corrosive service conditions.

9. All equipment, cabinets, consoles and devices furnished hereunder shall be heavy-duty type, designed for continuous industrial service. The system shall contain products of a single manufacturer, insofar as possible, and shall consist of equipment models, which are currently in production. All equipment provided shall be modular construction and shall be capable of field expansion.
10. Field-mounted digital system equipment and system components shall be designed for installation in dusty, humid and slightly corrosive service conditions.
11. All electronic and digital equipment shall be provided with radio frequency interference protections and shall be FCC approved.

B. Electrical

1. All equipment shall be designed to operate on a 60-hertz alternating current power source at a nominal 120 volts, +/- 10%, except where specifically noted. All regulators and power supplies required for compliance with the above shall be provided between power supply and interconnected instrument loop. Where equipment requires voltage regulation, constant voltage transformers shall be supplied.
2. Materials and equipment used shall be UL approved wherever such approved equipment and materials are available.

All equipment shall be designed and constructed so that in the event of a power interruption, the equipment specified hereunder shall resume normal operation without manual resetting when power is restored.

2.07 SOURCE QUALITY CONTROL

A. Substitutions

1. 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 - EXECUTION

3.08 INSTALLATION

- A. The system manufacturer shall assign a full time representative to provide coordination and supervision of on site I/C construction work. Individual is to be on site during all times when I/C work is being done.
- B. The system, peripherals, and accessory equipment shall be installed in accordance with the manufacturer's instructions and located as shown on the Drawings or as approved by the Engineer.
- C. All work shall be executed in full accordance with codes and local rulings. Should any work be performed contrary to said rulings, ordinances, or regulations, the Contractor shall bear the full responsibility for such violations and assume all costs arising therefrom.

- D. The Contractor shall investigate each space in the building through which equipment must pass to reach its final location. If necessary the manufacturer shall be required to ship the material in sections sized to permit passage through such areas.
- E. Noise Rejection
 1. Electrical isolation shall be provided between input systems and the processor units. Noise rejection for common mode shall be at least 100 decibels (db), from 0 to 100 Hertz, and up to 175 volts. Normal voltage rejection shall be not less than 35 db at 60 Hertz.
 2. All inputs and outputs shall be protected against accidental surges in accordance with IEEE solid state relay surge capability test. (1.5 Hz at 2.5 KV with 50 percent decay within 10 microseconds).
- F. Grounding
 1. Connect digital equipment to logic ground specified in Section 16060.
 2. Bond all instrument and control panel enclosures to the power system ground.
 3. Ground analog signal conductor shield at the control panel end only

3.09 FIELD QUALITY CONTROL

- A. Tests And Acceptance
 1. The equipment and programs shall be factory-tested prior to shipment for compliance with the conditions of this section, these specifications and for environmental conditions. Test procedures shall be in accordance with ANSI Standard RP55.1 "Recommended Practice - Hardware Testing of Digital Process Computer" in so far as they apply.
 2. Factory-test setup shall include simulated digital and analog inputs and shall demonstrate peripheral performance, including all displays and graphics and graphics, control routines, and exercising all peripherals. A 100-hour burn-in test shall be performed on all solid state devices. The Owner and/or the Engineer reserves the right to witness the factory tests and at least 10 days written notice shall be given by the Contractor prior to date of starting tests. Submit witness test and final checkout procedural outlines for approval to the Engineer not less than 60 days prior to starting factory tests. The tests shall include the complete system with all cabinet doors in place and peripherals attached for an agreed to period of time with documentation via periodic printouts.
 3. After installation of the complete system, the Contractor shall provide the services of a qualified systems engineer to test the complete system under the observation of the Engineer to verify that all functions specified are performed without error or malfunction. As a part of the test procedure, Contractor's personnel, when requested of the system supplier, shall cause each remote process to change state or value three

times to verify all functions during the checkout period, as required. This shall be repeated until the system performs correctly.

B. Training

1. The cost of training programs shall be included in the Contract Price, to be conducted with designated Owner's personnel, covering programming, operation, and maintenance of the system as specifically set forth hereinafter. The training and instruction, insofar as practicable shall be directly related to the system being supplied.

2. The system manufacturer shall provide training courses for Owner's personnel as follows. The courses shall be taught by professional, full-time instructors. All course materials as required to adequately support the material presented must be included. The Owner will bear the cost of student transportation and board. All times specified are for each individual project.

a. System Hardware Maintenance

1. Length: 1 day
2. Location: Owner's plant site

This course will instruct the computer maintenance personnel in maintenance and repair practices used to support the system hardware.

b. Application Software

1. Length: 1 day
2. Location: System manufacturer's training center

This course will provide the student with a working knowledge of all software supplied with the computer system. System Integrator covered shall include the operating system software, file structures, application software, and Fortran interfaces. Include lab sessions to reinforce classroom lessons.

END OF SECTION

SECTION NO. 13420

INSTRUMENTATION AND DEVICES

PART 1 - GENERAL

1.27 SECTION INCLUDES

- A. Primary elements.
- B. Transmitters.
- C. Receivers.
- D. Analytical instruments.

1.28 SYSTEM DESCRIPTION

- A. System consists of all field and panel mounted instrumentation devices as noted, complete with all necessary signal converters, isolators, amplifiers, power supplies, and other appurtenances necessary for interfacing with other components.
- B. Except as noted, scale all indicators in engineering units.

1.29 SUBMITTALS

- A. Submit product data. Panel layout & Schematic diagrams.

PART 2 - PRODUCTS

2.08 EQUIPMENT

A. Level Transmitters – Ultrasonic

- 1. Type: Microprocessor based ultrasonic level transmitter. Unit shall have input or output filter capability.
- 2. Sensor: Sensors shall have minimum 26 foot range and shall be supplied with sufficient cable length for arrangement indicated. Sensor shall have a NEMA 4X (minimum) enclosure. Unit shall be supplied with automatic temperature compensation as required below. Sensor face material shall be Kynar or Teflon as required.
- 3. Accuracy: ± 1.0 percent of calibrated range or better for ranges greater than 25-inches (with temperature compensation).
- 4. Output: Isolated 4-20 mADC into loop loads of 0 to 500 ohms (minimum), two (2) Form "C" Relay Contacts rated at 5A, 250 VAC, non-inductive.
- 5. Enclosure: NEMA 4X, polycarbonate or fiberglass.
- 6. Power Supply: 120 VAC
- 7. Mounting: The System Manufacturer shall coordinate mounting to ensure that the sensor is mounted away from vessel walls and other obstructions in accordance with the manufacturer's recommendations. All chemical storage tank sensors shall have Teflon face suitable for 6" flange mounting. The System Manufacturer shall provide appropriate standoff distance for sensor face from the highest liquid level to accommodate

blanking distance. Transmitter flanges, couplings, stanchions, piping, etc., shall be provided as required.

8. Acceptable Manufacturers: Equal to Milltronics (Hydro-Ranger 200), Endress & Hauser (Prosonic), Systematic Controls.

B. Solenoid Valves (Two-Way)

1. Type: Two-way pilot operated, see schedule for normal position.
2. Materials of Construction
 - a. Body: Brass.
 - b. Seals and Discs: PTFE.
 - c. Disc Holder: Nylon.
 - d. Core, Core Tube and Springs: Stainless steel.
3. Enclosure: NEMA 4X (minimum).
4. Coil Voltage/Rating: 120 VAC, 60 Hz/Class F insulation.
5. Minimum Operating Differential Pressure: 0 psig.
6. Maximum Operating Differential Pressure: 150 psig.
7. Connection Type: FNPT.
8. Acceptable Manufacturer: Equal to ASCO.

C. Solenoid Valves (Four-Way)

1. Type: Four-way, pilot-operated valves for activating pressure-open/pressure-close pneumatic valves. Solenoid valves provided under this Article shall be suitable for Dry Air Service.
2. Materials of Construction
 - a. Body: Brass.
 - b. Seals and Discs: PTFE.
 - c. Disc Holder: Nylon.
 - d. Core, Core Tube and Springs: Stainless steel.
3. Enclosure: NEMA 4X (minimum).
4. Coil Voltage/Rating: 120 VAC, 60 Hz/Class F insulation.
5. Minimum Operating Differential Pressure: 0 psig.
6. Maximum Operating Differential Pressure: 150 psig.
7. Connection Type: FNPT.
8. Spare Parts: Provide 4 solenoid valves, identical to the valves provided under this Article.
9. Acceptable Manufacturer: Equal to ASCO.

D. Digital Indicator

1. Type: Digital, microprocessor based, configurable panel indicator for single analog input. Display shall have 3-1/2 digit (minimum), LED with 1/2-inch (minimum) display height.
2. Input: 4-20 MADC, 100 ohms input impedance (maximum).
3. Readout: Engineering units with provision to scale input and place decimal point.
4. Power Supply: 120 VAC.
5. Read Rate: 2.5 per second (minimum).
6. Accuracy: 0.1 percent of reading, ± 1 count.
7. Spare Parts: Provide spare displays as indicated in the schedule below.

8. Acceptable Manufacturers: Equal to Precision Digital, Newport, Action Instruments, or Red Lion.

E. Pressure Gauge

1. Type: Bourdon tube or bellows as required by pressure range. Phenolic case gauge with 4.5-inch dial. Dial shall have white face with black lettering. Provide unit with blowout protection. Provide non-freeze models for all outdoor locations.
2. Fluid: Water at 120 degrees F (maximum).
3. Gauge Materials
 - a. Lens: Acrylic.
 - b. Bourdon Tube and Socket: 316 stainless steel (bronze and brass if diaphragm seal is used).
 - c. Movement: Stainless steel.
4. Accuracy: ± 0.5 percent (Grade 2A).
5. Gauge Connection Size/Location: 0.5 inch/lower.
6. Snubber: 316 stainless steel.
7. Diaphragm Seal: Provide diaphragm seal with flushing connection and the following:
 - a. Type Seal: Welded diaphragm.
 - b. Upper Housing Material: 316 stainless steel.
 - c. Lower Housing and Wetted Parts Material: For water service, 316 stainless steel. For gaseous chlorine service, Hastelloy C, Monel, or as otherwise recommended by the diaphragm seal manufacturer for gaseous chlorine service.
 - d. Upper Connection Size/Type: 0.5-inch NPT.
 - e. Lower Connection Size/Type: 1.0-inch NPT.
 - f. Diaphragm Material: For water service, 316 stainless steel. For gaseous chlorine service, diaphragm shall be Teflon, Viton, or as otherwise recommended by the diaphragm seal manufacturer for gaseous chlorine service.
8. Acceptable Manufacturers: Equal to Ashcroft, U.S. Gauge.

F. Flow Switch (Thermal Type)

1. Type: Thermal flow switch, liquid service only. The process connection shall be 3/4-inch MNPT with a standard "U" length suitable for mounting in a 3/4-inch threaded tee. The unit shall be designed to mount in horizontal piping in a side-mounted configuration.
2. Contacts: SPDT 5 amp resistive at 120 VAC (minimum).
3. Response Time: Unit shall guarantee less than 10 seconds response time for the line sizes, flow rates and other conditions as installed in this application.
4. Power: 120 VAC.
5. Materials of Construction
 - a. Wetted Parts: 316 stainless steel.
 - b. Electronics Enclosure: Cast aluminum with epoxy coating, suitable for outdoor service.

6. Acceptable Manufacturers: Equal to FCI (Series FLT), STI/Magnetrol (series TDF), Captor/Weber.
7. Provide rigid mounting for thermal flow switches. Weight of switch shall not be supported by the pipe on which the flow switch is mounted.

G. Alarm Light (Strobe Type)

1. Type; Heavy duty, corrosion-resistant high intensity strobe warning light.
2. Enclosure: Corrosion-resistant, NEMA 4X, suitable for outdoor service. Unit shall be suitable for mounting in Class I, Group D, Division 2 rated areas.
3. Power: 120 VAC, 60 Hz.
4. Dome Color: Red, blue, or amber, as called for in schedule below.
5. Acceptable Manufacturer: Equal to Federal Signal Corporation (Model 151XST).

H. Analog-Fiberoptic Converter

1. Type: Microprocessor-based devices to translate analog input signal to fiber optic data signal, receive and translate the fiber optic data signal to an analog output signal.
2. Transmitter and Receiver Characteristics:
 - a. Data rate - DC to 800 Hz.
 - b. Response time 10 to 90 percent - < 2 MSEC
 - c. Operating wavelength - 850 nm
 - d. Optical loss budget 62.5/125 micron - 18 dB minimum
 - e. Link accuracy - 0.1 percent at 0° to 70° C.
 - f. Fiber optic Connector shall be the same type as connectors used for the fiber optic ethernet network.
 - g. Separate transmitter and receiver modules.
3. Provide separate DC power supplies as necessary for power from 120 VAC source.
4. Spare Parts: Provide one spare transmitter and one spare receiver.
5. Acceptable Manufacturers: Equal to Hirschmann.

I. Level Transmitter – Pressure Sensing Transducer

Type: Microprocessor based intelligent type, diaphragm actuated. The instrument shall measure gauge pressure.

Sensor: Electrical Classification – Intrinsically safe or explosion proof for Class I and Class II, Division 1 locations.

Diaphragm sensor material – cobalt-Nickel-chrome alloy or Hastelloy C.

Sensor fill fluid – shall be suitable for process fluid being measured. When used for chemical metering service, the fill fluid shall be rated for the chemical being measured.

Accuracy: Plus or minus 0.1 percent of calibrated span.

Over range protection – provide positive over range protection to maximum process pressure.

RFI protection – 0.1 percent error between 27 and 500 MHz at 20 v/m field intensity.

Output: 4-20mA

Enclosure: Rated NEMA 4X

Power requirements: Loop Powered, two wire type.

Stability – combined temperature effects shall be less than 0.2 percent of maximum span per 50 degrees F temperature change.

Options/Accessories required: If required to meet the range of suppression/elevation requirements, the CONTRACTOR shall supply a differential pressure transmitter. Provide a shutoff valve and mounting bracket for each transmitter. Provide an integral indicator scaled in engineering units. Provide hand held programmer(s) as specified under tools and test equipment. Provide Stilling Well – see detail.

Manufactures: Ashcroft, Rosemount 9700, Endress + Hauser

J. Combustible Gas Detector

1. Sensors/Transmitters

a. Type:

- 1) Platinum-based catalyst detector with ceramic coating.
- 2) Poison resistant sensors.
- 3) Remote transmitter and calibration cup.

b. Functional/Performance:

- 1) Gases - Shall detect all combustible gases, including hydrogen.
- 2) Response Time - Less than 10 seconds to reach 50% full scale, and less than 30 seconds to reach 90% scale, with 100% LFL applied. Less than 10 seconds to reach 60% full scale with 100% methane by volume in air.
- 3) Recovery Time - Less than 30 seconds after exposure to pure methane.
- 4) Linearity - ± 5.0 % LFL or better.
- 5) Repeatability - ± 1.0 % LFL.
- 6) Long Term Stability - Less than 1.0% LFL per month zero and span in clean air.
- 7) Transmitter - Constant voltage type.

c. Physical:

- 1) Temperature - -40 to 185 degrees F, humidity 0-99% non-condensing.
- 2) Classification - FM certified Class I, Division 1.
- 3) Enclosure - Anodized aluminum enclosure, ceramic coating, gold-plated connectors, $\frac{3}{4}$ "NPT.

d. Options/Accessories Required:

- 1) Sensor Separation Kit - Each sensor shall be supplied with a sensor junction box equipped with a base board for transmitting sensor output to a matching base board (also to be supplied) in the remote transmitter assembly. Sensor and transmitter shall be no more than 450 feet apart and shall be connected by shielded cable, of a type recommended by the Manufacturer, supplied by ISS.

- 2) Remote Transmitter - Each transmitter (one per sensor) shall be supplied with a junction box. This junction box shall include a base board for receiving the remote signal from its sensor, and a local digital display indicating %LEL. Remote transmitters shall be wall-mounted 5 feet above the floor in a convenient location as close as possible to the sensor.
 - 3) Remote Calibration Cup - Each sensor shall be supplied with a permanently installed cup with Porex filter that allows ambient air to be detected under normal operation, but includes a 1/4" barbed nozzle connector for the direct feed of calibration gas to the sensor from a remote location. ISS shall supply 1/4" o.d. plastic tubing of appropriate length to allow calibration of each sensor from the location of its associated remote transmitter.
- e. Manufacturer:
- 1) Detector Electronics, K Series/Model 500.
 - 2) MSA Instruments
 - 3) Or approved equal.
2. Detector Cabinet
- a. Type:
- 1) Microprocessor-based, one to six separate controllers.
 - 2) NEMA 4X full view enclosure.
 - 3) Audio/visual alarm.
- b. Functional/Performance:
- 1) Controllers
 - Number - Cabinet shall contain as many controllers as there are sensors shown in the Loop Drawing.
 - Operation - Each controller shall receive 4-20 mA input from a sensor, display the sensor reading in both digital and bar graph form, display all alarm conditions with LEDs and actuate alarm relays upon three fully adjustable % LEL setpoints and upon controller fault. Controller shall be programmed to run an automatic calibration sequence on request from the front panel.
 - Output - Each controller shall have a 4-20 mA output and four (4) configurable SPST relays rated 5A @ 120VAC, one for each of the three setpoints and one for controller fault. Output terminal blocks for a single common alarm shall be pre-wired in the cabinet for customer use.
 - 2) Power Supply - Cabinet shall contain a 120VAC power supply that provides 24VDC power to all components.
 - 3) Connections - All components in the cabinet shall be shipped pre-wired by the Manufacturer. Terminals for customer wiring of power, signals, etc. shall be clearly labeled.
 - 4) Operating Temperature - 25 to 105 F.
- c. Physical:
- 1) Material - Fiberglass enclosure with transparent polycarbonate front window.
 - 2) Rating - NEMA 4X.
- d. Options/Accessories Required:
- 1) Calibration Kit - With each cabinet, supply a combustible gas calibration kit containing at least the following items: carrying case, two cylinders of 50%

methane gas, regulator and pressure indicator, tubing, and sensor calibration cup.

- e. Manufacturer:
 - 1) Detector Electronics, Q1051/1052 Series with R8471 controllers.
 - 2) Or approved equal, same manufacturer as sensors.

2.02 CABLES

A. Industrial Twisted Pair (ITP) 100 Mb Fast Ethernet Cables

1. ITP cables shall be fully compatible with the Siemens Optical Switch Modules (OSM) TP62 100Mb.
2. ITP cable shall have two cores stranded with two dummy elements to form a pair.
3. Each pair shall be sheathed in plastic film and shielded with two plastic-clad aluminum foils.
4. The outer shield braid shall be made of tinned copper wires around all pairs.
5. The plastic sheath shall be PVC.
6. The ITP cable shall be a standard 9 pin cable with RJ45 type connectors.
7. All ITP cables shall be Siemens FastConnect type and use the Siemens FastConnect (or AT&T, Belden equal) method of assembling cables.
8. ITP Cables shall be Siemens Industrial Twisted Pair standard cable or equal by AT&T or Belden.

PART 3 - EXECUTION

3.10 INSTALLATION

- A. Instrument Tagging
 1. Provide stainless steel identification tags attached with stainless steel wire or screws for all field instruments.

3.11 FIELD QUALITY CONTROL

- A. Tests And Calibration
 1. Perform continuity and insulation resistance tests on instrumentation conductors.
 2. Calibrate each instrument to its published accuracy. Submit calibration sheets including the instrument tag number or name, the date, name of individual performing calibration, procedures and equipment used, and results obtained.

END OF SECTION

SECTION NO. 13430

CABINETS AND ENCLOSURES

PART 1 - GENERAL

1.30 SECTION INCLUDES

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

1.31 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

2.09 MANUFACTURERS

- A. Cabinets and enclosures shall be equal to Crouse Hinds, Hoffman or Weigmam.

2.10 EQUIPMENT

- A. Hinged Cover Enclosures
 1. 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 1A for indoor dry locations and NEMA 4X, stainless steel for outdoor, wet or damp locations.
 2. Finish: Baked on enamel over a rust inhibitor.
 3. Covers: Continuous hinge, held closed by hasp and staple for padlock. Furnish three point latch for free standing enclosures.
 4. Panel for Mounting Terminal Blocks or Electrical Components: 14 gauge steel, white enamel finish.
- B. Cabinets
 1. Cabinet Boxes: Code gage galvanized steel. Provide 3/4-inch thick plywood backboard painted matte white, for mounting terminal blocks.
 2. Cabinet Fronts: Steel, surface type with concealed hinge and flush lock keyed to match branch circuit panel board; finish in gray baked enamel.

2.11 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.
- D. Provide light fixture with switch and a 120V convenience receptacle.

2.12 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 freestanding equipment enclosures.

END OF SECTION

SECTION NO. 13450

PROGRAMMABLE LOGIC CONTROLLERS

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. The General Provisions of Section 13400 shall apply to this section.
- B. The PLC Manufacturer shall furnish all labor, materials, equipment and incidentals required to provide, complete and ready for operation, the programmable logic controllers (PLCs) as specified.
- C. All work in this Section shall be the product of the System Integrator (SI). Sub-suppliers and/or manufacturers may provide components, and/or services to the SI, but the final product shall conform to this specification and shall be the sole responsibility of the SI.

1.02 RELATED WORK

- A. Refer to Section 13400 and 13610.

1.03 SYSTEM DESCRIPTION

- A. Refer to Section 13400.
- B. Each PLC system shall have an initial installed capacity of I/O as shown on the drawings and as described in the I/O List plus a minimum of 20 percent installed spares. All installed action and spare I/O points shall be wired and terminated to terminal strips. PLC system provided shall be sized for an additional 20 percent minimum I/O expansion slots within the panel that it is installed.
- C. The following new PLC systems shall be furnished as specified under this and related Sections.

1.04 SPARE PARTS AND TEST EQUIPMENT

- A. Provide spare parts and test equipment as specified in Section 13400 and as indicated below.
 - 1. One complete PLC systems including the following:
 - a. Power Supply.
 - b. Central Processing Unit (CPU).
 - c. Communications Module.
 - d. I/O Cards: One of each type used.
 - 2. I/O cards: 10 percent of each type used, but no less than one of each type.
- B. All spare parts shall be packed in a manner suitable for long-term storage and shall be adequately protected against corrosion, humidity and temperature.
- C. Program Development Software

1. Provide two (2) licenses of the PLC program development software. It shall be the latest version of Allen Bradley, Control Logic, or approved equal.

PART 2 PRODUCTS

2.01 PROGRAMMABLE LOGIC CONTROLLER (PLC)

A. Hardware

1. Major hardware components of the PLC system shall include:
 - a. Central Processing Unit (CPU)
 - b. Communications Equipment
 - c. Input / Output Modules (I/O)
 - d. Power Supply and Chassis
 - e. UPS for PLC
 - f. Panel mounted HMI (10" color touchscreen)

2. General

- a. The PLCs shall communicate between the operator workstations and field-mounted instrumentation, controllers and process actuators. Communications protocol shall be completely transparent to plant operators in the Control Room. The PLC shall be an intelligent microprocessor based device that can collect data and process control functions. Communications between PLCs and the operator workstations shall utilize an Ethernet 802.3 compliant data highway as shown on the Drawings. The protocol shall be Modbus/Ethernet. The PLC shall reside directly on the Ethernet data highway and communications shall be via a PLC chassis mounted Ethernet communications module as Manufactured by the PLC manufacturer.
- b. All components of the PLC system shall be normally recognized industry standards and regularly sold for industrial applications. The PLC manufacturer shall assemble all components of the PLC system in structurally sound housings. All connecting cables, switches and other operator-controlled devices shall be constructed so as to withstand, without damage, all normal use and handling.
- c. Electrical supply voltage to the PLC shall be 115 VAC +/- 15%, 48 – 63 Hz. PLC system power supplies shall be fused for overload protection.
- d. The PLC shall be capable of stand-alone operation in the event of failure of the communications link to the operator workstations.
- e. The PLC shall be a digital solid-state logic system capable of performing the same functions as conventional relays, timers, counters, math functions, controllers, etc.
- f. The PLC system shall be of modular plug-in design and shall consist of a CPU, memory, I/O cards, racks, power supplies, interconnecting cables, communication lines and other items as necessary to meet the functional requirements of the specification. All components of the PLC system shall be marketed and

- supported by one PLC manufacturer. All necessary cable shall be provided.
- g. All products shall be designed, manufactured and tested in accordance with recognized industrial standards. All components shall have corrosion protection and shall have UL, CSA and FM approval. The PLC subsystems shall be approved for and adhere to the following agency and environmental specifications:
1. Vibration - 3.5 mm Peak-to-Peak, 5-9 Hz: 1.0G, 9-150 Hz.
The methods of testing are to be based upon IEC 68-2-6 and JIS C 0911 standards for vibration. The system shall be operational during and after testing.
 2. Shock – 15G, 11 msec. The method of testing are to be based upon IEC 68-2-27 and JIS C 0912 standards for shock. The system shall be operational during and after testing.
 3. Temperature – All PLC hardware shall operate at an ambient temperature of 0 to 60⁰ C, with an ambient temperature rating for storage of –40 to +85⁰ C.
 4. Relative Humidity – All PLC hardware shall function continuously in the relative humidity range of 5% to 95% with no condensation.
 5. Noise Immunity – All PLC hardware shall be designed and tested to operate in a high electrical noise environment of an industrial plant as governed by the following regulations: EEE 472, IEC 801, MILSTD 461B, IEC 255-4, NEMA ICS 2-230.40 and ANSI/IEEE C-37.90A-1978.
- h. The PLC manufacturer shall provide operating instruction manuals with adequate information pertaining to the following:
1. System specifications
 2. Electrical power requirements
 3. Application considerations
 4. Assembly and installation procedures
 5. Power up procedures
 6. Troubleshooting procedures
 7. Programming procedures
 8. Internal fault diagnostics
 9. Shut down procedures
 10. Recommended spare parts list
- i. The PLC manufacturer shall utilize a network of field sales and support personnel located in major cities throughout the United States. It shall also utilize a field service department with experienced representatives stationed in major cities with the capability to provide telephone consultation, prompt on-site service and field replacement stock.
- j. The PLC manufacturer shall provide product application assistance by trained and experienced engineers to assist the Owner with program and system development through telephone consultation and on-site checkout, debug and start-up assistance.

- k. The PLC manufacturer shall have the capacity to conduct on-site training programs. It shall also have the capacity to provide videotape-training courses for operation and maintenance of PLCs.
 - l. Modules are defined herein as devices, which plug into a chassis and are keyed to allow installation in only one direction. The design must prohibit upside down insertion of the modules as well as safeguard against the insertion of a module into a wrong slot.
 - m. In a single chassis system, all system and signal power to the CPU and support modules shall be distributed on a single motherboard or backplane. Interconnecting wiring between modules via plug-terminated jumpers shall not be acceptable.
 - n. All system modules on the main or expansion chassis shall be designed to provide for free air flow convection cooling. Heat sinks shall be used to dissipate component heat. Internal fans shall not be permitted.
 - o. The PLC manufacturer shall be regularly engaged in the manufacturing and servicing of PLCs and all corresponding components.
 - p. The PLC manufacturer shall have a fully operational quality assurance and control program in place and shall comply with ISO9001 standards for "Quality Systems – Model for Quality Assurance in Design, Development, Production, Installation and Servicing".
 - q. The PLC manufacturer or it's authorized representative shall provide complete technical support for all of its products including a "1-800" phone line.
 - r. All major assemblies and sub-assemblies, circuit boards, components and modules shall be identified using permanent labels or markers, each of which indicate the manufacturer's catalog number and a product manufacturing date code.
 - s. The PLC system shall be Control Logic by Allen Bradley or approved equal.
3. Central Processing Unit (CPU)
- a. General
 - 1. The CPU shall be as a minimum a 16-bit microprocessor that provides system timing and is responsible for scheduling I/O updates. It shall execute user-developed relay ladder logic programs, communicate with intelligent I/O modules and perform on-line diagnostics. The CPU shall consist of a single module, which solves application logic, stores the application program, stores numerical values related to the application processes and logic and interfaces to the I/O.
 - 2. The CPU shall sample all the discrete and analog inputs and outputs including internal coils and registers and service special function modules on every scan. The CPU shall process the I/O with user programs stored in memory, then control the outputs based on the results of the logic operation. The CPU shall execute the user program by

rapidly scanning the program stored in user memory. Both logic and data word functions are executed in the order they appear in the user program. As each rung of logic is solved, the results shall be available to any following rungs. The CPU shall have an instruction to allow a decrease in scan time by skipping over parts of the program. The CPU shall allow the PLC program to be broken into ladder logic subroutines that execute only when called. The PLC shall allow analog and discrete points to be updated immediately within the scan as the analog or discrete value is called in the ladder logic program.

3. The CPU shall be a single printed circuit board utilizing surface mount technology. The CPU shall plug directly into the backplane and shall not require additional wiring to the backplane, power supply or the I/O.
4. The CPU shall support floating point without the need of a Co-processor.
5. The CPU shall be supplied with a battery-backed time of day clock and calendar.
6. The CPU family shall allow for user program transportability from one CPU model to another.

b. Capacity

1. The CPU I/O capacity shall be 8192 bits in and 8192 bits out minimum.
2. The processing of a typical logic program consisting of a mix of analog and digital commands shall not exceed 1.4 milliseconds for 1,024 instructions.

c. Diagnostics

1. The CPU shall perform on-line diagnostics that monitor the internal operation of the PLC. If a failure is detected, the CPU shall initiate system shutdown and fail-over if a failure occurs. The following at a minimum shall be monitored:
 - a. Memory failure
 - b. Memory battery low
 - c. CPU over temperature and general fault
 - d. Communications port failure
 - e. Scan time over run
 - f. I/O failure
 - g. Analog or special function I/O module failure
2. All diagnostic information shall be accessible at the programming terminal, which attaches at the CPU. A diagnostic CRT page shall provide information, which identifies the nature of the fault, the absolute memory or I/O address of the fault, and the date and time of occurrence of the fault.

3. All diagnostic information shall be accessible to the host communications interface.
 4. All diagnostic information shall be accessible to the ladder program or other executing software.
 5. The CPU shall have LED indicators to show status such as PLC Ready, PROGRAM RUN and BATTERY GOOD. If any of the above mentioned failure conditions occur, provide an internal PLC diagnostic alarm contact output. The CPU within the system shall perform internal diagnostic checking and give visual indication to the user by illuminating a "green" indicator when no fault is detected and a "red" indicator when a fault is detected.
- d. Programming Environment
1. The CPU shall be capable of being programmed by an external computer workstation via either a serial communication port on the CPU, or via optional Ethernet communications. Serial programming shall be possible without the use of a workstation interface board.
 2. The programming device shall have access to the application program, the system configuration, all registers, I/O, system fault status, I/O override and system diagnostic relays.
 3. Application programs may be loaded or stored while the CPU is running with minimal impact on the scan time.
 4. If contacts or entire rungs are intentionally deleted from an existing logic program, the remaining program shall be automatically repositioned to fill this void. Whenever contacts or entire rungs are intentionally inserted into an existing program, the original program shall automatically be repositioned to accommodate the enlarged program.
 5. The number of times a normally open (N.O.) and/or normally closed (N.C.) contact of an internal output can be programmed shall be limited only by the memory capacity to store these instructions.
 6. The CPU shall support multiple industry standard IEC 1131-3 programming languages. As a minimum, ladder diagram, structured text and Sequential Function Chart (SFC) programming shall be provided. All hardware and software necessary to program the CPU in a mode other than standard ladder logic shall be supplied.
- e. Memory
1. The CPU shall contain the CMOS RAM program memory. The memory shall have a battery backup system capable of retaining all memory for a minimum of three months under load and shall require no external or special vents. The backup battery shall be capable of being replaced without interruption of memory integrity.

2. A visual indication of backup battery status shall be provided. In the event of low battery voltage, a visual indication and a low battery output alarm contact (for remote alarm) actuation shall be provided before battery failure.
 3. The program memory shall be sized as required to implement the functions specified plus a minimum of 10 words (16 bit) for each I/O provided as spare, but not less than 48K bytes. The entire program memory shall be available for user program storage. Scratch pad or "housekeeping" programs shall not be counted in memory size rating.
 4. The PLC CPU memory shall consist of the following functional types of memory:
 - a. Ladder logic program memory
 - b. Constant data memory
 - c. Variable data memory
 - d. Input / output memory
 - e. CPU status data memory
 - f. I/O word memory
 - g. User memory for compiled programs
 5. Various memory combinations up to the maximum limits shall be software configurable between logic and data storage to more closely match the application requirements.
- f. Instruction Set
1. The PLC CPU shall be capable of performing the same functions as a conventional relay logic system, including relays, timers, counters and shift registers. The CPU shall also be capable of performing high-level instructions including data word functions such as:
 - a. Four-Function Math: The CPU shall be capable of performing addition, subtraction, multiplication and division on integer numbers.
 - b. Compare Function: The CPU shall perform the compare function that compares two integers for less than, equal to, greater than and not equal to. The programming function shall energize when true and de-energize when false.
 - c. Square Root Function: The CPU shall be capable of taking the square root of a positive integer.
 - d. Move Function: The CPU shall be able to move an integer value from one memory location to another memory location.
 - e. Other data word capabilities shall include data file compare with pointer, file (block) move, word rotate, bit set, pick and clear.
 2. The PLC CPU shall perform all the functions of the conventional three-mode (PID) analog controller. The CPU shall be able to process up to 64 PID loops with the

- processing time of each controller selectable. Each PID loop shall incorporate an anti-windup algorithm on reset.
3. The system shall have the capability to address software timers and software counters in any combination and quantity up to the limit of available memory. The CPU shall handle all management of these instructions into memory. Instructions shall permit programming timers in the "ON" or "OFF" delay modes. Timer programming shall also include the capability to interrupt timing without resetting the timers. Counters shall be programmable using up-increment and down-increment.
 4. Timer instructions shall include selectable time bases in increments of 1.0 second and 10 milliseconds. The timing range of each timer shall be from 0 to 32,767 increments as a minimum. It shall be possible to program and display separately the timer's preset and accumulated values.
 5. When using modules such as analog where multiple channels are terminated on one module, it shall be possible to transfer the current status of all channels to the CPU upon execution of one program instruction. This instruction shall be bi-directional to include data transfer from the CPU to the module or from the module to the CPU.
 6. Instructions shall be provided for grouping contiguous 16 bit data words into a file. The system shall address up to 1,000 files with up to 1,000 words per file. File manipulation instructions such as high speed "file copy" and "file fill", "file to file" move, "element to file" move, "file to element" move and "first in-first out" shall be supported by the system. The four function math instructions and instructions for performing "logical OR", "logical AND", "exclusive OR" and comparison instructions such as "less than", "greater than" and "equal to" shall be included within the system. All instructions shall execute on either single word or files.
 7. The system shall contain instructions, which will construct asynchronous and synchronous 16-bit word shift registers. Additional instructions shall be provided to construct synchronous bit shift registers.
 8. The PLC shall have a jump instruction, which will allow the programmer to jump over portions of the user program to a portion marked by a matching label instruction.
 9. It shall be a function of the CPU to automatically manage all data types.
 10. In applications requiring repeatable logic runs it shall be possible to place such rungs in a subroutine section. Instructions, which call the subroutine and return to the main program, shall be included within the system. It shall be possible to program several subroutines and define each subroutine by a unique program file designator. The processor shall support nesting of subroutines up to seven

- levels deep. The program format as displayed on the CRT shall clearly define the main program and all subroutines. It shall be possible to pass selected values (parameters) to a subroutine before its execution.
11. The program format shall display all instructions on a CRT programming panel with appropriate mnemonics to define all data entered by the programmer. The system shall be capable of providing a "HELP" instruction, which when called by the programmer will display on the CRT a list of instructions and all data and keystrokes required to enter an instruction into the system memory.
 12. The system shall have the capability to enter rung comments above ladder logic rungs. These comments may be entered at the same time the ladder logic is entered.
 13. The system shall have the capability to enter address comments and symbols. These entities may be entered at the same time the ladder logic is entered.
 14. A means to program a fault recovery routine shall exist. When a major system fault occurs in the system, the fault recovery routine shall be executed and then the system shall determine if the fault has been eliminated. If the fault is eliminated, program execution resumes. If the fault still exists, the system will shut down. A user shall have the option to either resume operation or to shut down upon fault detection.
 15. An interrupt routine shall be programmable such that the routine shall be executed regularly. The interval at which the routine is executed shall be user-specified in the range of 1 to 65,535 milliseconds.
 16. The CPU shall support indexed and indirect addressing of inputs and outputs, along with all data table words (integer, binary, floating point, timers and counters) for the software instruction set.
 17. Trigonometric instructions supported must include Sine, Cosine, Tangent, Inverse Sine, Inverse Cosine, and Inverse Tangent. These instructions must fully support floating-point math.
 18. Additional floating point instructions supported must include Log 10, Natural Log and Exponential.
 19. It shall be possible to complete complex, combined calculations in a single instruction, such as flow totalizing or equations of the format $((A+((B-C)*D))/E)$.
 20. File function instructions supported shall also include Sort, Average, Square Root and Standard Deviation.
 21. The processor instruction set shall provide support for a variety of ASCII string manipulation instructions such as search, concentration, extraction, compare and to/from integer conversion.

22. The processor shall support ladder functions providing ASCII port control such as read, write, handshake line control, buffer examination, etc.
 23. An interrupt routine shall be programmable such that the routines shall be executed based upon the input condition of one of sixteen discrete hardware inputs in the processor chassis. The routine will be executed within two milliseconds of the detection of the input signal.
 24. It shall be possible to divide user logic into multiple program blocks (structured programming).
- g. Communication Ports and Remote I/O (RIO) Communications.
1. The CPU shall have at least three built-in communication ports for programming, operator interface and remote I/O operations.
 2. The CPU shall be capable of communicating with up to 31 remote base locations at a combined distance of 15000 feet. The CPU shall automatically sample and update all local and remote I/O modules every scan cycle of the CPU.
 3. The communication link between the CPU and any RIO chassis shall be via coaxial cable as recommended by the PLC manufacturer. RIO Communications speeds shall not be diminished with increased cable length.
 4. Diagnostic and equipment status information shall be available from each RIO.
 5. The remote I/O system shall have available a remote input/output arrangement capable of operation at locations physically separated from the PLC CPU by up to 15,000 feet.
4. Input / Output Modules (I/O)
- a. General
1. The I/O count and type has been determined by the Engineer in conjunction with the Owner and includes an allowance for active spares as noted below.
 2. Each I/O system per location shall include 20 percent (minimum of 4 for each type) active input and output points (both DI, DO, AI and AO) for future use. The spares shall be the same type of I/O module as the active I/O modules and shall be wired down to the terminal strip.
 3. Minimum isolation between input/output and logic voltage shall be 2,500v RMS per NEMA standards via opto-isolation.
 4. All outputs shall have field replaceable fuse protection and blown fuse indicators.
 5. I/O modules shall be plug-in mounted to the I/O mounting bases. I/O modules shall be designed to allow insertion at any point on the mounting base.
 6. Field wiring terminal blocks shall be pull a part type if mounted on the I/O modules or mounted on the I/O mounting base to allow I/O module replacement without disconnecting of

the field wiring. All field wiring terminal blocks shall be 300V minimum NEMA rated and accommodate no less than two (2) #14 gauge wires.

7. I/O modules shall comply with the following schedule unless noted otherwise:
 - a. Analog input modules shall be 4-20 mA and shall have a maximum of eight (8) isolated differential channels per module. Common mode input protection of 30 volts DC minimum shall be provided. Input signal conversion shall be a minimum of 14-bit resolution.
 - b. Analog output modules shall be 4-20 mA and shall have a maximum of eight (8) isolated differential channels per module. Output load capability shall be 750 ohms minimum for each output. Accuracy shall be 0.1 percent of full-scale output span. Analog output modules shall be selectable on a point per point basis to either hold the last state or to return to zero upon reset or stop of the PLC.
 - c. Discrete input modules shall be 120 VAC and shall have a maximum of sixteen (16) circuits per module. Inputs shall be optically isolated (channel-to-channel) to protect bus circuits from transients and surges. Isolation resistance shall be 1000 ohms minimum at 300 VDC between any set of terminals and any other set or earth ground. Light emitting diodes shall be provided adjacent to each pair of output terminals for on status indication.
 - d. Discrete output modules shall be 120 VAC and shall have a maximum of sixteen (16) circuits per module. Outputs shall be optically isolated (channel-to-channel) to protect bus circuits from transients and surges. Light emitting diodes, one adjacent to each pair of input terminals shall be provided to indicate a closed contact, conducting transistor switch; a low positive logic level, AC line voltage on conditions.
 8. I/O points shall be optically isolated and capable of withstanding low energy common mode transients of 1,500 volts peak.
5. I/O List
 - a. Active inputs and outputs shall be provided according to I/O's shown on the P&ID. Inputs and outputs have been grouped together per PLC system and do not include specified spares or future I/O.
 6. Communications Module
 - a. Provide a fiber-optic Ethernet PLC communications module.

7. Power Supply and Chassis

- a. The I/O chassis shall provide for direct mounting of the CPU, power supplies, communication modules and I/O modules. The chassis shall be available for direct mounting in a 19-inch rack, flush or surface mounted. The I/O chassis shall have at least the number of I/O slots necessary to accommodate any mixture of CPUs, power supplies, communications modules or I/O modules. Modules shall be electrically isolated from each other (as a minimum 1,500VDC) allowing mixed voltages on the same I/O chassis. The chassis shall also allow for mounting both analog and digital I/O modules on the same I/O chassis. The chassis shall be capable of operating as either a CPU or expansion rack.
- b. The power supply shall operate on 120 VAC, 60 Hz, single-phase to power the CPU, communication modules and I/O modules. Power supply shall include a fuse and fuse holder, which is accessible without requiring the removal of the power supply from the chassis.
- c. The CPU shall monitor the power supply status and voltage levels.
- d. The power supply shall operate at the following:
 1. 120 VAC rms +/- 15% continuously.
 2. 120 VAC rms +/- 30% maximum for no more than 30 seconds.
 3. 120 VAC rms +/- 100% maximum for no more than 17 milliseconds.
 4. Line spikes at 100 VAC (5,000 microseconds duration), 0.5% maximum duty cycle.
 5. A single main power supply shall power the CPU and local I/O modules. Auxiliary power supplies shall provide power to remote I/O racks.
 6. At the time of power-up, the power supply shall inhibit operation of the processor and I/O modules until the DC voltages are within specifications.

8. Programming Panel

- a. Provide panel mounted HMI (10" Color touch screen) Allen Bradley Panel View or approved equal.

9. UPS

- a. A UPS shall protect the power supplied to the PLC.
- b. The UPS shall be based on ferroresonant technology, preventing spikes, sags, surges, noise and harmonics from adversely affecting equipment. The UPS shall contain redundant power paths. The UPS input and output power lines shall be galvanically isolated from one another. Input power shall be 240 VAC single phase and output power shall be 120 VAC, 60 Hz.
- c. The UPS shall contain internal backup batteries sufficient to allow all connected equipment to run continuously no less than one (1) hour after a power failure. SI, in coordination with the UPS manufacturer, shall provide total load calculations for UPS sizing, which show meet the requirement of this specification.
- d. The UPS shall automatically switch to battery power upon loss of power to the input line, and back to the input line upon return to normal condition, using a continuous no-break connection to

ensure that there are no momentary power interruptions. An external make-before-break UPS bypass switch shall be provided for maintenance purposes.

- e. The UPS shall be housed in its own NEMA 1 enclosure. The UPS shall include auto-diagnostics and communications capabilities, accessible from the UPS panel and via a RS-232 port. Individual trouble conditions shall be indicated visibly on the panel and a relay output contact shall be provided for a common trouble alarm.
- f. The UPS shall be FERRUPS Model FE as manufactured by Best Power Technologies or Engineer approved equal.
- g. The UPS output shall be wired to a 120 VAC Power Distribution Panel to provide power to all of the Central Data Management equipment located in or near the Control Room.

10. Control And Signal Cable

- a. Control Cable for Class 1 Remote Control and Signal Circuits: Copper conductor; 600 volt insulation, rated 60 degrees C; individual conductors twisted together, shielded, and covered with a PVC jacket; UL listed.
- b. Control Cable for Class 2 or Class 3 Remote Control and Signal Circuits: Copper conductor, 300 volt insulation, rated 60 degrees C, individual conductors twisted together, shielded, and covered with a PVC jacket; UL listed.
- c. Plenum Cable for Class 2 or Class 3 Remote Control and Signal Circuits: Copper conductor, 300 volt insulation, individual conductors twisted together, shielded, and covered with a fluoropolymer jacket; UL listed for use in air handling ducts, hollow spaces used as ducts, and plenums.
- d. 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.

B. Software

- 1. The SI shall provide as part of the PLC system, two software packages to allow off-line or on-line program development, annotating and monitoring on a PC-based computer operator workstation. The software shall support multiple industry standard IEC 1131-3 programming languages. As a minimum, ladder diagram, structured text and Sequential Function Chart (SFC) programming shall be provided.
- 2. The software packages shall include a software license agreement allowing the Owner the rights to utilize the software as required for any current or future modification, documentation or development of the PLC program.
- 3. The software shall provide as a minimum the following functions:
 - a. Annotation of all ladder elements with at least 3 lines of 6 characters each.

- b. Annotation of all ladder rungs with at least 240 characters.
- c. Provide visual "power flow" monitoring of circuit elements (when connected to the PLC).
- d. Provide annotated ladder diagram printout on a standard computer printer for documentation purposes.
- e. On-line help facility.
- f. Download or upload program from the PLC to the computer workstation.
- g. Provide ladder element and I/O cross-reference table.
- h. Provide all monitoring, forcing, programming error detection, searching, configuration, etc. functions as required to allow an operator / programmer to completely program a PLC.
- i. The programming software shall allow the PLCs to be programmed, debugged and downloaded from a computer workstation over the Ethernet data highway.
- j. The PLC software program shall serve the following functions:
"Program shall adjust Pump Motor speed based on level. Program shall read inputs from Flow meter and output Pump Motor speed to Pump VFD."

PART 3 - EXECUTION

3.01 FACTORY ACCEPTANCE TEST (FAT)

- A. Refer to Section 13400 and 13610.
- B. All PLC systems, sub-systems and communication networks shall be tested for proper operation and approved by the Engineer at the SI factory, or other selected site, prior to shipment to the Jobsite.
- C. Tests shall demonstrate all specified control functions by simulating inputs and outputs to the panels.
- D. Acceptance of factory tests by Owner or Engineer shall not constitute a waiver or requirements to meet field tests under specified operating conditions, nor does inspection relieve the SI of his responsibility in any way.

END OF SECTION

SECTION NO. 13460

APPLICATION ENGINEERING SERVICES

PART 1 - GENERAL

1.05 SCOPE OF WORK

- A. The General Provisions of Section 13400 shall apply to this section.
- B. All work in this Section shall be the product of the SYSTEM INTEGRATOR. Sub-suppliers and/or manufacturers may provide components, and/or services to the SYSTEM INTEGRATOR, but the final product shall conform to this specification and shall be the sole responsibility of the SYSTEM INTEGRATOR.
- C. The SYSTEM INTEGRATOR shall provide all applications programming and services required to achieve a fully integrated and operational system. The SYSTEM INTEGRATOR shall coordinate the control system for proper operation with related equipment and materials furnished by other suppliers under other sections of these Specifications and with related existing equipment.
- D. Auxiliary and accessory programming structures necessary for system operation or performance shall be included whether or not they are specified or shown on the Contract Drawings.
- E. All equipment shall be controlled in full conformity with the Specifications, Drawings, engineering data, instructions and recommendations of the equipment manufacturer.
- F. To facilitate the Owner's future operation and maintenance requirements, all programming and operator interface development shall utilize standards as agreed upon by the Owner and Engineer.
- G. The SYSTEM INTEGRATOR shall coordinate and schedule all testing procedures with the General Contractor.

1.06 RELATED WORK

- A. Refer to Section 13400.

1.07 SUBMITTALS

- A. Refer to Section 13400.
- B. Submittals listed below shall be provided, as a minimum. Each submittal must be complete in order to be reviewed by the Engineer.
 - 1. Preliminary Graphics Submittal
 - 2. Process Control Strategy, Graphic Screen and Reports Submittal
 - 3. Testing - Refer to Section 13400.
 - 4. Training - Refer to Section 13400.

5. O&M Manuals - Refer to Section 13400.

C. Submittal Descriptions

1. Preliminary Graphics Submittal

- a. The preliminary graphics submittal be reviewed at the first coordination meeting and shall include the following:
 - 1) Standard symbols
 - 2) Standard color conventions to be used for pumps, valves, filters, pipe colors, equipment on and off, alarm status colors, etc.
 - 3) Sample equipment interface popup displays
 - 4) Alarm acknowledge

2. Process Control Strategy, Graphic Screen and Reports

- a. The SYSTEM INTEGRATOR shall hold a minimum of one workshop to solicit Engineers and Owners input prior to submitting the process control strategies and operator interface submittals. This meeting shall also be used to establish standards for developing the database and control strategies. The submittals shall be reviewed and discussed at the second and third coordination meetings.
- b. The process control strategies shall be developed in a functional block (logic) diagram presentation based on information from the Specifications. Included with each diagram shall be:
 - 1) A short narrative of the control strategy
 - 2) Any assumptions made in developing the program
 - 3) I/O database list showing all field inputs and outputs (AI, AO, DI, DO) associated with the control strategy
 - 4) Cross-reference list of all I/O showing to which I/O modules or software modules they are linked
 - 5) A narrative of the operation of any panels shall be described as it relates to the strategy.
 - 6) A narrative of failure contingencies shall be described in detail

c. This submittal shall cover any associated program (function block diagrams, script language, etc.) developed under this Contract required to implement the control strategy specified.

d. The annotated program shall be submitted in 8-1/2 inch by 11-inch format and on diskette or CDs for all logic developed. Annotation shall be 3 lines of 6 characters each for every logic contact. In addition, each network or rung shall be annotated so that a non-technical person can read and easily comprehend what control function the rung or network is performing.

e. This submittal shall cover the specific plant control strategies as well as the semifinal details of the plant reports and process graphic displays. This submittal shall also include what appears on each display and what calculations are required to support them.

- f. Submitted process graphic displays shall be no less than 8-1/2 inches by 11-inches and in full high-resolution color.
- g. Each system point shall have the capability of being stored historically for an indefinite period of time and shall be capable of being changed. Each system point's raw value shall be available for trending.
- h. A complete list of all signals to be collected for long-term historical information shall be provided. This listing shall include frequency of data sampling and duration for which the data shall be immediately accessible.

1.08 System Description

- D. The SYSTEM INTEGRATOR is responsible for providing all applications programming and configuration services to accomplish the control and monitoring functions described in the Specifications and Contract Drawings. The SYSTEM INTEGRATOR shall provide all programming functions including, but not limited to, any control strategies and communications. The SYSTEM INTEGRATOR shall also provide all application programming and configuration services necessary to produce the HMI graphic displays, reports, trends, historical archive, etc. as described in the Specifications and Contract Drawings.

1.09 PROGRAMMING AND CONFIGURATION GUIDELINES AND DELIVERABLES

- A. Real Variables Processing
 - 1. Real variables shall represent process data for which there are analog signal inputs to the system. The system shall sample each of these input signals at the selected scan frequency and perform the proper conversions and scaling to obtain the instantaneous engineering values. Check for alarm conditions and store for use in historical files.
 - 2. Variables such as rate of flow, weight and kilowatt usage shall have their instantaneous values integrated with respect to time and their quantities totaled before archiving.
 - 3. Alarm conditions shall be stored in a separate historical file.
- B. Calculated Variables Processing
 - 1. Calculated variables shall represent process parameters for which there are no direct analog inputs to the system. These variables shall utilize real variables and manually entered constants or laboratory data to compute their value. The system shall perform periodic real time calculations upon selected database parameters. Calculations shall be operator configurable and shall include, but not be limited to: PLUS, MULTIPLY, DIVIDE, EXTRACT ROOTS, INTEGRATE, DIFFERENTIATE and BOOLEAN LOGIC. Calculations shall allow eight (8) levels of parentheses.
 - 2. There shall be two types of calculated variables defined:
 - a. Calculated variables, which utilize one, or more real variables and / or manually entered constants. These variables shall be treated in the same manner as real variables and shall have the same

attributes as real variables (including alarming and control), with the exception that the calculation shall be performed automatically every 5 seconds.

- b. Calculated variables which are used only for the Daily, Monthly and Annual Operation Summary reports and which utilize laboratory input data shall be computed once a day for inclusion in the Daily report and stored for use in the Monthly and Annual reports. The capability to display these variables shall be provided.

3. The system shall provide for a minimum of 16,385 calculated variables.

C. Manual Input Data Handling

1. The application software shall provide the capability to manually enter data from any operator's computer keyboard. This data shall consist of additional values for the current data file (e.g., laboratory analyses), inserting alarm limits, set point changes, adjustment to process constants, control system set point changes and system tuning parameter adjustments.
2. All manually entered data shall be entered and stored in the appropriate engineering units. All data entered shall be displayed for confirmation on the data entry device prior to incorporation to the database.

PART 2 - PRODUCTS

NONE IN THIS SECTION

PART 3 - EXECUTION

3.02 FACTORY ACCEPTANCE TEST (FAT)

- E. Refer to Section 13400.
- F. In addition to the tests specified in Section 13400, perform the following:
 1. Building and loading the database
 2. Conduct online modifications to the database
 3. Demonstrate operability of the interfaces (hardware and software)
 4. Demonstrate all system software functions specified
 5. Demonstrate operability of all process control strategies, graphic screens and reports
 6. Verify the displays and all interactive capabilities of the operators workstations

7. Simulate selected operating conditions to verify the performance of the monitoring and control functions
8. Demonstrate the performance of the historical database
 9. Demonstrate the performance of the alarm and event logging system
 10. Demonstrate the ability to share data between operator workstations
 11. Demonstrate the ability of each workstation to print reports and graphic displays
 12. Demonstrate the ability for each workstation to read and write to and from designated files from other workstations over the LAN.

END OF SECTION

SECTION NO. 13500

ODOR CONTROL SYSTEM

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. The Work under this Section includes, but is not limited to, design, furnishing, installing, and placing into successful service an odor control system. All equipment shall be installed, adjusted, tested, and placed into operation in accordance with these Specifications, the manufacturer's recommendations, and as shown on the Drawings.
- B. Unit Responsibility:
1. The work requires that the equipment specified herein shall be complete with all accessories and appurtenances, and shall be the end product of one responsible system manufacturer or responsible system supplier.
 2. The Contractor shall obtain each system from the responsible supplier of the equipment. The Supplier shall furnish all components and accessories of the system to enhance compatibility, ease of operation and maintenance, and as necessary to place the equipment in operation in conformance with the specified performance, features, and functions.
 3. The Contractor is responsible for ensuring that new equipment is fully compatible with existing equipment, and that the entire facility is fully functional.
- C. Major constituents of the odor control system include, but are not limited to, the following:
1. Fiber glass or HDPE vessel with inlet and discharge flanged connections
 2. Access fill ports located on the vessel top for media loading
 3. Media sample ports on the vessel on the media beds
 4. Dry media
 5. Mist/Grease eliminator
 6. Vacuum ports
 7. Transition from Mist Eliminator to inlet duct and all other transitions and fittings to connect the packaged odor control system to the captured air ductwork.
 8. Magnehelic differential pressure gauge one (1) for mist eliminator and one (1) for media.
 9. Flex connection at blower inlet with isolation valve.

10. Sound enclosure over motor, and silencer on outlet.
11. Exhaust stack to aid in dispersion with minimum exhaust velocity of 40 fps
12. Media sampling probe
13. Motor and Blower with VFD
14. Drain and fill valves with water supply line and an isolation valve on the duct inlet to the vessel to facilitate to provide the Owner the option of using regenerative media.

D. Control Panel

1. All equipment and appurtenances will be installed as shown and within the footprint given on the Plans, as recommended by the manufacturer and in compliance with all OSHA, local, state, and federal codes and regulations. Contract drawings show only functional features and some of the required external connections. They do not show all components required for a complete installation nor exact dimensions particular to any manufacturer's equipment. Contractor shall supply all parts, devices and equipment necessary to meet the requirements of the Contract Documents and shall make all dimensional adjustments particular to the equipment being furnished. All costs associated with such changes and adjustments shall be considered as being included in the price bid for the work shown and specified.

1.03 SUBMITTALS

- A. Submittals shall be made in accordance with Division 01 Section "Submittal Procedures". In addition, the following specific information shall be provided:
1. Manufacturer shall provide shop drawings, samples, administrative, quality control, and contract closeout submittals in accordance with the requirements of Division 01 and as listed below.
 2. All submittals for a complete odor control systems shall be submitted by the Contractor to the Engineer in one package simultaneously.
 3. Manufacturer shall provide shop drawings for the complete fabrication, assembly and installation drawings, together with electrical and instrumentation shall be submitted for review. All dimensions, parts, construction details and materials of construction shall be shown.
- B. Material:
1. Detailed shop drawings showing weights and dimensions of equipment, all nozzles, wall thicknesses, fabrication techniques, and construction materials.
 2. A description of the proposed quality control program that will be used during the manufacturing of the odor control systems.
 3. A schedule for the odor control system's fabrication along with the location of the fabrication site.
 4. Written instructions as to the recommended methods for unloading, storing, and installing the components and recommended lifting and handling procedures.

5. Submit a list of previous installations and references to the Owner. The proposed odor control fabricator must demonstrate an experience record of at least 5 years with the manufacturer.
6. Submit written installation procedures.
7. Submit factory test certifications.
8. Submit certification indicating the quality control, testing, and inspection have been completed and standards specified herein have been met prior to shipment to the jobsite.
9. Schematic of the system, showing all components and controls.
10. Electrical data for all equipment.
11. Information and data for all instrumentation and controls and for the control panel, including wiring and interconnection diagram.
12. Control panel layout drawing and fabrication details.
13. Complete listing of physical and chemical process parameters required for proper operation of the system.

C. In addition, the following data for motors shall be provided:

1. Name and manufacturer
2. Type and model
3. Bearing type and lubrication
4. Horsepower rating and service factor
5. Temperature rating
6. Full load rotative speed
7. Net weight
8. Efficiency at rated load
9. Full load current
10. Overall dimensions

D. Submit copies of O & M manual(s) as required in Division 01 Section "Project Record Documents" and the "Operation and Maintenance Manuals" article of this specification.

1.04 QUALITY ASSURANCE

A. Manufacturer:

1. Both systems furnished under this section shall be the products of a single manufacturer who has been regularly engaged in the design and manufacture of odor control equipment for a minimum of five years.
2. The manufacturer shall demonstrate experience by a list of at least five successful installations of comparable size (greater than or equal to 7,000 cfm), with references. All references shall include valid contact names and phone numbers that can be verified.
3. The manufacturer must be able to show two or more installations in which the media has lasted for five or more years or more with commensurate performance data.
4. All costs associated with engineering review of an alternate supplier shall be borne by the contractor.

B. Engineering: The cost of any change or modification to mechanical, structural, electrical, and emergency electrical facilities necessary to adapt alternate equipment to the layout and design shown shall be borne by the Contractor.

Contractor and the equipment supplier shall obtain the services of a licensed structural engineer in the State of Georgia to review the design shown on the plans. The contractor's engineer shall check the foundation design and concrete pad design to adequately support the equipment required for the odor treatment systems. Calculations shall be submitted to the Owner for review. If redesign is required contractor's engineer shall prepare plans and specifications sealed by a Georgia licensed professional engineer for submittal to the Owner and Engineer. Clearances shown on the Drawings shall be maintained. Any such proposed changes or modifications are subject to review and acceptance of the Owner. All costs associated with the engineering review shall be borne by the Contractor.

- C. Coordination: To ensure that all the equipment is properly coordinated and will function in accordance with the requirements of the Contract Documents, the Contractor shall obtain all equipment specified herein from an odor control equipment manufacturer in who shall be vested unit responsibility for the proper function of the complete system. However, The Contractor shall retain ultimate responsibility under this Contract for equipment coordination, installation, operation and guarantee, and the Contractor shall furnish and install all labor, equipment, materials, appurtenances, specialty items and services not provided by the supplier but required for a complete and operable system. The equipment covered by this specification is intended to be standard equipment of proven ability as manufactured by reputable firm having extensive experience in the production of such equipment. The equipment furnished shall be manufactured and installed in accordance with the best practice and methods, and shall operate satisfactorily when installed as shown and as specified in the Contract Documents.
- D. Alternate Manufacturers:
1. The Drawings and Specifications uses a PureAir Filtration Radial Flow Assembly as the "basis of design equipment". Additional acceptable odor control manufacturers include ECS, Purafil Environmental Systems Division, Siemens, Enduro Composites, Inc., or pre-approved equal. This is not intended to restrict competition or rule out comparable competitive alternate odor control systems that may have certain superior or inferior features not affecting the basic operation of the equipment, but is for the purpose of establishing the minimum standard of quality and features.
 2. The Engineer will not provide new Drawings for construction showing alternate odor control systems. Manufacturers of alternate odor control systems shall provide revised Drawings to the Contractor. The revised Drawings will be amendments to the Construction Documents and will become part of the Contract Documents. Change Orders will not be issued to pay the cost of the changes necessary for use of an alternate odor control system. Contract time will not be increased for the use of an alternate odor control system.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Components and accessories shall be shipped in safe packaged containers to prevent damage. Installation of components at the job site shall be in strict

compliance of manufacturer's recommendations and under adequate supervision provided by the system supplier.

1. Media shall be stored off the ground on a clean level, surface. Avoid cross contamination of foreign materials during handling and placement. Media shall be covered if stored prior to installation.
2. Long term media storage is not acceptable.
3. All electrical and ancillary equipment shall be stored in a climate controlled building greater than 50 degrees F.
4. Do not store media for more than 30 days.

- B. Protect all components during storage and shipment in accordance with the manufacturer's recommendations.

1.06 WARRANTIES AND BONDS

- A. Contractor shall provide a warranty against defective or deficient materials and workmanship in accordance with the requirements of Division 01 Section "Closeout Procedures".
- B. The manufacturer shall warrant the media for a minimum period of 2 years including full replacement costs, including but not limited to labor, equipment rentals, and compensation for Owner's loss of operation, from the date of Substantial Completion, provided that the system is operated in accordance with the manufacturer's printed Operation and Maintenance Manuals.
- C. All mechanical components shall be warranted free of manufacturing defects a period of 12 months from substantial completion.
- D. The Contractor shall procure and provide copies of all certified manufacturer's warranties to the Owner. The complete system, including accessories and components, shall be warranted for a minimum of one year by the manufacturer

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. The following items listed are to be supplied by the Contractor and the Equipment Manufacturer:
1. Installation and assembly of all equipment and instrumentation components required a complete operating system including labor, equipment and materials. Equipment installation to include odor controlling media vessel, blower and motor, control panels, bolts, ductwork, mist eliminators, sound protection, piping and duct supports, and all associated instrumentation and controls.
 2. Site preparation and clearing of materials.
 3. Appropriately sized reinforced concrete slabs for filter vessels, mist eliminator and blower placement.
 4. Install media. Contractor shall remove the covers, install and distribute media as recommended by manufacturer, and reinstall the covers.
 5. Supply and install all external water piping and drain piping to and from the equipment, including heat tracing, insulation, piping supports and drainage traps.
 6. Supply and install all air ductwork to and from the odor control systems including manual or actuated dampers (and actuators), filters, insulation, piping supports and Owner-selected exhaust configuration.

7. Utility requirements including main electrical service and all system field wiring outside the main control panels including all instrumentation wiring.
- B. The following system conditions apply.
1. Odor control systems using masking agents will not be considered.
 2. Odor control systems using "counteractants" will not be considered.
 3. Odor control system using chemicals including chemical scrubbers or biological systems will not be considered.
 4. Odor control systems that are not completely enclosed, including weather resistant covers to protect the media, extending media life and reducing energy consuming pressure losses will not be considered.
 5. Systems that do not provide for periodic flushing or cleaning of the media, when regenerative media is supplied, will not be considered.
 6. Substitution of the specified media must be pre-approved.
 7. It is the intent of this specification that a complete odor treatment system is provided by a single manufacturer having complete system responsibility

2.02 DRY MEDIAS

- A. The Radial Flow System shall contain media to provide complete removal of sewage odors. Once spent, the media shall not be considered hazardous waste and shall be capable of being disposed of in a municipal landfill.
- B. TYPE: The activated carbon shall be virgin, pelletized, derived from high grade bituminous coal, vapor phase type, suitable for the control of sewage odors. The media shall be designed to remove hydrogen sulfide and reduced-sulfur compounds as described in 2.13 below.

C. Specifications

CTC Value	70% min
Surface Area	1050 m ² /g
Density	580 kg/m ³
Moisture Content	15%
Hardness	97 min
H ₂ S Capacity, g H ₂ S/cc ¹	Greater than 0.30

- a. The determination of H₂S breakthrough capacity will be made by passing a moist (85% R.H.) air stream containing 1% H₂S at a rate of 1,450 cc/min. through a 1 inch diameter by 9 inch deep bed of uniformly packed activated carbon and monitored to 50 ppm breakthrough. Results are expressed in grams H₂S removed per cc of carbon. Test shall be performed per ASTM Test method D-6646, without modification or addition.
- D. Media shall consist of suitable materials without restricting the flow of air through the media. The media supplied shall have been used successfully in the treatment of odors of similar size and configuration for at least five years.
- E. The media shall not shrink or swell with varying moisture contents.
- F. The media shall be resistant to the corrosive attack of acids.

2.03 ADSORBER VESSEL:

- A. The reactor vessel shall be of HDPE or FRP. Alternate materials will not be accepted.
- B. The reactor vessel shall be capable of processing odorous air at such a velocity that the empty bed contact time (EBCT) across the activated carbon bed shall not exceed 2.16 seconds.
- C. The reactor vessel shall be configured such that odorous air enters through the outside surface of the annular carbon bed (via an air inlet in the vessel sidewall), is processed through the carbon bed, and exits through the center top outlet.
- D. The reactor vessel shall not require personnel entry into the reactor vessel for the purposes of loading, leveling, and unloading the activated carbon media.
- E. The reactor vessel shall have a support system for the annular carbon bed which shall consist of structural components and media retaining screens.
- F. The odor control reaction vessel unit shall be a self-contained unit.
- G. All piping shall be schedule 80.
- H. Unit dimensions as shown on the drawings.
- I. Pressure gauge: Differential "Magnehelic"- style pressure gauge; mid-point of gauge range shall be approximately normal operating pressure; accuracy to be sufficient to determine critical changes in operation.
- J. Grounding rod: 316 stainless steel ground rod, factory installed
- K. Flanged inlet/outlet shall be sized and drilled per PS 15-69.
- L. The reactor vessel shall include a manometer to give a direct read-out of differential pressure in inches of water column across the system. Full range of the manometer should be twice the expected normal operating differential pressure.
- M. A transition duct and flow control damper shall be installed between the fan outlet and the vessel, to regulate airflow through the vessel. The manufacturer of the odor control system shall furnish the damper.
- N. Particulate (grease and mist eliminator) filter assembly will be supplied.
- O. Lifting and hold down lugs are to be of stainless steel construction.
- P. A drain port fitted with a ball valve is to be provided at the bottom of the vessel.
- Q. Pre-approval required to be submitted to engineer 14 days prior to bid

2.04 HDPE VESSEL SPECIFICATIONS:

- A. Scrubber vessels shall be constructed of High-Density Polyethylene (HDPE). The polyethylene shall be of virgin material, containing no fillers. Pigments and ultraviolet stabilizers shall be integrated in the resin. Minimum mechanical properties of the HDPE shall be as follows:
- B. Vessel design shall be an upright, single wall, flat bottom, polyethylene VBS vessel for odor and corrosion control application(s). Each vessel is to be constructed according to ASTM D 1998 and NSF 61 standards and will be capable of storing the internal support structure, media and design CFM requirements.
- C. Vessels are designed for above-ground, vertical installation and are capable of containing specified medias at designed pressure.
- D. The material used shall be virgin polyethylene resin as compounded and certified by the manufacturer. Vessels shall be made from high density linear polyethylene (HDLPE) resin as manufactured by ExxonMobil Chemical, or resin of equal physical and chemical properties.

- E. All polyethylene resin material shall contain a minimum of a U.V. 8 stabilizer as compounded by the resin manufacturer. Pigments may be added at the purchaser's request, but shall not exceed 0.25% (dry blended) of the total weight.
- F. Mechanical Properties of Type II vessel material: High density Linear (HDLPE)

Resin Properties	Typical Valve Unit	Test Based On
Density	0.956 g/cm ³	ASTM D1505
Melt Index (190°C/2.16kg)	0.30 g/10min	ASTM D1238
Thermal		
Brittleness Temperature	< -76° F	ASTM D746
Vicat Softening Temperature	261° F	ASTM D1525
Molded Properties		
Tensile Strength at Yield	4030 psi	ASTM D638
Tensile Strength at Break	1970 psi	ASTM D638
Flexural Modulus	180000 psi	ASTM D790
Environmental Stress-Crack Resistance (100% Igepal)	366 hr	ASTM D1693B
Impact		
Tensile Impact Strength (73° F)	126 ft-lb/in ²	ASTM D1822

2.05 FRP Vessel Specifications

A. Scrubber Housing

1. Resin - The scrubber shall be fabricated of a premium quality, industrial grade vinyl ester resin such as Reichhold Dion 9300 or approved equal. The proper resin will be selected based upon meeting all structural and mechanical, as well as chemical resistance requirements of the project. The resin shall contain no fillers, except as required for fire retardance. Antimony Trioxide will be permitted up to a five percent limit, as recommended by resin the manufacturer, to establish a product with a Class I flame spread rating of 25 or less when tested per ASTM-E84.
2. Exterior Gel Coat - The scrubber housing exterior will utilize an industrial grade gel coat. It will be pigmented and shall contain UV inhibitors. Material used shall be that of Ram Chemical Company or an approved equal.
3. Fiberglass Reinforcement - Glass fibers shall be of an industrial grade as manufactured by Owens-Corning or an approved equal.
4. Interior Surface - The interior surface of the scrubber housing shall be resin rich. A corrosion barrier including a minimum of 10 mils chemical resistant veil shall be applied. Veil type will provide adequate resistance to chemicals in the process.

B. Inlet and Outlet Transitions

1. Outlet transition shall be included and fabricated of the same material as the scrubber vessel. The transition shall be designed to provide a smooth transition from duct velocity to scrubber velocity without causing airflow

disruptions. The transition will include a flange to match the scrubber body as well as duct connections.

2.06 STATIC GROUNDING OF CARBON BED:

- A. Include provisions to ground the carbon bed. Submit details to demonstrate that the carbon bed will be grounded. Provide grounding materials and hardware for connection to the system grounding grid.

2.07 DAMPERS:

- A. Opposed multiblade for balancing, butterfly for open-close type, as indicated, constructed of one gage heavier than respective duct, with lever-type accessible locking-quadrant identified with OPEN and CLOSE position.
 - 1. Butterfly damper leakage not to exceed 5.25 CFM per inch of circumference against 30" W.G.
- B. Material, same as ductwork except as otherwise noted.

2.08 GASKETING AND SEALING:

- A. Make all sealing methods and materials resistant to hydrogen sulfide.
- B. Fabricated gaskets: Machine-made or die-stamped with inside and outside edges parallel or concentric, as applicable. Make bolt holes oversized to prevent crimping of gasket when installed.

2.09 CARBON ADSORBER ACCESSORIES:

- A. Ball valves on sample probes to be PVC.
- B. Manometer-differential pressure across each carbon bed, wall or tank mounted, calibrated in inches of water column. Dwyer gauge series 2000

2.10 FAN:

- A. General
AMCA rated and constructed.
 - 1. Impeller wheels statically and dynamically balanced, free from vibration or noise.
 - 2. Provide electric motor, drive equipment, belt guard, vibration isolators, supports and appurtenances.
 - 3. Provide fan with non-overloading characteristics for the horsepower indicated.
 - 4. V-belt drive rated 50 percent greater than motor horsepower with adjustable sheaves to provide fan speeds 10 percent above or below rating point.
 - 5. Electric motors mounted on adjustable heavy steel plate.
 - 6. Motors for fans with backward-inclined blades shall operate within motor nameplate rating at all speeds provided by adjustable-pitch sheaves.
 - 7. Provide integral or supplementary vibration or sound-adsorbing fan mountings.
- B. Centrifugal Fan:
Single-width, single-inlet, multiblade design, backward-inclined blades. Drive motor, fan and casing mounted on common rail or support base with vibration

isolators.

1. Construct fan of fiberglass reinforced polyester. Encase steel shaft in an FRP sleeve.
2. Provide a casing drain, flanged inlet and outlet connections.
3. Belt-driven fan with two self-aligning bearings on fan shaft.

2.11 MOTORS:

- A. Totally enclosed, fan cooled. Chemical and mill duty. 1.15 service factor.

2.12 SPARE PARTS:

- A. Provide in accordance with Section 01600.
- B. Furnish and deliver to the Authority at site of Work the following spare parts, all identical and interchangeable with similar parts installed in Work:
 1. Complete set of replacement belts for each fan.
 2. Deliver spare parts at a time and place acceptable to the Owner.

2.13 DESIGN SPECIFICATIONS AND PERFORMANCE REQUIREMENTS

- A. System shall meet the following design and performance criteria:
 1. Single Stage Radial Flow Unit. .
 2. Total Design Air Flow Rate: 7,000 cfm
 3. Number of Units: 1
 4. Airflow Capacity cfm: 7,000 at 7.25 IWG
 5. Location: Outdoors.
 6. Ambient Air Temperature Range: 10 to 110 degrees F.
 7. Relative Humidity: 60 to 100%.
 8. Hydrogen Sulfide Concentration:
 - a. Peak: 15 ppmv.
 - b. Removal Efficiency: 99.95% removal at all levels
 11. Air Changes per Hour 12
 12. Minimum carbon life 2 years
 13. Media Capacity (minimum) 900 cubic feet
- B. Provide odor abatement systems capable of handling and safely removing hydrogen sulfide (H₂S) and Volatile Organic Compounds (VOCs) from its air stream as follows:
 1. 99.95 percent efficiency H₂S removal.
 2. 70 percent efficiency VOC removal.
- C. Equipment Purpose: To handle odorous gases from the wetwell, and channels. Design system and components for 24 hour per day operation, continuous duty.
- D. The Odor Control System consists of radial flow activated carbon adsorber systems, complete with fans, motors, valves, gages, piping, ductwork, motor operated dampers and other items, as indicated on the drawings and as specified hereinafter.

2.14 MOUNTING UNITS

A. Each unit shall be furnished with concrete anchors and hold down lugs, complete with 316 stainless steel plates, bolts, nuts, and washers for proper anchoring of the unit as required by the design calculations.

B. All metal hardware shall be 316 stainless steel.

C. The media shall be accessible through openings located so the media can be inspected routinely and replaced as necessary without the need to disassemble the units.

2.15 FANS AND DUCTWORK

A. Ductwork to be supplied by Contractor; refer to Section 15810 Nonmetal ducts for detailed requirements; for specific routing and type, refer to the Drawings.

2.16 MIST ELIMINATOR/PRE-FILTER

A. The mist eliminator shall be designed to remove 99% of water vapor (>4 micron diameter)

B. The mist eliminator shall be located at the air inlet. Water collected shall drain into a collector pan and into the drain system. The drain system, complete with loop seal (P-trap), is required to overcome the vacuum created by the downstream blower.

C. The mist eliminator pad shall be 2 inches in thickness at a minimum and shall consist of six layers of Kimre 1696 general purpose polypropylene mesh or approved equal.

D. Hinged access doors with gaskets shall allow for the mist eliminator to be removed, cleaned, and/or replaced.

F. Pressure taps and gages shall be installed to permit a local read out of the pre-filter pressure drop.

G. Mist eliminator shall be centered at inlet.

H. An inlet transition shall be provided by vessel manufacturer and connect to the mist eliminator.

2.17 PIPING

A. All piping shall be SCH 80 PVC. The Contractor shall heat trace and insulate all exposed piping.

2.18 INSTRUMENTATION AND CONTROLS

A. The electrical control panel shall provide electrical control for the unit. An operator interface and display shall be provided that contains the following:

1. "Hands-Off-Auto" selector switch
2. Indicating push-to-set LED style lamps: "Fan Off" and "Fan Running"
3. Air Flow

- B. A 460 / 120 VAC 3-phase feed shall be supplied to the panel for use to power the system.
- C. Motor starter: FVNR, ATL, with overload heaters, NEMA sized as required for the supplied motor 460 VAC motor.
- D. Control panel transformer: 460 / 120 VAC with fused primary and secondary
- E. Main circuit breaker: magnetic with front-panel operating handle.
- F. The control panel enclosure shall be constructed of 316 stainless steel and rated NEMA 4X. The panel shall be factory tested to full operation with all other components prior to shipment. The local control panel shall be provided with a sun and rain shield.
- G. Provide fuse protection for all motor circuits. Provide two spare fuses of each size and type.
- H. Differential Pressure: A gauge shall be provided with the unit to permit local readout of pressure drop through the mist eliminator. The gauge shall be manufactured by Dwyer, or approved equal. Contractor shall be responsible for field mounting gauge per manufacturer's recommendations. Gauge shall be Magnehelic type.
- I. Instrumentation and control shall comply with all Division 13 Specifications and Electrical shall comply with all Division 16 Specifications.
- J. The odor control system is to be connected to the pump station's Control System and Mission Telemetry System.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. The odor control system shall be installed in accordance with the supplier's installation instructions, and in compliance with all OSHA, local, State, and Federal codes and regulations.

3.02 FIELD QUALITY CONTROL

- A. Supplier will provide the services of a factory-trained representative to check the installation and to start-up the odor control system. The factory representative will have complete knowledge of proper installation, operation, and maintenance of equipment supplied. Representative will inspect the final installation and supervise a start-up test of the equipment.

3.03 COOPERATION AND MAINTENANCE TRAINING

- A. The Contractor shall provide the services of a factory-trained manufacturer's representative to provide training of the Owner's personnel in the proper operation and maintenance of the equipment. Prior to final acceptance, the Contractor shall furnish the Owner with two copies of the manufacturer's certifications.

3.04 OPERATION AND MAINTENANCE MANUALS

- A. Initial Manual Submittal: Submit draft copy of each manual at least 30 days before commencing initial testing. Engineer will comment on whether general scope and content of manual are acceptable.
- B. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing initial testing. Engineer will return copy with comments.
 - 1. Correct or revise each manual to comply with Engineer's comments. Submit copies of each corrected manual within 15 days of receipt of Engineers comments and prior to commencing initial testing.
- C. Furnish, prior to substantial completion, six (6) copies of final maintenance manuals. All corrections shall have been made necessary to comply with Engineer's comments in the final manuals. Final manuals shall be indexed and composed of suppliers' maintenance manuals on all equipment and suppliers' brochures on all specialty equipment, including performance curves with size, model, figure number, etc., indicated to identify unit furnished.
- D. Maintenance manuals are to be of a hardback, loose-leaf type and of a durable quality. In addition, a complete electronic copy shall be provided in Excel, MS-Word or searchable Adobe PDF format.
- E. Manuals are to be for the specific equipment provided. Manuals describing general equipment lines will not be accepted. Where non-relevant information is present in the manual, it shall be neatly marked out with a single "X" through non-relevant portions.
- F. Include in each set of manuals the following:
 - 1. Manufacturer's parts list identified with the make, model and serial number of the equipment furnished.
 - 2. Control and wiring diagrams.
 - 3. Installation, operation (including start up and shut down procedures), lubrication and maintenance instructions.
 - 4. Manufacturers recommended spare parts list.
- G. If an Owner's representative is assigned to the project either through the Owner or the Engineer, the Contractor shall make a copy of all instruction manuals available to the Representative. Manuals on specific items shall be available prior to installation of the item. This requirement in no way relieves the Contractor of his other responsibilities.

3.05 MANUFACTURER'S SERVICES

- A. The Contractor shall include in his bid all costs associated with providing the services of the manufacturer's field representative for checking, aligning, testing, placing in operation, and Owner training.

- B. The system manufacturer's representative shall be present at the job site for the following time period; travel time excluded:
 - 1. One day for inspection and certification of the installation.
 - 2. Two day to train Owner's staff in operation of the system.
 - 3. Five days for initial startup and monitoring of system.
 - 4. One follow-up trip for three days, three to four weeks after startup to assess the acclimation process, adjusts to steady state operation.
 - 5. Five days for performance testing.
 - 6. A minimum of five trips are required.

3.06 PERFORMANCE TESTING

- A. General: The Contractor shall be responsible for all costs associated with odor control system performance testing of each system.
- B. Functional Testing: Using nonodorous ambient air, the entire odor control system shall be operated for not less than 24 continuous hours in order to demonstrate the mechanical and electrical integrity of the system. Any mechanical or electrical breakdowns, unusual vibrations, or control sequencing problems shall be considered sufficient cause to reject the test.
Inability to successfully complete the functional testing in five tries shall be considered cause for the Owner to reject the odor control system. Contractor shall balance all air flows prior to system performance testing.
 - 1. Conduct on each piece of equipment in the system.
 - 2. Alignment: Test complete assemblies for correct rotation, proper alignment and connection, and quiet operation.
 - 3. Blower Vibration Test
 - 4. Ductwork Pressure Testing:
 - a. Conduct pneumatic tests on all ductwork at the pressures listed.
 - b. Test procedures shall be as specified in Division 15 of these specifications.
- C. Air Balancing:
 - 1. Provide for services of an independent air balancing and testing firm to balance the odorous air into odor control system as specified in Division 13 of these specifications.
 - 2. Test and balance odor control system in operation.
- D. Odor Control System:
 - 1. Test all system components for proper adjustment and operation in both the manual and automatic operating modes.
 - 2. Provide certification of functional acceptance prior to commencing performance testing.
 - 3. Test under design average loading condition for 1 hour.
- E. Sampling and Data Measurement: During the test period, as a minimum, the following data and measurements shall be taken at the frequency specified above:
 - 1. Overall system airflow rate (cfm).
 - 2. Discharge pressures (inches WC).
 - 3. Inlet Airflows (cfm): Measurement of airflows shall be performed using an anemometer or pitot tube instrument previously approved by Engineer.
 - 4. Hydrogen sulfide concentrations (ppbv/ppmv) at the inlet and outlet to the system: H₂S measurements to be performed by hand-held instrument previously approved by Engineer (i.e., Jerome 631X). Inlet H₂S

- concentrations during each sampling period shall first be screened using gas-phase H₂S adsorbent tubes (e.g., GAS-TEC).
5. Hydrogen sulfide (ppbv) outlet concentrations: Individual sampling event performance results will then be calculated by:
 - a. Percent Removal = (Inlet – Outlet)/Inlet.
 - b. Note: Individual hourly removal rates shall be averaged to determine system average removal rates for hydrogen sulfide.
 - 6 Other Sulfur Compounds: Two samples shall be collected from the outlet during the testing period and analyzed for other sulfur compounds. Sulfur speciation shall be in accordance with ASTM 5504
- F. Sampling Log: A sampling log shall be maintained that will include:
1. Date, time, location, sampler, and results of each sample.
 2. Weather conditions for the sampling day.
 3. A qualitative description of the operation of the wastewater and wastewater treatment processes.
 4. A description of any exceptions from the sampling plan.
- G. Bed Pressure Drop: Pressure differential measurements shall demonstrate that differential pressure (pressure drop) across the bed does not exceed pressure limits specified.
- I. Hydrogen Sulfide Sampling and Analysis:
1. Hydrogen sulfide sampling shall be completed using a Jerome Model 631 X Analyzer or approved equal with a detection limits of 1 ppbv.
 2. The analyzer shall be operated in compliance with the manufacturer's instructions.
 3. A copy of the instructions shall be submitted with the final report.
 4. The results of the hydrogen sulfide sampling shall be recorded in the sampling log.
- J. Manufacturer shall submit a plan to start-up, acclimate and test the odor control units. The performance testing plan shall list the name of the testing laboratory being proposed, the H₂S monitoring and recording equipment, the procedures that will be followed during the 72 hour test period, and any other procedures required to successfully evaluate the units.
- K. Manufacturer shall monitor the start-up and acclimation of the units. Acclimation period shall be three weeks from the date of start-up of the complete odor control system.
- L. Performance testing shall be conducted by a pre-approved testing laboratory following the approved acclimation period for the odor control units and within the first year of operation following receipt of an adequate representative wastewater flow to the station.
- M. Test under the loading conditions for three continuous days (72 hours).
- N. Manufacturer shall submit a report of the test procedures and results to the Engineer within one week of the conclusion of the performance test.
- O. If the system fails the performance test, the Manufacturer, at the Owner's request, will correct any system deficiencies and re-test at the Manufacturer's expense using the same procedures outlined above. No additional payment shall be made for adjustments, modifications and re-testing. Following three failed tests, the Contractor shall replace the system with equipment that meets the specified requirements at the Owner's request.

3.07 IDENTIFICATION PLATES:

- A. Affix identification plates to switch boxes, controls equipment and appurtenances.

END OF SECTION

SECTION NO. 15016

PRESSURE TESTING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work under this section includes pressure testing of all piping systems, and includes requirements common to all mechanical systems herein. Provide all labor, tools, instruments, etc., as required to completely test the systems.
- B. All work provided under these specifications shall be subject to constant inspections and final approval of Engineer and all Code authorities having jurisdiction. Tests, in addition to those specified herein, required to prove Code compliance, shall be provided as required by the authorities without additional cost to Owner. All work found to be defective or indicating leakage shall be repaired or replaced with new materials, as directed by Engineer. Tests shall be repeated until all work is proven to have been installed properly.

1.2 QUALITY CONTROL

All tests shall be conducted by qualified personnel. When requested, qualifications of individuals shall be submitted to Engineer for approval.

1.3 NOTIFICATION

- A. The Engineer shall be notified prior to all tests.
- B. Code authorities having jurisdiction shall be notified prior to all tests.

PART 2 - PRODUCTS

2.1 GENERAL

Provide all materials, test equipment, instruments and labor required for the tests. All instruments shall be properly calibrated and shall have records on calibration.

PART 3 - EXECUTION

3.1 CONCEALED WORK

All concealed work must remain uncovered until required tests have been completed; however, in the event the project schedule requires, the Contractor shall make arrangements for prior tests on the portion of the work involved. The costs of all tests shall be borne by the Contractor.

3.2 DUCTILE IRON PRESSURE PIPING SYSTEMS

Ductile iron pressure piping systems shall be hydrostatically tested at 150 psi for 2 hours.

3.3 PVC PRESSURE PIPING SYSTEMS

PVC pressure piping systems shall remain undisturbed for 24 hours prior to pressure testing to achieve full joint strength. Systems shall be air tested at full operating pressure 12 hours.

3.4 PLUMBING SYSTEMS

- A. Water piping shall be proven tight by a hydrostatic test of not less than 150 psig. for a period of not less than two (2) hours. Piping shall be tested as an entire system, but all underground and concealed piping shall be tested and approved before the piping is covered.

- B. Soil, waste, and vent piping shall be proven tight by a hydrostatic test of not less than 10 ft. of head measured at the highest fixture or drain connection into that portion of the system being tested. The system shall hold the required pressure for a period of not less than one (1) hour. Each joint shall be inspected for leaks while under pressure. Piping systems may be tested as a complete system, or in sections according to the Codes having jurisdiction. However, no part of the piping system shall be tested to a lower pressure than that specified. All underground and concealed piping shall be tested and approved before the piping is covered.

CARBON STEEL PIPING SYSTEMS

Carbon steel piping systems shall be air tested at 25 psi for 2 hours, during which time each exposed joint shall be soap tested for visible leaks.

END OF SECTION

SECTION 15060

PIPE AND PIPE FITTINGS

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. Furnish all labor, materials, equipment and incidentals required and install, in the locations inside, and under buildings and structures as shown on the drawings, all piping, fittings and appurtenances as specified herein.
- B. Furnish all concrete thrust blocks, excavation, backfilling, sheeting, slope protection, drainage, concrete work, rip rap, grading and all other work necessary to complete the construction, installation and testing of the piping.
- C. The Contractor's attention is called to the fact that all PVC piping and accessories are not necessarily shown completely on the schematic drawings. However, the Contractor shall furnish and install all piping shown or required for proper operation of the equipment of services requiring such piping.

1.2 RELATED WORK

Section 02221 – Excavation, Backfill Fill and Grading for Pipe
Section 03300 – Miscellaneous Concrete
Section 11500 – Dry Pit Submersible Wastewater Pumps
Section 15016 - Pressure Testing
Section 15050 - Basic Materials and Methods
Section 15094 - Pipe Hangars and Supports
Section 15100 - Valves and Appurtenances

1.3 REFERENCES

American Society for Testing and Materials (ASTM):

- A53-96 Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
- A74-96 Specification for Cast Iron Soil Pipe and Fittings.
- A106-95 Specification for Seamless Carbon Steel Pipe for High-Temperature Service.
- A182/ Forged or Rolled Alloy-Steel Pipe
- A182M-98 Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service
- A312/312M-95 Seamless and Welded Austenitic Stainless Steel Pipe
- B32-96 Specification for Solder Metal.
- B88-96 Specification for Seamless Copper Water-Tube.
- B306-96 Specification for Copper Drainage Tube (DWV).
- C564-95a Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
- D312-95a Specification for Asphalt Used in Roofing.
- D2241-96 PVC Pressure Rated Pipe.
- D2564-96a Specification for Solvent Cements for Poly (Vinyl Chloride)(PVC) Plastic Piping Systems.

1.4 SUBMITTALS

- A. Shop drawings and product data shall be submitted in accordance with Section 01300.
- B. Submit to the Engineer within thirty (30) days after Notice to Proceed a list of materials to be furnished, the names of suppliers and the date of delivery of materials to the site.
- C. Shop drawings shall indicate piping layout in plan and elevation as may be required. Drawings shall be completely dimensioned. The drawings shall include a complete schedule of all pipe, fittings, specials and supports. Special castings shall be clearly detailed showing all pertinent dimensions.
- D. All ductile-iron pipe and fittings to be installed under this Contract shall be inspected and tested at the foundry as required by the standard Specifications to which the material is manufactured. Furnish in duplicate to the Engineer sworn certificates of such tests and their results. In addition all ductile-iron pipe and cast-iron fittings to be installed under this Contract may be inspected at the foundry for compliance with these Specifications by an independent testing laboratory selected by the Owner. The manufacturer's cooperation shall be required in these inspections. The cost of foundry inspection of all pipe approved for this Contract, plus the cost of inspection of a reasonable amount of the disapproved pipe, will be borne by the Owner, as outlined in the General Conditions.
- E. The Contractor shall furnish the Engineer with lists, in duplicate, of all pieces of pipe and fittings in each shipment received. These lists shall give the serial or mark number, weight, class, size and description of each item received.

1.5 QUALIFICATIONS

All of the pipe and fittings shall be furnished by manufacturers who are fully experienced, reputable and qualified in the manufacture of the materials to be furnished. The pipe and fittings shall be designed, constructed and installed in accordance with the best practices and methods and shall comply with these Specifications as applicable.

PART 2 - PRODUCTS

2.1 COPPER TUBING

A. Joints

Aboveground pipe, Type L Tubing: Seamless hand drawn or annealed, ASTM B88.
Buried pipe, Type K Tubing: Seamless hand drawn or annealed, ASTM B88.
Type DWV Tubing: Seamless hand drawn, ASTM B306.

B. Fittings

1. Copper tubing solder fittings: Brass Casting, ANSI B16.18 or wrought copper ANSI B16.22.
2. Copper tubing solder drainage fittings: Brass Casting, ANSI B16.23 or wrought copper, ANSI B16.22.

3. Threaded: Standard weight, banded ANSI B16.15

C. Joints

1. Wire type solder applied in accordance with the manufacturer's recommendations. No paste solder or flux solder will be allowed.
2. Copper joints underground, under floors on grade, or concealed in chases shall be brazed with silver solder.
3. Copper joints exposed above the floors on grade or readily accessible above removable ceilings shall be made with 95-5 wire solder or brazed with silver solder.
4. Connections of copper to ferrous piping or equipment shall be made with dielectric couplings and proper adapters.
5. Solder joints at valves shall be made with 95-5 solder only. Flare connections to equipment will be allowed where required.
6. Ends of all pipe and tubing shall be cut square and reamed smooth. Ends of tubing and pipe and cups of fittings shall be cleaned of oxides by mechanical means and lightly fluxed as soon as possible with a non-corrosive paste type flux. When inserting pipe or tubing into a fitting a slight twisting motion shall be applied to spread flux.
7. All joint materials to be certified lead free.
8. Mechanically jointed: Victaulic Style 606 couplings, used with drawn temper tubing only.

D. Protective Coating

1. Bitumen, Cabots', Flexi-Black or approved equal.

2.2 STAINLESS STEEL PIPING

A. Pipe

ASTM A312, Grade 304L, Schedule 10 minimum wall thickness for pipe sizes larger than 2 inches; Schedule 40 minimum for pipe sizes 2 inches and smaller. The entire length of weld in each longitudinal welded pipe shall be radiographically examined in accordance with ASTM A 312/A 312M, S5 Radiographic Examination.

B. Fittings

1. Threaded Fittings and Socket Welding Fittings: ANSI B16.11, except stainless steel shall conform to ASTM A182/A 182M, Grade F304L.
2. Buttwelding Fittings and Tapered Reducing Fittings: ANSI B16.9, except stainless steel shall conform to ASTM A 403/A 403M, Class WP, Type 304L, of the same weight as the pipe in which the fittings are installed.
3. Flanges: ANSI B16.5, Class 150, except stainless steel shall conform to ASTM A182, Grade F304L.
4. Unions: ASME/ANSI B16.39, Class 150, except stainless steel shall conform to ASTM A312, Type 304L.

C. Joints

1. Welded Joints
 - a. Process for Stainless Steel: ANSI B31.3, Gas Tungsten Arc Process or Gas Metal Arc Process.
 - b. Welding Electrodes: AWS A5.4, E308L electrodes.

2.3 CARBON STEEL PIPING

A. Pipe

ASTM A53/A53M-99b, Type E (electric-resistance welded, Grades A or B) or Type S (seamless, Grade A or B), weight class STD for pipe sizes larger than 2 inches, weight class XS (extra strong) for pipe sizes 2 inches and smaller.

B. Fittings

1. Threaded Fittings and Socket Welding Fittings: ANSI B16.11. Threaded fittings may conform to ANSI B16.3, Class 150.
2. Butt welding Fittings and Tapered Reducing Fittings: ANSI B16.9, ASTM A234/A 234M, Type WPB, of the same material and weight as the piping in which fittings are installed. Backing rings shall conform to ANSI B31.3 and shall be compatible with materials being welded.
3. Flanges: ANSI B16.5, Class 150, raised face type, ASTM A 105/A M.105M.
4. Unions: ASME/ANSI B16.39, Class 150.

C. Joints

1. Welded Joints

- a. Process for Carbon Steel: ASME B31.3, Metallic Arc Process.
- b. Welding Electrodes: AWS A5.1 or AWS A5.5, E70XX low hydrogen electrodes.

2.4 POLYVINYL CHLORIDE (PVC) PIPING

A. Pipe

1. ASTM D2241, Standard specification for PVC pressure pipe.
2. ASTM D 1784-99a and ASTM D 1785-99, Class PVC 1120, Schedule 80. Pipe shall be suitable for field cutting, welding, bending and coupling.

B. Fittings

1. Solvent Weld Fittings: Socket type, ASTM D2467-99 or ASTM D2466-99, Schedule 40 or 80 (compatible with pipe in which it is installed).
2. Threaded: Fittings: ASTM D2464.
3. Reducing Fittings: Bushing reducers shall be acceptable in PVC piping unless otherwise indicated

C. Joints

1. Solvent Welded Joint Procedure: ASTM D2855-96 Standard Practice for Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings
2. Primer for Solvent Welds: ASTM F656-96a Standard Specification for Primers for Use in Solvent Cement Joints of Poly(Vinyl Chloride) (PVC) Plastic Pipe and Fittings.
3. Solvent Cement: ASTM F493-97 Standard Specification for Solvent Cements for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe and Fittings.

2.5 CHLORINATED POLYVINYL CHLORIDE (CPVC) PIPING

A. Pipe

Chlorinated Polyvinyl Chloride Piping shall conform to ASTM F441/F441M-99 Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe,

Schedules 40 and 80.

B. Fittings

1. Solvent Weld Fittings: Socket type, ASTM F438-99 or ASTM F439-99a, Schedule 40 or 80 (compatible with pipe in which it is installed).
2. Threaded: Fittings: ASTM F437-99, Schedule 80.

C. Joints

1. Solvent Welded Joint Procedure:
2. Primer for Solvent Welds:
3. Solvent Cement:

2.6 POLYETHELENE (PE)

2.7 GASKETS

Shall be as recommended by the manufacturer for the service, Temperatures and pressures to be encountered.

2.8 HEAT TRACING

A. Piping shall be heat traced for freeze protection where exposed to subfreezing temperatures or where shown or specified on the Drawings. All heat traced piping shall be insulated. All necessary fittings, tape, and seals, and other accessories shall be furnished and installed.

B. Heat tracing shall be of the parallel circuit, self-limiting, semiconductor type electric resistance heat tracing suitable for cut-to-length field installation. Heat tracing shall be waterproof and chemical resistant. Heat tracing shall be UL listed and FM approved for Class 1, Division 2 hazardous locations.

C. Heat tracing shall have a watt per foot rating at 50° F as follows:

<u>Pipe Size</u>	<u>Insulation Thickness</u>	<u>Watts Per Foot</u>
1" and smaller	1"	2.0
1-1/2"	1 - 1/2"	2.0
2"	1 - 1/2"	2.2
2 - 1/2"	1 - 1/2"	2.5
3"	1 - 1/2"	2.9
4"	1 - 1/2"	3.5
6"	2"	3.9
8"	2"	4.8
10"	2"	5.8
12"	2"	6.7

D. Heat tracing strip shall have a flat profile and shall be furnished with a non-corrosive metal braid shield or jacket. Unless otherwise shown or required, heat tracing shall operate at 120 volt, 60 hertz, single phase.

E. Heat tracing rated 5 watts per foot or less shall be suitable for ambient temperature control and shall not be damaged if crossed in direct contact.

- F. Heat tracing rated 5 watts per foot or less shall be controlled by a separate, liquid filled, ambient sensing thermostat. Thermostat shall have a tamperproof calibrated setpoint dial SPST or SPDT contacts rated minimum 20 amps at 120 volts, a cast aluminum NEMA 4 enclosure.
- G. Heat tracing rated in excess of 5 watts per foot shall be controlled by a separate, pipeline sensing, liquid-filled thermostat with stainless steel bulb and a minimum 10 feet of flexible stainless steel capillary tubing. Thermostat shall have a tamperproof, calibrated setpoint dial, SPST or SPST contacts rated minimum 20 amps at 120 volts, 6° F differential, an a cast aluminum NEMA 4 enclosure.
- H. Thermostats shall be furnished by the heat tracing manufacturer and shall be adjustable over an operating range of 25° F to 90° F.
- I. A heavy-duty, oil-tight indicator light in a separate NEMA 4 enclosure shall be provided at the thermostat to indicate when the heat tracing circuit is energized.
- J. Circuit breakers used to protect electric heat tracing circuits shall be of the ground fault type.

PART 3 - EXECUTION

3.6 PIPING GENERAL

- A. Run piping as indicated in Construction Documents subject to modifications as required to suit field conditions, to avoid interference with other trades, and for proper, convenient, and accessible locations to parts of the piping system.
- B. Run piping in wall chases, recesses, pipe shafts, and hung ceilings where provided.
 - 1. Do not run gas or water piping in floor fill.
 - 2. Run piping as high as possible under building, above ceilings, and close to slabs.
 - 3. Do not permanently close, furr in, or cover piping before examination and final tests.
- C. All piping shall be installed and arranged to allow free movement of the piping due to expansion, contraction, building movement, etc., without putting excessive stress or strain into the piping or equipment. All piping, risers, runouts, etc. subject to deflection by expansion and contraction shall be cold sprung 50% of the deflection required to be absorbed. All sleeves and other openings in the construction shall be of sufficient size and spaced so as to allow for the necessary pipe movement without undue stress on piping. Risers shall be free to travel as required with the horizontal piping. Piping runouts to and from risers shall be pitched as required so that the vertical movement of the risers may be absorbed and still maintain the specified pitch for the runouts and piping to and from the risers.
- D. All vertical piping shall be installed plumb and true. Horizontal piping specified to be graded shall be installed at a straight and uniform grade without pockets. Horizontal piping not specified to be graded, shall be installed in a straight and true manner.

- E. Run piping straight and where concealed as direct as possible with risers erected plumb and true.
 - 1. Install piping with minimum 1 inch clearance between finished pipe coverings and adjacent work.
 - 2. Support piping from structure above, maintaining maximum headroom available.
 - F. Do not run piping in telephone rooms, electrical equipment rooms/closets, transformer vaults or rooms containing related equipment, or close to or above control panels, switchboards and electric motors. If pipes are installed in these rooms, they shall be relocated at no extra cost to the owner.
 - G. Provide control valves where noted or required for complete regulating control of systems, plumbing fixtures, and equipment. Provide valves in accessible locations or accessible through access panels.
 - H. Fittings, Valves, and Hangers on Chrome Plated Piping: Chrome plated finish to match.
 - I. Provide reducing fittings for changes in pipe sizes. Bushings will not be allowed.
 - J. Provide extra heavy pipe for nipples where unthreaded pipe is less than 1-1/2".
 - 1. Do not use close nipples. Use saddle nipples.
 - 2. Provide galvanized iron sleeves for pipes passing through roof slabs, interior floors, ceilings, walls, or partitions.
 - K. Expansion Swings:
 - 1. Make adequate provisions for proper expansion and contraction of piping and for piping passing through building expansion joints.
 - 2. Make branch connections from risers with ample swing or offset to avoid strain on fittings or short pipe lengths. Anchor horizontal runs of pipe over 50 feet in length to walls or supporting structure about midway of run to allow expansion evenly divided toward ends.
 - 3. Provide sufficient number of elbow swings or accepted expansion joints to allow proper expansion and contraction of mains and risers.
 - L. All piping systems except soil, waste, vent and rainwater shall be arranged to drain to one or more low points or fixtures. Each low point shall be equipped with a hose end valve drain connection.
 - M. Exposed Piping:
Install horizontal runs maximum 4 inches below adjacent structure and run parallel or perpendicular to walls, ceilings, beams, and columns unless otherwise noted on Construction Documents.
- 3.7 COPPER TUBING
- B. Copper joints shall be made with a wire type solder applied in accordance with the manufacturer's recommendations. No paste solder or flux solder will be allowed.

- C. Copper joints underground, under floors on grade, or concealed in chases shall be brazed with silver solder.
 - D. Copper joints exposed above the floors on grade or readily accessible above removable ceilings shall be made with 95-5 wire solder or brazed with silver solder.
 - E. Connections of copper to ferrous piping or equipment shall be made with dielectric couplings and proper adapters.
 - F. Solder joints at valves shall be made with 95-5 solder only.
 - G. Flare connections to equipment will be allowed where required.
 - H. Ends of all pipe and tubing shall be cut square and reamed smooth. Ends of tubing and pipe and cups of fittings shall be cleaned of oxides by mechanical means and lightly fluxed as soon as possible with a non-corrosive paste type flux. When inserting pipe or tubing into a fitting a slight twisting motion shall be applied to spread flux.
- 3.8 DUCTILE IRON PIPING
- A. Flanged joints shall be made with bolts, bolt studs with a nut on each end, or studs with nuts, where flange is tapped. The number and size of bolts shall conform to the same American Standard as the flanges. Bolts and nuts shall, except as otherwise specified or noted on the Drawings, be Grade B conforming to ASTM Standard Specification for Low-Carbon Steel, Externally and Internally Threaded Standard Fasteners, Designation A307-68. Bolt studs and studs shall be of the same quality as machine bolts.
- 3.9 UNIONS
- Unions and/or companion flanges shall be provided at all equipment connections and elsewhere as indicated on the drawings or as required for easy removal of equipment.
- 3.5 WELDED JOINTS
- A. No field welding is allowed on this project.
- 3.6 MECHANICAL JOINTS:
- Pipe ends shall be square cut and reamed of any burrs. Clean, sharp grooves shall be cut into pipe and the mechanical couplings and fittings shall be installed in strict accordance with the manufacturer's recommendations.
- 3.7 UNDERGROUND PIPING
- A. All piping below grade or below slabs on grade, except cast iron pipe, shall be double wrapped with Tape-Coat 20 applied and primed in accordance with the manufacturer's recommendations.
 - B. All gas piping below grade or below slabs on grade shall be mill-wrapped in accordance with Standard N.A.P.C.A. Coating Specification T.G.F.-I. All fittings and breaks in the mill-wrap shall be hot primed and double wrapped with Tape-Coat 20.

- C. All underground piping shall be tested for breaks and bare spots in the protective coating by an electronic device designed for the purpose, in the presence of the Engineer.

3.8 INSTALLATION OF HEAT TRACING

- A. Heat tracing shall be installed in a continuous straight strip along the pipe or spirally wrapped as required to obtain the necessary watt density. An additional turn shall be taken around valves, fittings and strainers.
- B. Length of circuits shall not exceed the rating of the controlling thermostat or the maximum circuit length specified by the manufacturer.
- C. Heat tracing shall be secured to the pipe using heat-resistant tape at intervals of 12 inches or less. Heat tracing shall be protected from damage and from the weather until weather resistant insulation jackets are in place.
- D. After installation and before applying insulation, test the system for grounds and short circuits using a 500 Vdc megger. Insulation resistance should exceed 10,000 megaohms per 250 feet.

END OF SECTION

SECTION NO. 15062

DUCTILE IRON PIPE AND FITTINGS

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials, equipment and incidentals necessary to install, all ductile iron piping, fittings, and appurtenances as indicated on the drawings and specified herein.
- B. Furnish all concrete thrust blocks, excavation, backfilling, sheeting, slope protection, drainage, concrete work, rip rap, grading and all other work necessary to complete the construction, installation and testing of the piping.

1.02 RELATED WORK

- A. Division 2: Excavation, Backfill, Fill and Grading for Pipe.
- B. Division 3: Concrete.
- C. Division 15: Valves and Appurtenances.
- D. Division 15: Pipe Hangers and Supports.

1.03 DESCRIPTION OF SYSTEMS

- A. Buried piping shall include all ductile iron piping below grade in contact with the soil or concrete encased.
- B. Piping inside structures shall include all ductile iron piping and fittings below grade inside vaults, tanks, manholes, boxes, or similar structures but not in contact with the soil.
- C. Exposed piping shall include all ductile iron piping and fittings above grade exposed to view.
- D. The equipment and materials specified herein is intended to be standard types of ductile iron pipe and fittings for use in transporting sewage, sludges, and water.

1.04 QUALIFICATIONS

All of the ductile-iron pipe and fittings shall be furnished by manufacturers who are fully experienced, reputable, and qualified in the manufacture of the materials to be furnished. The pipe and fittings shall be designed, constructed, and installed in accordance with the best practices and methods and shall comply with these Specifications as applicable.

1.05 SUBMITTALS

- A. Submit to the Engineer within thirty (30) days after Notice to Proceed a list of materials to be furnished, the names of the suppliers and the date of delivery of materials to the site.

- B. All ductile-iron pipe and fittings to be installed under this Contract shall be inspected and tested at the foundry as required by the standard Specifications to which the material is manufactured. Furnish in duplicate to the Engineer sworn certificates of such tests and their results. In addition, all ductile-iron pipe and cast-iron fittings to be installed under this Contract may be inspected at the foundry for compliance with these Specifications by an independent testing laboratory selected by the Owner. The manufacturer's cooperation shall be required in these inspections. The cost of foundry inspection of all pipe approved for this Contract, plus the cost of inspection of a reasonable amount of the disapproved pipe, will be borne by the Owner, as outlined in the General Conditions.
- C. Shop drawings including layouts within, and under buildings and structures shall be submitted to the Engineer for approval in accordance with General Conditions and shall include dimensioning, methods and locations of supports and all other pertinent technical specifications for all piping to be furnished.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Pipe
 - 1. Buried piping shall be ductile iron conforming to ANSI/AWWA C151/A21.51, Class 52, with push-on joints or mechanical joints.
 - 2. Piping inside structures and exposed piping shall be ductile iron flanged pipe conforming to ANSI/AWWA C115/A21.15, with a pressure rating of 250 psi. Flanges shall be factory-applied screwed long hub-type. Flanges shall be faced and drilled after being screwed on the pipe with flanges true to 90 degrees with the pipe axis and shall be flush with the end of the pipe.
- B. Pipe Fittings:
 - 1. Buried fittings shall be ductile iron conforming to ANSI/AWWA C110/A21.10, minimum pressure rating of 150 psi, with mechanical joints.
 - 2. Fittings inside structures and exposed fittings shall be flanged ductile iron conforming to ANSI/AWWA C110/A21.10, with a minimum pressure rating of 150 psi.
- C. Joints:

Mechanical joints shall conform to ANSI/AWWA C111/A21.11 with rubber gaskets, ductile iron glands, and alloy steel tee head bolts and hex nuts.

 - 1. Push Joints shall conform to ANSI/AWWA C111/A21.11 with rubber gaskets.
 - 2. Flange Joints shall conform to ANSI/AWWA C110/A21.10 and ANSI/AWWA C115/A21.15 with rubber gaskets.
- D. Piping Accessories:

1. Ductile iron wall castings shall be of the size and type shown on the drawings, manufactured to be compatible with the pipe and joints as specified herein.
 2. Link Seals shall be provided where indicated on the drawings and shall be as manufactured by Thunderline Corp., Wayne Michigan, or equal.
- E. Factory-applied Linings and Coatings
1. All ductile iron pipe and fittings shall be internally lined with factory-applied cement mortar and a bituminous seal coat in accordance with ANSI/AWWA C104/A21.4.
 2. Buried pipe and fittings and pipe and fittings inside of structures shall be externally factory coated with an asphaltic coating in accordance with applicable ANSI/AWWA standards for pipe, flanged pipe, and fittings.
 3. Exposed Pipe and fittings shall be shop primed on the outside with one coat Rust Inhibitive Primer as specified in Division 9. All other pipe and fittings shall be shop coated on the outside with coal tar enamel in accordance with the above referenced ANSI Specifications and will not require any other coating. Should portions of the exposed piping inadvertently be given the outside coating of coal tar enamel instead of the rust inhibitive primer as required for exposed piping the surfaces shall be sealed with a non-bleeding sealer coat such as Inertol Tar Stop, or Mobil Anti-Bleeding Aluminum Sealer. Sealing shall be a part of the work of this Section.

2.02 MANUFACTURERS

Ductile iron pipe and fittings shall be manufactured by American Ductile Iron Pipe Company, U.S. Pipe and Foundry Company, Clow Corporation, or McWayne Pipe Foundry.

PART 3 - EXECUTION

3.01 HANDLING PIPE AND FITTINGS

- A. Care shall be taken in loading, transporting, and unloading to prevent injury to the pipe or coatings. Pipe or fittings shall not be dropped. All pipe or fittings shall be examined before laying, and no piece shall be installed which is found to be defective. Any damage to the pipe coatings shall be repaired as directed by the Engineer.
- B. All pipe and fittings shall be subjected to a careful inspection and hammer test just prior to being laid or installed.
- C. If any defective pipe is discovered after it has been laid, it shall be removed and replaced with a sound pipe in a satisfactory manner at no additional expense to the Owner. All pipe and fittings shall be thoroughly cleaned before laying, shall be kept clean until they are used in the work, and when installed or laid, shall conform to the lines and grades required.

3.02 INSTALLING DUCTILE-IRON PIPE AND FITTINGS INSIDE STRUCTURES AND IN EXPOSED LOCATIONS

- A. All piping and fittings shall be installed true to alignment and rigidly supported thrust anchors shall be provided where required. Any damage to linings shall be repaired to the satisfaction of the Engineer before the pipe is installed. Each length of pipe shall be cleaned out before erection.
- B. Sleeves shall be installed of proper size for all pipes passing through floors or walls as shown on the Drawings. Where indicated on the Drawings or for liquid or gas-tightness the pipe shall be sealed with a mechanical seal.
- C. Concrete inserts for hangers and supports shall be furnished and installed in the concrete as it is placed. The inserts shall be set in accordance with the requirements of the piping layout and jointing method and their locations shall be verified from approved piping layout drawings and the structural Drawings. Pipe hangers and supports are specified in Section 15094.
- D. Flanged joints shall be made with bolts, bolt studs with a nut on each end, or studs with nuts, where flange is tapped. The number and size of bolts shall conform to the same American Standard as the flanges. Bolts and nuts shall, except as otherwise specified or noted on the Drawings, be Grade B conforming to ASTM Standard Specification for Low-Carbon Steel, Externally and Internally Threaded Standard Fasteners, Designation A307-68. Bolt studs and studs shall be of the same quality as machine bolts. Gaskets shall be ring gaskets of rubber with cloth insertion. Gaskets 12-in. in diameter and smaller shall be 1/16-in. thick; larger than 12-in. in diameter and 3/32-in. thick.
- E. All valves, fittings, equipment, and appurtenances needed upon the pipelines shall be set and jointed as indicated on the Drawings or as required.
- F. All pipe and appurtenances connected to equipment shall be supported in such a manner as to prevent any strain being imposed on the equipment. When manufactures have indicated requirements that piping loads shall not be transmitted to their equipment, a certification shall be submitted stating that such requirements have been complied with.

3.03 INSTALLING BURIED DUCTILE IRON PIPE

- A. Ductile iron pipe and fittings shall be installed in accordance with requirements of AWWA Standard Specification C600 except as otherwise provided herein. A firm, even bearing throughout the length of the pipe shall be constructed by tamping selected material at the sides of the pipe up to the springline. **BLOCKING WILL NOT BE PERMITTED.**
- B. All pipe shall be sound and clean before laying. When laying is not in progress, including lunch time, the open ends of the pipe shall be closed by watertight plug or other approved means. Good alignment shall be preserved in laying. The deflection at joints shall not exceed that recommended by manufacturer. Fittings, in addition to those shown on the plans, shall be provided, if required, in crossing utilities which may be encountered upon opening the trench.

- C. When cutting pipe is required, the cutting shall be done by machine, leaving a smooth cut at right angles to the axis of the pipe. Cut ends of pipe to be used with a bell shall be beveled to conform to the manufactured spigot end. Cement lining shall be undamaged.
- D. Jointing Ductile-Iron Pipe:
 - 1. Push-on joints shall be made in strict accordance with the manufacturer's instructions. Pipe shall be laid with bell ends looking ahead. A rubber gasket shall be inserted in the groove of the bell end of the pipe, and the joint surfaces cleaned and lubricated. The plain end of the pipe to be entered shall then be inserted in alignment with the bell of the pipe to which it is to be joined, and pushed home with a jack or by other means. After joining the pipe, a metal feeler shall be used to make certain that the rubber gasket is correctly located.
 - 2. Mechanical joints at valves, fittings and where designated on the drawings and/or as specified shall be in accordance with the "Notes On Method of Installation" under ANSI Specification A21.11 and the instructions of the manufacturer. To assemble the joints in the field, thoroughly clean the joint surfaces and rubber gasket with soapy water before tightening the bolts. Bolts shall be tight to the specified torque. Under no condition shall extension wrenches or pipe over handle or ordinary ratchet wrench be used to secure greater leverage.
- E. Ball joints, where designated on the Drawings and/or as specified, shall be installed in strict accordance with the manufacturer's instructions. Where ball joint assemblies occur at the fact of structures or tanks, the socket end shall be at the structure or tank and the ball end assembled to the socket.
- F. All valves, fittings and other appurtenances needed upon the pipe lines shall be set and jointed as indicated on the Drawings or as required by the manufacturer.

3.04 VALVES AND VALVE BOXES

Valves and valve boxes shall be installed as shown on the drawings. Mechanical joints shall be made in the standard manner. Valve stems shall be vertical in all cases. Place cast iron box over each stem with base bearing on compacted fill and top flush with final grade. Boxes shall have sufficient bracing to maintain alignment during backfilling. Knobs on cover shall be parallel to pipe.

3.05 THRUST BLOCKS

- A. Longitudinal thrust along pipe lines of bends, tees, reducers, and caps or plugs shall be counteracted by thrust blocking, as shown on the drawings. Where the bends are in a vertical plane, the thrust shall be counteracted by enough weight of concrete to counterbalance the vertical thrust forces. Where undisturbed trench walls are not available for thrust blocking, the Contractor shall furnish and install suitable pipe harnesses or ties designed and manufactured specifically for this purpose.
- B. Joints shall be protected by felt roofing paper prior to placing concrete.

- C. Bearing area of thrust blocks shall be adequate to prevent any movement of the fitting and shall be of the size and dimensions as shown on the drawings.
- D. Concrete for thrust blocking shall be no leaner than 1 part cement, 1-1/2 parts sand and 5-1/2 parts stone. Concrete shall be placed against undisturbed material, and shall not cover joints, bolts or nuts, or interfere with the removal of any joint. Wooden side forms shall be provided for thrust blocks.
- E. In lieu of thrust blocking and with prior approval, pipe harnesses and/or ties or restrained push-on or restrained mechanical joints may be used.

3.06 SURFACE PREPARATION AND PAINTING

- A. All piping and fittings exposed to view shall have its surface prepared and be painted as specified in Division 9. Surface preparation and shop priming is a part of the work of this Section. Pipe marking is included in Division 9, but it shall be part of the work of this Section to assist as required by the Engineer in identifying pipe contents, direction of flow and all else required for proper marking of pipe.

END OF SECTION

SECTION NO. 15064

POLYVINYL CHLORIDE PIPE AND FITTINGS

PART 1 - GENERAL

1.01 SCOPE OF WORK

Furnish all labor, materials, equipment and incidentals required to install in the locations as shown on the Drawings, the plastic piping, fittings and appurtenances as specified herein.

1.02 RELATED WORK

- A. Division 2: Excavation and backfill for pipe.
- B. Division 9: Painting.
- C. Division 15: Pipe hangers and supports.
- D. Division 15: Valves and appurtenances.
- E. Division 11: Chemical feed systems.

1.03 DESCRIPTION OF SYSTEM

- A. Piping shall be installed in the locations as shown on the Drawings.

1.04 QUALIFICATIONS

All plastic pipe, fittings and appurtenances shall be furnished by a single manufacturer who is fully experienced, reputable, and qualified in the manufacture of the items to be furnished. The equipment shall be designed, constructed, and installed in accordance with the best practices and methods and shall comply with these Specifications.

1.05 SUBMITTALS

- A. Shop Drawings shall be submitted to the Engineer for approval in accordance with the General Conditions and shall include dimensioning and technical specification for all piping to be furnished.
- B. Submit to the Engineer, for approval, samples of all materials specified herein.

1.06 TOOLS

Special tools, solvents, lubricants, and caulking compounds required for normal installation shall be furnished with the pipe.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Plastic pipe shall be rigid, unplasticized, polyvinyl chloride (PVC) pipe and shall be in accordance with ASTM D-1784 and ASTM D-1785, Class PVC 1120 and as manufactured by Celanese Piping Systems, Chemtrol Division; Cabot Company; or equal.

- B. The pipe shall be suitable for field cutting, welding, bending and coupling and shall be Schedule 80 unless otherwise shown on the Drawings and of the sizes as shown on the Drawings. Pipe supports shall be as specified in Section 15094.
- C. All pipe shall be bundled or packaged in such a manner as to provide adequate protection for the ends, threaded, or flanged, during transportation from the manufacturer.
- D. Fittings shall be the socket type for solvent welded joints as designated in ASTM D-2467 or D-2466, except where threaded as shown on the Drawings, and as designated in ASTM D-2464 or flanged as shown on the Drawings and shall be compatible with the pipe where installed. Flanges shall be furnished with 1/8-in. thick full-faced gaskets. Flange bolts and nuts shall be ASTM A276, Type 304 or 316 stainless steel.
- E. Plastic tubing shall be clear, flexible, non-cracking with a wall thickness that is adequate for the pressures involved and of the sizes as shown on the Drawings.
- F. Caulking for plastic pipe in wall sleeve shall be by a mechanical, modular, rubber sealing element placed in between the sleeve and pipe and expanded to make a tight fit or other method approved by the Engineer.
- G. Expansion joints shall have integral duck and rubber flanges. They shall have individual solid steel ring reinforcement with a carcass of highest grade woven cotton or acceptable synthetic fiber. Joints shall be constructed of pipeline size and to meet working pressure and corrosive conditions similar to the line where installed. They shall be of a filled arch-type construction with a minimum of three arches per joint. All joints must be finish-coated with Hypalon paint to prevent ozone attack. They shall be Style 500 as manufactured by Mercer Rubber Co. of Trenton, New Jersey, or approved equal.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. The installation of plastic pipe shall be strictly in accordance with the manufacturer's technical data and printed instructions.
- B. Joints for plastic pipe shall be solvent welded except flanged or threaded where required. In making solvent welded connections, clean dirt and moisture from pipe and fittings, bevel pipe ends slightly with emery cloth, if necessary, and apply solvent cement of the proper grade. Expansion joints shall be installed every 50 ft on long runs and in every straight run longer than 15 ft.
- C. Installation of valves and fittings shall be strictly in accordance with manufacturer's instructions. Particular care shall be taken not to over-stress threaded connections at sleeves. In making solvent weld connections, the solvent shall not be spilled on valves or allowed to run from joints.

- D. All piping shall have a sufficient number of unions to allow convenient removal of piping and shall be as approved by the Engineer.
- E. Where plastic pipe passes through wall sleeves, joints shall be sealed with a mechanical sealing element as specified in Section 15100.
- F. All plastic pipe to metal pipe connection shall be made using flanged connections. Metal piping shall not be threaded into plastic fittings, valves, or couplings, nor shall plastic piping be threaded into metal valves, fittings or couplings.
- G. Concrete inserts for hangers and supports shall be furnished and installed in the concrete as it is placed. The inserts shall be set in accordance with the requirements of the piping layout and the Contractor shall verify their locations from approved piping layout Drawings and the structural Drawings. Pipe hangers and supports are specified in Section 15094.
- H. Buried piping shall be as specified in Section 02600.

3.02 FIELD PAINTING

Pipe normally exposed to view shall be painted and marked as specified in Painting Division 9. Engineer will assist in identifying pipe contents, direction of flow and all else required for proper marking of pipe.

3.03 INSPECTION AND TESTING

- A. All pipelines shall remain undisturbed for 24 hours to develop complete strength at all joints. All pipelines shall be subjected to a hydrostatic pressure test for 12 hours at full working pressure. All leaks shall be repaired and lines retested as approved by the Engineer. Prior to testing, the pipelines shall be supported in an approved manner to prevent movement during tests.

END OF SECTION

SECTION NO. 15094

PIPE HANGERS AND SUPPORTS

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. Furnish hangers to support the required loads. Where necessary, supports shall be designed to permit movement due to expansion and contraction. Where drawings show details of supports and anchors, conform to details shown. Where details are not shown, conform to general requirements specified herein.
- B. "C" CLAMPS shall not be used to support piping.
- C. Do not pierce waterproofing with support bolts.
- D. All ferrous metal hangers and supports, not otherwise coated shall be provided with a field applied coat of zinc chromate primer prior to installation. In lieu of field painting the contractor may furnish cadmium plated, or galvanized hangers and supports, except for supports installed corrosive environments inside the pump station wet well and influent channels where supports and hardware shall be stainless steel.

1.02 RELATED DOCUMENTS

Drawings and general provisions of Contract, including General Conditions, Supplemental Conditions apply to work of this section.

1.03 QUALITY ASSURANCE

- A. All hangers, support, anchors, and guides shall be in accordance with the American National Standard Code for Pressure Piping, ANSI B31.1 with addenda 31.1 OA-69.
- B. Provide an adequate suspension system in accordance with recognized engineering practices, using where possible, standard commercially accepted pipe hangers and accessories.
- C. Horizontal suspended pipe shall be hung using adjustable pipe hangers with bolted hinged loops or turnbuckles. Chains, wire, perforated strap iron or flat steel strap are not acceptable.
- D. Submit fastening methods to the engineer for review.
- E. For the purpose of this specification figure numbers for Grinnell products are given, equal products by Carpenter & Patterson Inc. and Elson are acceptable.

PART 2 - PRODUCTS

2.01 UPPER ATTACHMENTS

- A. New Concrete Construction:
 - 1. Support piping in new concrete construction with adjustable type inserts, Grinnell Fig. 282. Where the pipe load exceeds the recommended load of

- the insert, use two inserts with a trapeze-type connecting member below the concrete.
2. Where hangers are required between structural members, (beams) provide side beam brackets, Grinnell Fig. 202, attached to the upper 1/3 of the beam, and all auxiliary steel for the installation of the pipe hangers. Supports shall be designed in accordance with the AISC Steel Handbook and shall receive a field coat of zinc chromate primer.
- B. Existing Concrete Construction:
1. Support piping in existing concrete construction with Cadmium plated, malleable iron, expansion case, Grinnell Fig. 117.
 2. Where hangers are required between structural member (beams) side beam brackets Grinnell Fig. 202, attached to the upper 1/3 of the beam, and all auxiliary steel for the installation of the pipe hanger. Supports shall be designed in accordance with the AISC Steel Handbook and shall received a field coat of zinc chromate primer.
- C. Steel Construction:
1. Support piping in steel construction with adjustable beam clamps and tie rods, Grinnell Fig. 218., or side beam brackets bolted or welded to the side of the beam.
 2. Where hangers are required between structural members (beams or joists) provide all auxiliary steel for the installation of the pipe hanger. Supports shall be designed in accordance with the AISC Steel Handbook and shall receive a field coat of zinc chromate primer.
- D. Wood Construction:
1. Support piping in wood construction with Side Beam Bracket, Grinnell Fig. 202 or Hanger Flange, Grinnell Fig. 128R, using lag screws.
- 2.02 WALL SUPPORTS
- Where piping is run adjacent to walls or steel columns, welded steel brackets Grinnell Fig. 195 and 199 may be used. The bracket shall be bolted to the wall and have a back plate of such size and thickness as to properly distribute the weight.
- 2.03 FLOOR SUPPORTS
- A. Where pipe lines runs are located next to the floor and no provision for expansion are required, support piping with Grinnell Fig. 258, pipe rest with nipple and floor flange.
 - B. Where provisions for expansion are required, support piping with Grinnell adjustable pipe stand Fig. 274, or pipe roll stand Fig. 271.
 - C. Vertical piping shall be supported at every other floor using riser clamps Grinnell Fig. 261, for steel and cast iron pipe, and copper clad riser clamp Grinnell Fig. CT.121, for all copper piping.
- 2.04 SUPPORT FOR PIPING OUTSIDE THE STRUCTURE
- Support piping outside the structure on adjustable pipe supports Grinnell Fig. 264.

2.05 PIPE INSULATION PROTECTIVE SHIELDS AND SADDLES FOR HORIZONTAL PIPING

- A. Provide galvanized sheet metal pipe insulating protection shields at each pipe hanger for all horizontal insulated water pipes and condensate drain pipes. Shield sizes shall be:
- | | |
|--------------------------|---------------------|
| Pipes 2" and smaller: | 18 gauge x 12" long |
| Pipes 2-1/2" and larger: | 16 gauge x 18" long |
- B. Shields shall be 180 degree type at all pipe hangers, except that on trapeze hangers, pipe racks and on floor supported horizontal pipes shields shall be 360 degree type. Use foamglass inserts at all shields, hangers, sleeves, etc.

2.06 FACTORY-FABRICATED FRAMING CHANNELS AND FITTINGS

- A. Factory-fabricated framing channels and fittings shall be used for constructing pipe racks and trapeze type hangers for supporting multiple horizontal pipes where indicated.
- B. Framing channels and fittings shall be provided with factory applied baked enamel finish.
- C. Galvanized pipe clamps, including bolts and nuts shall be provided with the framing channels and shall be used for securing pipes to channels. Pipe clamps on insulated pipes shall fit around pipe and pipe insulation protection shield.
- D. Framing channels and fitting shall be F&S Mfg. Co. Series F Metal Framing, Fee & Mason FAMET Channel and Fitting, Carpenter & Patterson Channel Strut or Unistrut P-Series.

2.07 INTERMEDIATE ATTACHMENTS

- A. Supports for horizontal piping shall be all threaded carbon steel, ASTM A-107, Grinnell Fig. 146., of the following sizes:
- | Pipe Size | Hanger Rod Diameter |
|----------------|---------------------|
| 2" and smaller | 3/8" |
| 2-1/2" and 3" | 1/2" |
| 4" and 5" | 5/8" |
| 6" | 3/4" |
| 8" to 12" | 7/8" |
| 14" and 16" | 1" |

2.08 PIPE ATTACHMENTS

- A. Hangers and supports for fire protection and sprinkler system shall conform the requirements of NFPA 13, and be UL listed.
- B. Hangers for insulated pipe shall be sized to bear on the outside of the insulation.
- C. Hangers for steel and cast-iron horizontal piping where provision for expansion are not required shall be Grinnell Fig. 260., clevis type with vertical adjustment.

- D. Hangers for uninsulated copper pipe 4" and smaller shall be copper plated adjustable band hangers Grinnell Fig. CT. 99C., clevis type hanger with a 4 psf lead saddle at each hanger location.
- E. Hanger for PVC pipe shall be Grinnell Fig. CT.99., adjustable band hanger.
- F. Hangers for steel and copper piping where provisions for expansion are required shall be Grinnell Fig. 171 or Fig 181., adjustable roller hanger with Grinnell Fig. 160., pipe covering protection saddles.
- G. Support domestic hot and cold water piping in spaces behind plumbing fixtures with plastic coated brackets and plastic coated U bolts.
- H. Pipe guide shall be Grinnell Fig. 256.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Support horizontal equipment such as in-line pumps, strainers, air separators, etc., independently of the piping system.
- B. Hang pipe from substantial building structure. Pipe shall not be hung from other piping.
- C. Support each horizontal length of NO-HUB cast iron pipe with in 2-1/2' of each joint and a maximum of 5'-0" on centers.
- D. Provide a hanger within one foot of each elbow.
- E. Provide a hanger within one foot of each riser in addition to the riser clamp support at every other floor.
- F. Unless specified otherwise provide the following support spacing.
 - 1.

Pipe Size	Support Spacing
1" and smaller	5'-0"
1-1/4" and larger	10'-0"

END OF SECTION

SECTION NO. 15101

VALVES AND APPURTENANCES

PART 1 – GENERAL

1.1 WORK INCLUDED

- A. The work covered by this section includes furnishing all labor, equipment, and materials required to furnish and install all metal valves, including operators, boxes, and accessories as specified herein, shown on the Drawings, or required for proper completion of the work under these Contract Documents.
- B. The Contractor's attention is called to the fact that all valves, especially in the smaller sizes, are not necessarily shown completely on the Drawings, which are more or less schematic. However, the Contractor shall furnish and install all valves indicated or required for proper operation of the equipment or services requiring such valves.
- C. The equipment shall include, but not be limited to, the following:
 - 1. Gate valves
 - 2. Eccentric plug valves
 - 3. Check Valves
 - 4. Pressure Indicators
 - 5. Yard hydrants
 - 6. Hose Bibbs
 - 7. Valve Boxes
 - 8. T-Handle Operating Wrench

1.2 SUBMITTALS

- A. Complete shop drawings and engineering data shall be submitted to the Engineer in accordance with the requirements of Section 01340.
- B. Submit complete operation and maintenance data on the valves in accordance with the requirements of Section 01730.

1.3 DESCRIPTION OF SYSTEMS

All of the equipment and materials specified herein are intended to be standard for use in controlling the flow of sewage, sludges, water, air or chemicals, depending on the applications.

1.4 QUALIFICATIONS

All of the types of valves and appurtenances shall be products of well established reputable firms who are fully experienced, reputable and qualified in the manufacture of the particular equipment to be furnished. The equipment shall be designed, constructed and installed in accordance with the best practices and methods and shall comply with these Specifications as applicable.

1.5 TOOLS

Special tools, if required for normal operation and maintenance, shall be supplied with the equipment.

PART 2 - PRODUCTS

2.1 GENERAL

- A. All castings, regardless of material, shall be free from surface defects, swells, lumps, blisters, sandholes, or other imperfections.
- B. All valves shall have the name of the manufacturer, rated working pressure, and size of the valve cast upon the body or bonnet in raised letters. Alternately, the name of the valve manufacturer, rated working pressure, and size may be stamped on a stainless steel identification plate permanently attached to the valve body or bonnet. Valves specified to conform to AWWA requirements shall have the letters "AWWA" cast upon the valve body or bonnet in raised letters.
- C. Valves and operating mechanisms shall be of the proper size and dimensions to fit the pipe connections thereto and shall be installed in the position and within the space shown on the Drawings.
- D. Unless otherwise specified, the direction of rotation of the operator to open the valve shall be to the left (counterclockwise). Each valve body or operator shall have cast thereon the word OPEN and an arrow indicating the direction to open.
- E. A union or coupling shall be provided within 2 feet on each side of a threaded end valve unless the valve can be otherwise easily removed from the piping.
- F. All exposed bolts and nuts on buried or submerged valves and operators shall be brass or stainless steel for corrosion resistance. Exposed bolts and nuts on exposed valves and operators shall be of corrosion-resistant materials or shall be zinc or cadmium plated.
- G. Valves and operators shall be of the proper size to fit the pipe connections and shall fit in the position and space as shown on the Drawings.
- H. Valve operators shall be of sufficient size and capacity to seat, unseat, and operate the valve under the maximum specified differential pressure. Where no maximum differential pressure is specified, the operator shall be designed for a differential pressure equal to the maximum working pressure of the valve. Additional allowances shall be made for the lubricating and/or scale forming tendencies of the fluid.

2.2 GATE VALVES

- A. Unless otherwise specified, all gate valves used in wastewater applications shall be of the single disc, double-seated, solid tapered wedge type. Iron body gate valves for potable water lines shall be of the double disc type. Valves shall have non-rising stems and shall be capable of being repacked under pressure when valve is fully open.
- B. Gate valves 2-1/2 inches in size and smaller shall be bronze body; bronze fitted valves, and shall have 150-pound, cast bronze body, union bonnet, Teflon-impregnated asbestos packing, and threaded ends per ANSI B2.1. Bronze shall conform to ASTM B 62. Brass for nuts and gland shall conform to ASTM B 16. Valve discs shall be reversible. Bronze gate valves shall be Stockham Fig. B-130, Nibco Fig. T-136, or equal. For use in copper plumbing, gate valves shall be furnished with solder ends per ANSI B16.18.
- C. Gate valves 3 inches in size and larger in water and wastewater shall be iron body, bronze mounted valves conforming in all respects to the applicable material and dimensional requirements of AWWA C500. Minimum working pressures shall be 200 psi for valves 12 inches in size and smaller and 150 psi for valves 16 inches and larger. Gate valves shall have an O-ring or self-adjusting chevron packing stem seal, and 125 pound, flanged ends per ANSI

B16.1, except for valves to be buried underground, which shall have mechanical joint ends per ANSI A21.11 (AWWA CLII). Body seat rings shall be ASTM B 62 bronze and shall be screwed into the body so as to be field replaceable. Disc faces and all moving parts shall be bronze or bronze mounted. Cast iron for body and bonnet shall conform to ASTM A 126; Grade B. Iron body gate valves with solid wedge discs shall be M & H (Dresser) Fig. 2067, Transverse City Fig. A248, or equal. Iron body gate valves with double discs shall be M & H (Dresser) Fig. 67, Mueller Fig. A-2380, or equal.

- D. Gate valves shall be furnished with nut, wrench, chain, or handwheel operators as shown on the Drawings. Unless otherwise shown or specified, valves shall have operators as specified in Part 2.12 of this Section. Extension stems, and valve boxes and covers shall be furnished where shown or required.

2.3 ECCENTRIC PLUG VALVES

- A. Plug valves shall be of the non-lubricated, eccentric type with resilient plugs and screwed, flanged, or mechanical joint ends as shown on the Drawings. Valves shall be designed for 150 psi working pressure. Port areas of valves shall be 100 percent of full pipe area.
- B. Valve bodies shall be ductile iron with raised seats. Seats shall have a welded-in overlay of not less than 90 percent pure nickel on all surfaces contacting the plug face. Valves shall have stainless steel permanently lubricated upper and lower plug stem bushings. Packing shall be adjustable. All exposed nuts, bolts, and washers shall be stainless steel.
- C. Valves 12-inch and larger shall have gear wheel actuator. Valves smaller than 12-inch shall have lever actuator.
- D. Valves shall be installed with valve stem in horizontal position so that plug rotates to the top when open.
- E. Valves installed on the suction side of a pump shall be full port (100%) opening.

2.4 CHECK VALVES

- A. Unless otherwise shown or specified, check valves shall be of the swing type suitable for use in either horizontal or vertical piping. Disc shall swing entirely clear of the path of flow when in the open position. All internal parts shall be readily accessible and easily replaced in the field.
- B. Check valves in sizes 2-1/2-inches and smaller shall be Y-pattern, regrinding, bronze-body, bronze-mounted valves. Valves shall have 200-pound, cast bronze body, renewable bronze disc, screwed cap, and threaded ends per ANSI B2.1. Bronze for body and cap shall conform to ASTM B61. Brass nuts and pin shall conform to ASTM B16. Valves shall have a hinge bumper capable of preventing the valve from sticking in the open position and an arrow cast on the valve body to indicate direction of flow. Bronze check valves shall be Powell Fig. 560Y, Stockham Fig. B-345, Nibco Fig. T-453-B, or equal.
- C. Check valves in sizes 3 inches and larger shall be iron body, bronze-mounted valves conforming to AWWA C508. Valves shall have 125-pound cast iron body, bolted and gasketed cover, stainless steel or brass hinge pin, renewable bronze seats and disc, outside lever and adjustable weight, and 125-pound flanged ends per ANSI B16.1. Cast iron for body and cap shall conform to ASTM A 126, Grade B. Bronze for disc and seats shall conform to ASTM B62. Check valves shall be outside lever and air cushioning chamber assembly, or equal. Iron body

check valves shall be Golden Anderson Fig. 250 - D, M&H (Dresser) Cushion Check Valve, DeZurik Arco CVS-250 or equal.

2.5 PRESSURE INDICATORS

- A. The pressure indicators shall be constructed of polypropylene.
- B. The pressure indicators shall be ¼" back-connection pressure gauges with pressure range of 0-100 psi.

2.6 YARD HYDRANTS

- A. Yard hydrants shall have 2-in. hub inlet and 2-1/8-in. valve of the compression type closing with line pressure, and shall be manufactured by American Valve & Hydrants, Dresser Manufacturing Division, or equal. The hydrant shall have one 1-1/2-in. hose nozzle with National Standard hose thread and shall open left or counterclockwise. Furnish six (6) operating wrenches Mueller A-24089.

2.7 HOSE BIBS

- A. Hose bibbs shall be brass, polished chromium plated, as manufactured by Chicago Faucet Company. Potable water bibbs shall be No. 952, 2 inch with vacuum breaker as noted on the Drawings. Non-potable water bibbs shall be No. 387, with lock-shield cap and removable tee handle. Provide heavy brass hook 6'-6" above floor level and provide for a brass chain to store handle on hook. Provide permanent, plastic or brass name tags located above the bibbs which shall state either "POTABLE" or "NON-POTABLE, DO NOT DRINK" as required. Letters shall be approximately 3/4 inch high.

2.8 MANUAL VALVE OPERATORS

- A. Unless otherwise shown or specified, all valves shall be furnished with manual operators as follows:
 - 1. Gate valves, buried - extension stem and valve box with standard operating nut.
 - 2. Gate valves, submerged or located in deep vault - extension stem with floor-stand and hand wheel operator.
- B. Operating nuts for buried or submerged valves shall be standard 2-inch square nuts and shall conform to AWWA C500, Section 19. Extension stems, valve boxes, and stem guides shall be furnished where shown, specified, or required for proper operation.
- C. Rotary manual operators for above ground service shall be of the worm and worm gear or of the traveling nut type. Rotary operators shall have a heavy-duty, weatherproof cast iron or steel housing with gasketed, removable cover and shall be equipped with a mechanical dial or slot type position indicator and a suitable handwheel. Manual operators shall be totally enclosed and sealed to prevent the entrance of rain, dirt, and corrosive atmospheres. Traveling nut operators shall have a grease lubricated alloy steel screw stem, brass nut, and self-lubricating bronze bushings. Worm gear operators shall have hardened, grease lubricated alloy steel worms and bronze worm gears. All exterior bolts and fasteners shall be bronze or stainless steel for corrosion resistance. The valve shall open with counterclockwise rotation of the handwheel.
- D. Manual rotary operators for buried or submerged service shall conform with the requirements of Item C above except the operator shall be totally enclosed and

completely sealed to prevent the entrance of water and dirt. Buried or submerged operators shall be finished on the outside with a bituminous or other approved coating. Rotary operators for buried or submerged service shall be capable of withstanding 300 ft-lbs. of torque on the operating nut or handwheel. A corrosion resistant, dial type valve position indicator shall be provided at the operating nut on the extension stem of buried operators to provide a remote indication of valve position.

- E. All manual rotary operators shall be capable of seating or unseating the valve disc under the most adverse conditions in the particular application with not more than an 80-pound pull on the handwheel or lever. Valve operators shall be capable of holding the valve in any position between fully open and fully closed without creeping or fluttering. Operators shall be provided with adjustable, mechanical, stop-limiting devices to prevent over-travel of the valve disc in the open and closed position. Manual rotary and lever operators shall comply with all applicable requirements of AWWA C504, Sections 11.1, 11.2, and 11.3.

2.9 EXTENSION STEMS

- A. Extension stems shall be solid steel not smaller than the stem of the valve or galvanized steel pipe having an inside diameter not smaller than the outside diameter of the valve or valve operator stem. Extension stems shall connect to the valve by a flexible, socket coupling. All couplings shall be pinned, keyed, or socket type.
- B. Each extension stem for buried valves shall extend to within 6 inches of the top of the valve box or floor box and shall be provided with spacers which will center the stem in the valve box. A standard wrench nut shall be provided on the top of the extension stem. Extension stems for rising stem valves shall be stainless steel or carbon steel with bronze or stainless steel sleeves. Sleeves shall be of sufficient length and location to extend through each stem guide throughout the full vertical stem travel. Extension stems for submerged service shall be stainless steel or bronze.
- C. Adjustable stem guides of the wall bracket type shall be provided as shown on the Drawings. Stem guide shall be of bronze-bushed, cast iron construction adjustable in two directions. Stem guides shall be installed so the unsupported length of the extension stem does not exceed 10 feet or an L/r of 200.. Stem guide shall be Model F5660 as manufactured by Clow Corporation, Bensenville, Illinois, equal Rodney Hunt Company, Orange, Massachusetts, or equal.

2.10 VALVE BOXES

- A. All buried valves shall be provided with 3-piece, cast iron, extension sleeve type, valve boxes suitable for the depth of cover as shown on the Drawings.
- B. Valve boxes shall not be less than 5 inches in diameter, shall have a minimum thickness of 3/16-inch at any point, and shall be provided with suitable cast iron bases and covers. Covers shall have cast thereon an appropriate name designating the service for which the valve is intended ("W" for water, "S" for drain or waste lines). Covers in roadways shall be of the deep locking type.
- C. All parts of valve boxes, bases, and covers shall be heavily coated with a suitable bituminous finish.
- D. Valves and boxes shall be set plumb. Each valve box shall be placed directly

over the valve it serves with the top of the box flush with the finished grade.

2.11 T-HANDLE OPERATING WRENCH

- A. The Contractor shall furnish four T-handle, steel valve operating wrenches with sockets compatible with standard 2-inch square valve operating nuts.
- B. The operating wrenches shall be at least 36 inches in length.

PART 3 - EXECUTION

3.1 FACTORY TESTS

- A. All valves shall be tested at the point of manufacture for proper and unobstructed operation and for leakage and adequacy of design.
- B. Iron body gate valves shall be tested in accordance with AWWA C500, Section 29.
- C. Iron body check valves shall be tested in accordance with AWWA C508, Section 5.
- D. All other valves shall be given an operation test, a leakage test at rated pressure differential, and a hydrostatic test at two times rated pressure. During the hydrostatic test, there shall be no leakage through the metal, the end joints, or the shaft or stem seal, nor shall any part be permanently deformed. During the leakage test, leakage shall not exceed that permitted by ANSI B16.104, Class IV, for metal seated valves and Class VI for resiliently seated valves.

3.2 INSTALLATION

- A. All valves shall be installed in strict conformance with the Drawings and approved shop drawings and manufacturer's instructions. All valves and appurtenances shall be true to alignment and rigidly supported. Any damage to the above items shall be repaired to the satisfaction of the Engineer before they are installed.
- B. Swing check valves shall be installed only in a horizontal position. Lever shall be free to operate without obstruction.
- C. All underground valves shall be installed using a concrete valve box with cast iron frame and cover or in a cast iron valve box as specified herein.
- D. Valves shall be installed in such a way that operators and packing are easily accessible. Valves with field replaceable seats shall be installed with sufficient clearance to permit removal of valve bonnet and stem without removing valve from the line.
- E. Install all floor boxes, brackets, extension rods, guides, the various types of operators and appurtenances as shown on the Drawings that are in masonry floors or walls, and install concrete inserts for hangers and supports as soon as forms are erected and before concrete is poured. Before setting these items, the Contractor shall check all plans and figures which have a direct bearing on their location and he shall be responsible for the proper location of these valves and appurtenances during the construction of the structures.
- F. Pipe for use with flexible couplings shall have plain ends as specified in the respective pipe Sections in Division 15.
- G. Buried flanged or mechanical joints shall be made with cadmium plated bolts. All exposed bolts shall be made with cadmium plated bolts. All exposed bolts and nuts shall be heavily coated with two (2) coats of bituminous paint comparable to Inertol No. 66 Special Heavy.
- H. Yard hydrants shall be installed in accordance with manufacturer's

- recommendation and applicable requirements of fire hydrants above.
- I. Prior to assembly of split couplings, the grooves as well as other parts shall be thoroughly cleaned. The ends of the pipes and outside of the gaskets shall be moderately coated with petroleum jelly, cup grease, soft soap or graphite paste, and the gasket shall be slipped over one pipe end. After the other pipe has been brought to the correct position, the gasket shall be centered properly over the pipe ends with the lips against the pipes. The housing section then shall be placed. After the bolts have been inserted, the nuts shall be tightened until the housing sections are firmly in contact, metal-to metal, without excessive bolt tension. Special care shall be taken in assembly of couplings in lines to be cleaned by hot water to provide the proper end clearance.
 - J. Prior to the installation of sleeve-type couplings, the pipe ends shall be cleaned thoroughly for a distance of 8-in. Soapy water may be used as a gasket lubricant. A follower and gasket, in that order, shall be slipped over each pipe to a distance of about 6-in. from the end, and the middle ring shall be placed on the already laid pipe end until it is properly centered over the joint. The other pipe end shall be inserted into the middle ring and brought to proper position in relation to the pipe already laid. The gaskets and followers shall then be pressed evenly and firmly into the middle ring flares. After the bolts have been inserted and all nuts have been made up fingertight, diametrically opposite nuts shall be progressively and uniformly tightened all around the joint, preferable by use of a torque wrench of the appropriate size and torque for the bolts.

3.3 SHOP PAINTING

Ferrous surfaces of valves and appurtenance shall receive a coating of rust-inhibitive primer as specified in Division 9. All pipe connection openings shall be capped to prevent the entry of foreign matter prior to installation.

3.4 FIELD PAINTING

All metal valves and appurtenances specified herein and exposed to view will be painted as part of the work in Division 9

3.5 FIELD INSPECTION AND TESTING

- A. Following installation, all valves shall be tested by the Contractor under the anticipated operating conditions. The ability of the valves to operate properly without leakage, binding, sticking, fluttering, or excessive operating torque shall be demonstrated to the satisfaction of the Engineer. The Contractor shall at his own expense adjust and/or replace any valve as necessary to assure satisfactory operation.
- B. Following installation and testing, all ferrous and non-machined surfaces of exposed valves, operators, floorstands, and stem guides shall be field primed and painted AS specified herein.

END OF SECTION

SECTION NO. 15115

STEEL PIPE

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. The Contractor shall supply all labor, equipment, materials and incidentals necessary to install and disinfect all piping and appurtenances located outside the buildings and structures and test as specified herein.
- B. Furnish all concrete thrust blocks. Also all excavation, backfilling, sheeting, slope protection, drainage, concrete work, rip rap, grading and all other work necessary to complete the construction, installation and testing of the piping.
- C. The water distribution system shall comply with NFPA 24 and shall have the approval of Factory Mutual and local authorities.
- D. Pipe shall be manufactured by American Spiral-Welded, Corropipe, Inc. or equal.
- E. Steel pipe shall only be used as called out in the drawings.

1.2 SUBMITTALS

- A. Submit shop drawings showing a complete laying plan of all pipe, including all fittings, adapters, valves and specials along with the manufacturer's drawings and specifications indicating complete details of all items. The above shall be submitted for approval before fabrication and shipment of these items. The locations of all pipes shall conform to the locations indicated in the drawings. In most cases, a certain amount of flexibility in positioning of pipes will be allowed, especially where new pipes will connect to existing structures or piping.
- B. Test certificates in accordance with AWWA standards shall be furnished prior to shipment of valves to the job site.

1.3 INSPECTION

- A. All pipe and fittings to be installed under this Contract may be inspected at the site of manufacture for compliance with these Specifications by an independent laboratory selected by the Owner.

1.4 APPROVAL OF MATERIALS

- A. Submit to the Engineer for approval, within thirty (30) days after the Notice to Proceed, a listing, including materials to be furnished, the name of the suppliers, the date of delivery of materials to the job site, and a time schedule for the completion of the project.

1.5 QUALITY ASSURANCE

- A. It is the CONTRACTOR's responsibility that all pipe units and all component parts of the line are manufactured and installed such that the maximum infiltration/exfiltration limit will not be exceeded, as determined by AWWA standards for steel pipe.
- B. All steel pipe and fittings shall be furnished by manufacturers who are fully experienced, SPFA certified, reputable, and qualified in the manufacture of the products to be furnished. Also, the plant in which the pipe is manufactured shall be SPFA certified. The pipe and fittings shall be designed, constructed, and installed in

accordance with the best practices and methods and shall comply with these specifications as applicable.

- C. Pipe shall be the product of one manufacturer that has not less than five (5) years successful experience manufacturing pipe of the particular type and size indicated.

1.6 COMPENSATION

This item will be included in the base bid price, see section 00 0200. No separate or additional payment will be made for this item or for tie-ins or connections to existing, temporary or new structures.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Steel welded pipe shall meet the requirements of ANSI/AWWA C200-97 and C206-97. All flanges shall meet the requirements of ANSI/AWWA C207-94. All fittings shall meet the requirements of ANSI/AWWA C208-96.

PART 3 - EXECUTION

3.1 HANDLING PIPE AND FITTINGS

- A. Care shall be taken in loading, transporting and unloading to prevent injury to the pipe or coatings. Pipe or fittings shall not be dropped. All pipe for fittings shall be examined before laying, and no piece shall be installed which is found to be defective. Any damage to the pipe coatings shall be repaired.
- B. All pipe and fittings shall be subjected to a careful inspection and hammer test just prior to being laid or installed.
- C. If any defective pipe is discovered after it has been laid it shall be removed and replaced with a sound pipe in a satisfactory manner at no additional expense to the Owner. All pipe and fittings shall be thoroughly cleaned before laying, shall be kept clean until they are used in the work, and when installed or laid, shall conform to the lines and grades required.

3.2 STEEL PIPE

- A. Steel pipe and fittings shall be installed in accordance with requirements of AWWA Standard Specification C200 except as otherwise provided herein. A firm, even bearing throughout the length of the pipe shall be constructed by tamping selected material at the sides of the pipe up to the springline. **BLOCKING WILL NOT BE PERMITTED.**
- B. All pipe shall be sound and clean before laying. When laying is not in progress, including lunch time, the open ends of the pipe shall be closed by watertight plug or other approved means. Good alignment shall be preserved in laying. The deflection at joints shall not exceed that recommended by manufacturer. Fittings, in addition to those shown on the plans, shall be provided, if required, in crossing utilities which may be encountered upon opening the trench. When cutting pipe is required, the cutting shall be done by machine, leaving a smooth cut at right angles to the axis of the pipe.
- C. Where welds are required on joints and fittings, a "weld after tape" joint preparation shall be used.

- D. Pipe shall be lap-welded slip joints at all pipe and fitting joints. O-ring gasket joints shall be used at wall penetrations as shown on drawings.
- E. The outer coating of the pipe shall be a tape coating of 80 mil thickness in accordance to AWWA C-214. The inner coating shall be a polyurethane lining of 20 mil thickness suitable for wastewater service.
- F. Pipe wall thickness shall be a minimum 0.375".

3.3 THRUST BLOCKS

- A. Longitudinal thrust along pipe lines of bends, tees, reducers, and caps or plugs shall be counteracted by thrust blocking, as necessary. Where the bends are in a vertical plane, the thrust shall be counteracted by enough weight of concrete to counterbalance the vertical thrust forces. Where undisturbed trench walls are not available for thrust blocking, the CONTRACTOR shall furnish and install suitable pipe harnesses or ties designed and manufactured specifically for this purpose.
- B. Joints shall be protected by felt roofing paper prior to placing concrete.
- C. Bearing area of thrust blocks shall be adequate to prevent any movement of the fitting and shall be of the size and dimensions as shown on the drawings.
- D. Concrete for thrust blocking shall be no leaner than 1 part cement, 1-1/2 parts sand and 5-1/2 parts stone. Concrete shall be placed against undisturbed material, and shall not cover joints, bolts or nuts, or interfere with the removal of any joint. Wooden side forms shall be provided for thrust blocks.
- E. In lieu of thrust blocking and with prior approval, pipe harnesses and/or ties or restrained push-on or restrained mechanical joints may be used.

3.4 JOINTS

- A. O-ring: O-ring joints shall only be used for buried pipe and conform to AWWA C200 Standard. In addition, the O-ring joints shall consist of a flared-bell end formed and sized by forcing the pipe end over a plug die. The spigot end groove designed to retain the O-ring rubber gasket shall be formed and sized by rolling on male-female dies to match the bell. The difference between the ID of the bell and the OD of spigot shoulder at the point of full engagement with allowable deflection shall be 0.00 inches to 0.04 inches as measured on the circumference with a diameter tape.

The O-ring gasket shall have sufficient volume to approximately fill the area of the groove and shall conform to AWWA C200.

The joint shall be suitable for a safe working pressure equal to the class of pipe furnished and shall operate satisfactorily with a deflection angle, the tangent of which is not to exceed $1.00/D$ where D is the outside diameter of the pipe in inches with a pull-out of 1 inch.

O-ring joints may be furnished only by a manufacturer who has furnished pipe with joints of similar design (for comparable working pressure, pipe diameter, pipe length, and wall thickness) that has been in successful service for a period of at least five years.

- B. Lap weld: Lap field-welded joints shall be used where tied joints are indicated on the plans.

The standard bell shall provide for a 2 ½ inch lap. The minimum lap shall be 1 inch. The design maximum joint deflection or offset shall be a 1" joint pull.

- C. Mechanical Couplings: Mechanical couplings, where indicated on the plans, shall be Smith Blair Sytle 411, Baker Style 200, Brico Depend-O-Lok FxF or ExE, or equal.

Coupling for buried service shall have all metal parts painted with epoxy paint conforming to AWWA C210 or C213.

Where tied joints are required, mechanical couplings shall be harnessed for the maximum pressure (test pressure or transient pressure) in accordance with AWWA M11. Depend-O-Lok FxF self restrained joints with end rings may be used in lieu of harnessing unrestrained mechanical joints.

Pipe ends for mechanical couplings shall conform to AWWA C200. The shop-applied outside coating shall be held back as required for field assembly of the mechanical coupling or to the harness lugs or rings. Harness lugs or rings and pipe ends shall be painted with one shop coat of epoxy conforming to AWWA C210. The inside lining shall be continuous to the end of the pipe.

- D. Flanges

1. Flanges shall be in accordance with AWWA C207 Class D for operating pressures to 175 psi and transient pressures to 262.5 psi on 4 inch through 12 inch diameters, and for operating pressures to 150 psi and transient pressures to 225 psi on diameters over 12 inches.

Shop lining and coating shall be continuous to the end of the pipe or back of the flange. Flange faces shall be shop coated with a soluble rust-preventive compound.

2. Gaskets: Full face, 1/8 inch thick, cloth-inserted rubber, Garlock 3000, John Crane Co. Style 777, or equal.

3. Bolts and Nuts for Flanges

- a. Bolts for flanges located indoors and in enclosed vaults and structures shall be carbon steel, ASTM A307, Grade B, and nuts shall be ASTM A563, Grade A heavy hex for Class B and D flanges. Bolts and nuts shall conform to ASTM A193 and A194 Grade B7 for Class E and F flanges.
- b. Bolts for buried and submerged flanges shall be TYPE 316 stainless steel conforming to ASTM A193, Grade B8M, Class 1 and ASTM 194, Grade 8M nuts.

3.5 LININGS AND COATINGS AVAILABLE

A. POLYETHYLENE TAPE COATING

1. Prefabricated Multi-layer Cold-Applied Tape Coating: Except as described below, the coating system for straight-line pipe shall be in accordance with AWWA Standard C214. The system shall consist of the following:

- a. prime layer
 - b. inner layer tape-corrosion-protective tape (20 mils)
 - c. outer layer tape-mechanical-protective tape (30 mils)
 - d. a second outer layer tape-mechanical protective tape (30 mils)
- The total thickness of the tape coating shall be at least 80 mils.

2. Coating Repair

Coating repair shall use tape and primer conforming to AWWA Standard C209, Type II. The tape and primer shall be compatible with the tape system used for straight-line pipe.

3. Coating of Fittings, Specials and Joints

- a. General: Fittings, specials, and joints that cannot be machine coated in accordance with above shall be coated in accordance with AWWA Standard C209. Prefabricated tape shall be Type II and shall be compatible with the tape system shall consist of three layers consisting of the following:

1. prime layer
2. inner layer tape-corrosion-protective tape (40 mils)
3. outer layer tape-corrosion-protective tape (40 mils)

The total thickness of the tape coating shall be at least 80 mils. The field coating shall completely encapsulate bonding wires on O-ring joints.

- b. Coating Repair: Coating repair for fittings and specials shall be in accordance with the procedure described above for straight line pipe.

B. PIPE LINING

1. Pipe shall be lined with a product suitable for sewer service.

3.6 INSTALLATION

- A. The CONTRACTOR shall provide and install all required piping and accessories in accordance with the contract documents and manufacturer's recommendations. Pipe installation as specified in this section supplements AWWA M11.

JOINT ASSEMBLY

1. O-ring Joints

- a. Wire brush clean the exposed ends of the joint surfaces.
- b. Thoroughly lubricate the gasket with material provided by the pipe manufacturer.
- c. Place the gasket in the grooved spigot and relieve tension by inserting a dull instrument under the gasket and completing two revolutions around the joint's circumference.
- d. Insert the joint to full metal-to-metal contact prior to providing the maximum allowable 1 inch joint opening for any necessary deflection.

- e. Electrically bond the joint through the use of welded steel bars, clips, or copper wires thermite welded to the pipe in the field.
 - f. Complete the exterior and interior of the joints with appropriate coating and lining.
2. Lap field-welded joints
 - a. Wire brush the exposed ends of joint surfaces.
 - b. The plain end shall extend into the expanded bell to provide a minimum overlap of 1 inch at any location around the joint's circumference.
 - c. A single full-fillet weld shall be provided by certified welders in accordance with AWS D1.1.
 - d. Interior and exterior joint surfaces shall be completed in accordance with the appropriate lining and coating requirements.
 3. Flanged Joints
 - a. Bolt holes of flanges shall straddle the horizontal and vertical centerlines of the pipe. Clean flanges by wire brushing before installing flanged fittings. Clean flange bolts and nuts by wire brushing; lubricate bolts with graphite or oil.
 - b. Insert the nuts and bolts (or studs), finger tighten, and progressively tighten diametrically opposite bolts uniformly around the flange to the proper tension.
 - c. Exercise care when tightening joints, to prevent undue strain upon valves, pumps, and other equipment.
 - d. If flanges leak under pressure testing, loosen or remove the nuts and bolts, reset or replace the gasket, reinstall or retighten the bolts and nuts, and retest the joints. Joints shall be watertight.
 4. Mechanical Joints:

Mechanical joints shall be installed in accordance with manufacturer's published installation instructions.

INSTALLING BURIED PIPING

1. Inspect each pipe and fitting before lowering the buried pipe or fitting into the trench. Inspect the interior and exterior protective coatings. Patch damaged areas in the field with material similar to the original. Clean the ends of the pipe thoroughly. Remove foreign matter and dirt from inside of the pipe and keep it clean during and after laying.
2. Handle pipe in a manner to avoid any damage to the pipe. Do not drop or roll pipe into trenches under any circumstances.

3. Grade the bottom of the trench and place a 4-inch minimum layer of select or scarified material under the pipe. Before laying each section of pipe, check the grade and correct any irregularities found. The trench bottom shall form a uniform bearing and support for the pipe.
4. At the location of each joint, dig bell (joint) holes in the bottom of the trench and at the sides to permit completion and visual inspection of the entire joint.
5. Keep the trench in a dewatered condition during pipe laying.
6. When the pipe laying is not in progress, include during the noon hours, close the open ends of the pipe. Do not permit trench water, animals, or foreign objects to enter the pipe.

INSTALLING ABOVEGROUND PIPING

1. All piping and fittings shall be installed true to alignment, and rigidly supported thrust anchors shall be provided where required. Any damage to the linings shall be repaired to the satisfaction of the ENGINEER before the pipe is installed. Each length of pipe shall be cleaned out before installation.
2. Sleeves shall be installed for all pipes passing through floors or walls, as shown on the drawings.
3. Concrete inserts for hangers and supports shall be furnished and installed in the concrete as it is placed. The inserts shall be in accordance with the requirements of the piping layout and joining method, and their location shall be verified from approved piping layout drawings and structural drawings.
4. Except as otherwise shown on the drawings, either lap welded, butt welded, or flange joints may be used (split-type couplings may only be used with the prior approval of the Engineer.) Prior to approval of joining method, layouts for hanger and supports shall be submitted to the engineer for approval.
5. Flanged joints shall be made with bolts, bolt studs with a nut at each end, or studs with nuts where the flange is tapped.
6. Exterior surfaces of the pipe and fittings shall receive a prime coat of paint consistent with any required final coat. The steel surface shall be prepared in accordance with the paint manufacturer's requirements.

3.7 BEDDING

- A. Bedding support under pipe shall be structural backfill as indicated in Section 02221 with 95% standard proctor compaction below pipe and $\frac{3}{4}$ up side of pipe.

3.8 FIELD QUALITY CONTROL

- A. Perform a hydrostatic pressure test in the presence of the ENGINEER.

- B. Provide all necessary piping between the reach being tested and the water supply, together with all required materials and equipment.
- C. Provide dished heads, blind flange, or bulkheads as necessary to isolate and test the pipe.
- D. Methods and scheduling of tests are to be approved by the ENGINEER.
- E. Repair or replace, and retest, all pipe failing the pressure test.
- F. Protect the pipe and provide thrust restraint as required to complete the test.
- G. Provide for proper legal disposal of test water.

3.9 TESTING

- A. Furnish all necessary equipment and labor for carrying out a pressure test and leakage test on the pipelines.
- B. Make any traps and furnish all necessary caps, plugs, etc., as required in conjunction with testing a portion of the pipe between valves. Also, furnish a test pump, gauges, and any other equipment required with carrying out the hydrostatic tests.
- C. Domestic water pipelines shall be subjected to a hydrostatic pressure of 50% above the normal working pressure of 150 psi and this pressure maintained for at least 30 minutes. The leakage test shall be conducted at the maximum operating pressure of 150 psi, and this pressure shall be maintained for at least 30 minutes during this test. The amount of leakage which will be permitted shall be in accordance with the Specifications for Installation of Water Mains, AWWA C200.

END OF SECTION

SECTION NO. 15162

PIPE COUPLINGS AND EXPANSION JOINTS

PART 1 - GENERAL

1.1 SCOPE

The work covered by this section includes furnishing all labor, equipment, and materials required to furnish and install pipe couplings and expansion joints, including grooved couplings, flanged adapters, expansion couplings, and rubber expansion joints, as shown on the Drawings, specified herein, and/or required for proper installation of piping and equipment.

1.2 RELATED WORK

- A. Division 9: Painting
- B. Division 15: Ductile Iron Pipe and Fittings

1.3 SHOP DRAWINGS AND PRODUCT DATA

Complete shop drawings and product data shall be submitted to the Engineer in accordance with the requirements of Section 01300 of these Specifications.

1.4 STORAGE AND PROTECTION

Pipe couplings shall be stored and protected in accordance with the requirements of Section 01600 of these Specifications.

1.5 SHOP PAINTING

Pipe couplings shall be cleaned, shop primed, and shop painted as specified herein.

PART 2 - PRODUCTS

2.1 EXPANSION COUPLINGS

- A. Unless otherwise shown or specified, expansion couplings shall be of a gasketed, short sleeve type, with a diameter to fit the pipe properly. Expansion couplings shall have a working pressure equivalent to that of the pipe employed in the piping system.
- B. Each short sleeve coupling for joining cast iron or ductile iron pipe shall consist of one cylindrical cast iron middle ring without pipe stop, two high-grade malleable iron or steel followers, two rubber-compound, wedge section gaskets, and a sufficient number of tract head, electroplated steel bolts to compress the gaskets properly. Cast iron couplings shall be Dresser Style 53, Rockwell Style 441, or equal.

- C. Where expansion couplings are required for joining cast iron pipe to steel pipe of the same nominal size, steel transition couplings, Dresser Style 62, Rockwell Style 413, or equal, shall be used.
- D. Rubber gaskets shall be composed of a resilient synthetic rubber compound suitable for use in wastewater containing oil and grease.
- E. Expansion Couplings to be restrained joint, type Romac DJ400, ECF400, or equivalent.

2.2 FLANGED ADAPTORS

- A. Flanged adapters shall be used, when necessary, for joining existing plain end cast iron or ductile iron pipe to flanged valves, pumps, and fittings. Flanged adapters shall be suitable for working pressures equivalent to that of the pipe employed in the piping system, type EBAA IRON 2100 Megaflange, or equal.
- B. Flanged adapters in sizes 12-inch and smaller shall consist of an ASTM A 126, Class B cast iron flanged body drilled to mate with a 125-pound cast iron flange per ANSI B16.1, a cast iron follower ring, a rubber-compound, wedge section gasket, and a sufficient number of track head, electroplated steel bolts to compress the gasket properly.
- C. Flanged adapters in sizes 14-inch and larger shall consist of a high strength steel flanged body drilled to mate with a 125-pound cast iron flange per ANSI B16.1, a high strength steel follower ring, a rubber compound, wedge section gasket, and a sufficient number of electroplated steel bolts to compress the gasket properly.
- D. Rubber gasket shall be composed of a resilient synthetic rubber compound suitable for use in wastewater containing oil and grease.

2.3 FLANGED RUBBER EXPANSION JOINTS

- A. Flanged rubber expansion joints shall be standard spool-type single or multiple arch expansion joints constructed of abrasion resistant rubber reinforced with high tensile strength synthetic fabric and steel rings. The expansion joints shall be designed for the working and surge pressures equivalent to that of the pipe employed in the piping system.
- B. Ends of the expansion joint shall be integral with the body and shall be full faced and drilled per ANSI B16.1 for 125-pound flanges. Beveled and split, galvanized steel retaining rings shall be provided to prevent damage to flanges and to distribute bolting stresses during assembly.
- C. Tube, body, and flanges shall be constructed using Buna-N for wastewater, natural rubber for clean water, and Buna-N or neoprene for air. For working temperatures in excess of 180F or for chemical service, tube, body, and flanges shall be constructed of Viton. The exterior of the expansion joint shall be coated with Hypalon to resist weathering.

- D. When used to convey slurries, raw water, or untreated wastewater in horizontal piping, arches shall be filled with a special soft rubber compound integrally cured in the arches.
- E. In unrestrained piping systems or pipe systems subject to excessive longitudinal deflection, joints shall be furnished with two plated steel control rods filled with nuts to limit compression and extension and prevent damage to the joint.
- F. Rubber expansion joints shall be "Redflex," as manufactured by Red Valve Company, "Invincible Expansion Joint," as manufactured by Mercer Rubber Company, or equal, subject to the requirements of this section.

2.4 SLIP-ON RUBBER EXPANSION JOINTS

- A. Slip-on rubber expansion joints for low pressure applications (less than 15 psig) up through 6-inch diameter in size shall be sleeve-type, single-arch expansion joints constructed of abrasion resistant rubber reinforced with high tensile strength synthetic fabric.
- B. Ends of the joint shall be designed to slip over pipe ends and shall be secured in place with adjustable stainless steel clamps. Two clamps shall be provided on each end of the joint.
- C. Joint shall be constructed of Buna-N for wastewater and Buna-N or neoprene for air at working temperatures up to 180F.

2.5 SHOP COATINGS

- A. Couplings and adapters shall be coated as follows:

<u>Material</u>	<u>Location</u>	<u>Primer</u>	<u>Finish</u>
Cast Iron	Buried or Submerged	Asphaltic Varnish Inside and Out	--
Cast Iron	Exposed	Asphaltic Varnish (Interior)	--
Cast Iron	Exposed	Primer (Exterior)	(Field Applied)
Steel	Buried or Submerged	Epoxy Primer Inside and Out	Coal Tar Epoxy
Steel	Exposed	Primer (Exterior)	(Field Applied)
Steel	Exposed	Epoxy Primer (Interior)	Coal Tar Epoxy (Interior)

- B. Coating used for couplings and adapters in potable water shall be approved for use with potable water.

2.6 SPARE PARTS

The Contractor shall furnish two spare gasket sets and two spare track head bolt sets for each size and type of coupling.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Pipe couplings and expansion joints shall be installed where shown on the Drawings, required, or directed by the Engineer. Couplings and joints shall be installed in strict conformance with the manufacturer's instructions.
- B. Pipe ends shall be cleaned, brushed, or filed to produce a mating surface for the gasket that is free from dirt, rust, chuck marks, mill scores, dents, burrs or other foreign substances that would impede proper gasket seating.
- C. A lubricant recommended by the coupling manufacturer shall be used in seating all gaskets.
- D. On expansion couplings and flanged adapters, bolts shall be tightened diametrically opposite each other and in progression so that the inner rims project an equal distance over the flares of the middle ring at all points. Bolts shall be tightened sufficiently to insure a watertight joint but shall not be tightened beyond the point of stretching.
- E. Following installation and testing, couplings shall be field painted in accordance with the requirements of the Section 09900, Painting, of these Specifications. Rubber expansion joints shall not be painted.

END OF SECTION

SECTION NO. 15450

PLUMBING AND MISCELLANEOUS PIPING SYSTEMS

PART 1 - GENERAL

1.6 SCOPE

- A. This section covers the work necessary to furnish and install and complete the plant and potable water piping systems. Like items of materials provided here under shall be the end products of one manufacturer to achieve standardization for appearance, maintenance, and replacement.
- B. Contract drawings show only functional features and some of the required external connections. They do not show all components required for a complete installation nor exact dimensions particular to any manufacturer's equipment. Contractor shall supply all parts, devices and equipment necessary to meet the requirements of the Contract Documents and shall make all dimensional adjustments particular to the equipment being furnished. All costs associated with such changes and adjustments shall be considered as being included in the price bid for the Work.
- C. Related Sections include, but are not necessarily limited to:
 - 1. Division 15: Pressure Testing
 - 2. Division 15: Valves and Appurtenances

PART 2 - PRODUCTS

2.9 GENERAL

The use of a manufacturer's name and model or catalog number is for the purpose of establishing the standard of quality and general configuration desired only. Products of other manufacturers will be considered in accordance with the General Conditions.

2.10 PIPE AND FITTINGS

- A. Pipe
 - 1. Buried plant and potable water piping 2 ½" and smaller shall be Type K Copper.
 - 2. Exposed plant and potable water piping shall be Type L Copper.
- B. Pipe Fittings
 - 1. Copper fittings to be wrought copper, solder type fittings, suitable for the temperature and pressures to be encountered and for the solder or brazing specified. Ells shall be long radius pattern. Flare connections to equipment will be allowed only where required. Unions shall be Nibico No. 633 wrought copper with copper-to-copper solder joints.
- C. Pipe Joints
 - 1. Copper joints shall be made with a wire type solder applied in accordance with the manufacturer's recommendations. No paste solder or flux solder will be allowed. Copper joints underground, under floors on grade, or

concealed in chases shall be brazed with silver solder. Copper joints exposed above the floors on grade or readily accessible above removable ceilings shall be made with 95-5 wire solder or brazed with silver solder. Connections of copper to ferrous piping or equipment shall be made with dielectric couplings and proper adapters. Solder joints at valves shall be made with 95-5 solder only. Flare connections to equipment will be allowed where required. Ends of all pipe and tubing shall be cut square and reamed smooth. Ends of tubing and pipe and cups of fittings shall be cleaned of oxides by mechanical means and lightly fluxed as soon as possible with a non-corrosive paste type flux. When inserting pipe or tubing into a fitting a slight twisting motion shall be applied to spread flux.

2.11 HOSE BIBBS

- A. Hydrants connected to plant water shall have a conspicuous minimum 12" sign reading "Non-Potable Water – DO NOT DRINK" as shown on the Contract Drawings.
- B. Hose bibbs shall be Crane 58 or approved equal. Hose bibbs shall be 1 inch.

2.12 MISCELLANEOUS PIPING SPECIALTIES

- A. Strainers: Strainers for water service shall be iron body, Y-pattern, 125-pound rated, with screwed bronze or bolted iron cap. Screen shall be heavy-gauge stainless steel or monel, 30-mesh. Strainers shall be Crane No. 998-1/2 or Mueller No. H—9330.
- B. Water Hose: Provide 50-foot lengths of 1-inch rubber water hose with fittings at each hose bibb as shown on the Contract Drawings. Provide each length with brass male and female iron pipe hose thread couplings to fit 1-inch brass nozzles. Hoses shall be B.F. Goodrich, BFG General Service Black Cover Hose or Boston Industrial Hose.
- C. Hose Racks: Provide each length of hose with a rail or wall mounted hose racks. Hose racks shall be suitable for exterior mounting and shall accommodate 100 feet of 1-inch diameter rubber hose.

PART 3 - EXECUTION

3.10 GENERAL

- A. Install all piping, fixtures, equipment and accessories in strict accordance with the plumbing codes, rules, and regulations of the State and of the local authority. All work shall be approved by the State, County, or City Plumbing Inspector.
- B. Drawings do not attempt to show exact details of all piping, and no extra payment will be allowed for obstruction by work of other trades or local obstructions to the work under this Contract which require offsets. Where diagrams have been made to show piping connections, the Contractor is cautioned that these

diagrams must not be used for obtaining material quantities. Changes in location of equipment or piping, advisable in the opinion of the Contractor, shall be submitted to the Engineer for approval before proceeding with the work. All measurements and dimensions shall be verified at the site. All equipment shall be adjusted and left in a condition satisfactory to the Construction Manager.

- C. Any preparation of the structural components of the building required for equipment and material regarding this unit of the Contract shall be done by the particular affected trade and shall be done to the satisfaction of the Engineer. All workmanship shall be done to the satisfaction of the Engineer, and work which is deemed unsatisfactory shall be removed and reinstalled until the approval of the Engineer is obtained. The work carried on under this portion of the Contract shall be done in a neat and orderly fashion.

3.2 MOUNTING OF FIXTURES

- A. All exposed chrome plated piping shall be installed with no threads exposed.
- B. All piping breaking out of building construction, walls, chases, to plumbing fixtures shall be securely anchored within the building construction, wall, chase to prevent movement of piping from the occupied area. The manner of anchoring shall be as approved by the Engineer.
- C. All floor-mounted fixtures shall be set level and well grouted to assure firm positioning and a waterproof floor installation.

3.3 INSTALLATION OF PIPING

- A. Shall be installed and connected to the equipment essentially as indicated on the drawings, in a neat and workmanlike manner. Unless specifically noted otherwise, all piping shall be concealed above ceilings and in chases.
- B. All piping shall be installed and arranged to allow free movement of the piping due to expansion, contraction, building movement, etc., without putting excessive stress or strain into the piping or equipment. All piping, risers, runouts, etc. subject to deflection by expansion and contraction shall be cold sprung 50% of the deflection required to be absorbed. All sleeves and other openings in the construction shall be of sufficient size and spaced so as to allow for the necessary pipe movement without undue stress on piping. Risers shall be free to travel as required with the horizontal piping. Piping runouts to and from risers shall be pitched as required so that the vertical movement of the risers may be absorbed and still maintain the specified pitch for the runouts and piping to and from the risers.
- C. All vertical piping shall be installed plumb and true. Horizontal piping specified to be graded shall be installed at a straight and uniform grade without pockets. Horizontal piping not specified to be graded, shall be installed in a straight and true manner.
- D. All piping systems except soil, waste, vent and rainwater shall be arranged to drain to one or more low points or fixtures. Each low point shall be equipped with

a hose end valve drain connection.

3.4 UNIONS

Unions and/or companion flanges shall be provided at all equipment connections and elsewhere as indicated on the drawings or as required for easy removal of equipment.

3.5 STERILIZATION

- A. After being cleaned, all potable water piping and all equipment shall be sterilized in a manner as recommended by the State Health Department and approved by the Local Health Department.
- B. After being sterilized, the entire system shall be flushed and refilled and the water shall be tested by the Health Department. A copy of the report from the Health Department shall be delivered to the Owner.
- C. If the test indicates the water to be non-potable, the system shall be re-cleaned, re-sterilized and re-tested until the water is proven to be potable to the satisfaction of the State Health Department and local authorities.

3.6 PIPE IDENTIFICATION

- A. A marker showing the service and an arrow indication the direction of flow shall be applied on all above ground piping installed under this section of the specifications.
- B. Piping shall be labeled at each side of each wall penetration, at each riser and at the connection to each piece of equipment. In addition, straight runs of piping shall be labeled at intervals not greater than 50 feet.
- C. The letter size and background color shall conform with the Identification of Pipe System ANSI A-13-1. The vinyl plastic markers shall be as manufactured by Seton Name-Plate Company, W.H. Brady Company, Westline Products, or approved equal.

END OF SECTION

SECTION NO. 15810

NONMETAL DUCTS

PART 1 - GENERAL

1.7 RELATED DOCUMENTS

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

1.8 SUMMARY

- A. Section Includes:
1. Thermoset FRP ducts and fittings.

1.9 PERFORMANCE REQUIREMENTS

- A. Duct Design: Duct construction, including duct closure, reinforcements and hangers and supports, shall comply with SMACNA's "Fibrous Glass Duct Construction Standards": and performance requirements and design criteria indicated.
1. Static-Pressure Classes:
 - a. Exhaust Ducts (Negative Pressure): 3-inch wg.
 - b. Exhaust Ducts Downstream of Fans (Positive Pressure): 6-inch.
- B. Structural Performance: Duct hangers and supports and seismic restraints shall withstand the effects of gravity and seismic loads and stresses within the limits and under conditions to comply with SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems."
1. Seismic Hazard Level A: Seismic force to weight ratio, 0.48.
 2. Seismic Hazard Level B: Seismic force to weight ratio, 0.30.
 3. Seismic Hazard Level C: Seismic force to weight ratio, 0.15.

1.10 SUBMITTALS

- A. Product Data: For each type of the following products:
1. Thermoset FRP duct materials.
- B. Shop Drawings:
1. Fabrication, assembly, and installation including plans, elevations, sections, components, and attachments to other work.
2. Duct layout indicating sizes and pressure classes.
3. Elevation of top ducts.
4. Dimensions of main duct runs from building grid lines.
5. Fittings.
6. Reinforcement and spacing.
7. Seam and joint construction.
8. Penetrations through fire-rated and other partitions.

9. Equipment installation based on equipment being used on Project.
10. Hangers and supports, including methods for duct and building attachment, seismic restraints, and vibration isolation.

- C. Welding certificates.
- D. Field quality-control reports.

1.11 QUALITY ASSURANCE

- D. Welding Qualifications: Qualify procedures and personnel according to AWS D1.2/D1.2M, "Structural Welding Code – Aluminum," for aluminum supports.
- E. NFPA Compliance:
 1. NFPA 90A, "Installation of Air Conditioning and Ventilating Systems."

PART 2 - PRODUCTS

2.13 THERMOSET FRP DUCTS AND FITTINGS.

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Viron.
 2. McGill AirFlow, LLC.
 3. Perry Fiberglass Products, Inc.
 4. Spunstrand Inc.
 5. Or approved equal.
- B. Duct and Fittings:
 1. Thermostet FRP Resin: Manufacture duct with resin that complies with UL181, Class 1, maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested by an NRTL according to ASTM E 84.
 2. Inner Liner: FSK liner rated by an NRTL to comply with UL 181, Class 1.
 3. Round Duct: ASTM D2996, Type I, Grade 2, Class E, filament-wound duct, minimum 0.125-inch wall thickness, with tapered bell and spigot ends for adhesive joints, or plain ends with couplings.
 4. Round Fittings: Compression or spray-up/contact, molded of same material, pressure class, and joining method as duct.
 5. Rectangular Fittings: Minimum 0.125-inch thick flat sheet with fiberglass roving and resin-reinforced joints and seams.
 6. Gel Coating: Polyester resin, Ultra violet inhibitor, and pigment for color. Select and submit color samples to match surrounding structure.
- C. Joining Materials: Roving and polyester resin.
- D. Fabrication:
 1. Fabricate joints, seams, transitions, reinforcement, elbows, branch connections, and access doors and panels according to SMACNA's

- “Thermoset FRP Duct Construction Manual,” Chapter 7, “Requirements”
2. Fabricate 90-degree rectangular elbows mitered elbows to include turning vanes, 90-degree round elbows with a minimum of three segments for 12 inches and smaller and a minimum of five segments for 14 inches and larger.

- E. Drains: Formed drain pockets with minimum of NPS 1 (DN 25) threaded pipe connections.

2.14 HANGERS AND SUPPORTS

- A. Hanger Rods for Noncorrosive Environments: Cadmium-plated rods and nuts.
- B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.
- C. Strap and Rod Sizes: Comply with SMACNA’s “HVAC Duct Construction Standards – Metal and Flexible,” Table 4-1, “Rectangular Duct Hangers Minimum Size,” and Table 4-2, “Minimum Hanger Sizes for Round Duct.”
- D. Steel Cables: ASTM-A 492, stainless steel with end connections made of cadmium-plated steel assemblies with brackets, swivel, and bots designed for duct hanger service, with an automatic-locking and clamping device.
- E. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- F. Trapeze and Riser Supports: Steel shapes complying with ASTM A 36/A 36M.

2.15 SEISMIC-RESTRAINT DEVICES

- C. Manufactures: Subject to compliance with requirements, provide products by one of the following:
 1. Cooper B-Line, Inc.; a division of Cooper Industries.
 2. Ductmate Industries, Inc.
 3. Hilti Corp.
 4. Kinetics Noise Control.
 5. Loos & Co.; Cableware Division.
 6. Mason Industries.
 7. TOLCO; a brand of NIBCO INC.
 8. Unistrut Corporation; Tyco International, Ltd.
 9. Or approved equal.
- D. General Requirements for Restraint Components: Rated strengths, features, and applications shall be as defined in reports by an evaluation service member of the ICC Evaluation Service.
 1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which the will be subjected.

- E. Channel Support System: Shop- or field fabricated support assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end. Include matching components and corrosion-resistant coating.
- F. Restraint Cables: ASTM A 492, stainless-steel cables with end connections made of cadmium-plated steel assemblies with brackets, swivel, and bolts designed for restraining cable service; and with an automatic-locking and clamping device or double cable clips.
- G. Hanger Rod Stiffener: Reinforcing steel angle clamped to hanger rod.
- H. Mechanical Anchor Bolts: Drilled-in and stud wedge or female-wedge type. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

PART 3 - EXECUTION

3.11 DUCT INSTALLATION

- D. Install ducts with fewest possible joints.
- E. Unless otherwise indicated install ducts vertically and horizontally, and parallel and perpendicular to building lines.
- F. Install all ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of the building.
- G. Install ducts with a clearance of 1-inch, plus allowance for insulation thickness.
- H. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "Duct Cleanliness for New Construction Guidelines."
- I. Install Thermoset FRP ducts and fittings to comply with SMACNA's "Thermoset FRP Duct Construction Manual."

3.4 HANGER AND SUPPORT INSTALLATION

- D. Install hangers and supports for thermoset FRP ducts and fittings to comply with SMACNA's "Thermoset FRP Duct Construction Manual," Chapter 7, "Requirements."
- E. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
 - 1. Install concrete inserts before placing concrete.
 - 2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.

3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes of for slabs more than 4 inches thick.
 4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes of for slabs less than 4 inches thick.
 5. Do not use powder-actuated concrete fasteners for seismic restraints.
- F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.5 SEISMIC-RESTRAINT-DEVICE INSTALLATION

- E. Install ducts with hangers and braces designed to support the duct and to restrain against seismic forces required by applicable building codes. Comply with SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems."
1. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.
 2. Brace a change in direction longer than 12 feet.
- F. Select sizes of components so strength will be adequate to carry present and future static and seismic loads within restrain device capacity.
- G. Install cables so they do not bend across edges of adjacent equipment or building structure.
- H. Install cable restraints were ducts are suspended with vibration isolators.
- I. Install seismic-restraint devices using methods approved by an evaluation service member of the ICC Evaluation Service.
- J. Attachment to Structure: If specific attachment is not indicated, anchor bracing and restraints to structure to flanges of beams, to upper truss chords of bar joists, or to concrete members.
- K. Drilling for and Setting Anchors:
1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcement of embedded items during drilling. Notify the Owner if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
 2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
 3. Wedge Anchors: Protect threads form damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
 4. Set anchors to manufacturer's recommended torque, using a torque wrench.
 5. Install zinc-coated steel anchors for interior applications and stainless-steel anchors for applications exposed to the weather.

3.7 FIELD QUALITY CONTROL

- A. Perform all required field test and inspections.

3.8 DUCT SCHEDULE

- D. Above grade Ducts and Fittings:
 - 1. Thermoset FRP Round Ducts and Fittings.

END OF SECTION

SECTION NO. 15879

LOUVERS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

Drawings and general provisions of Contract, including General Conditions and Division-1 Specification Sections, and Section 15010 apply to work of this section.

1.02 QUALITY ASSURANCE

AMCA Standard 500 Compliance: Provide louvers which have been tested and rated for pressure drops, sound performance, and water penetration.

1.03 PRODUCT COORDINATION

The louvers of one manufacturer have been used as the basis of design. Any modifications to the mechanical systems and their components, the electrical systems, the building structure and architecture, or any other portion of the building that results from the uses of any product other than the basis of design equipment shall be coordinated with all trades. Such coordination shall occur before delivery of equipment from the manufacturer (before shop drawing submittals) and shall be clearly indicated on the shop drawings. Any modifications shall be performed without incurring any additional cost to the Owner.

1.04 ACCEPTABLE MANUFACTURERS

Louvers manufactured by Airlite, Arrow, Construction Specialties, Greenheck Carnes or Ruskin are acceptable. Any units selected must meet or exceed all the requirements of these Contract Documents.

PART 2 - PRODUCTS

2.01 DESCRIPTION

A. Louvers shall be 4" deep, all-welded construction and fabricated from 0.081" nominal wall thickness 6063-T5 extruded aluminum alloy frame with extended sill. Blades shall be slanted at 45 degrees spaced on 5" centers fabricated of 6063-T5 extruded aluminum with 0.081" wall thickness. Louver shall be fitted with an aluminum insect screen. An integral water stop shall be provided at the bottom interior side adjacent to the insect screen. Louvers shall be equivalent to Ruskin model ELF-811.

B. Finish shall be Kynar 500 enamel in a color selected by the Architect. Submit manufacturer's standard color charts with shop drawings. Field painting will not be acceptable. The performance standards shall be certified by the

manufacturer in accordance with the AMCA Certified Ratings Program and the louver shall carry the AMCA Seal.

- C. Performance standard shall be as follows:
 - 1. Maximum static pressure drop at 600 FPM velocity through free area - 0.06" W.C.
 - a. No water penetration at up to 850 FPM velocity through the free area.
 - b. Minimum free area in relation to gross overall area - 55%.

PART 3 - EXECUTION

3.01 GENERAL

See Architectural and Mechanical drawings for sizes and locations of louvers.

3.02 INSTALLATION

Louvers shall be installed as indicated and in conformance with the manufacturer's recommendations. Coordinate actual installation with all trades.

3.03 INSPECTION

General: Examine areas and conditions under which louvers are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

END OF SECTION

SECTION NO. 16010

ELECTRIC GENERAL

PART 1 – GENERAL

1.01 SCOPE

- A. This Division and the accompanying electrical drawings cover furnishing all labor, equipment and materials and performing all operations in connection with the installation of complete electrical systems as documented on plans and specifications.
- B. There are many interfaces between the work involved with this Division and the work in other Divisions, particularly with Division 15. Be aware of the responsibilities at the interfaces. The exact locations of apparatus, fixtures, equipment and raceways shall be ascertained from all concerned and the work shall be laid out accordingly. In addition, coordinate with all equipment suppliers and other trades to verify the actual installation requirements prior to rough-ins.
- C. The plans and specifications are considered cooperative and complimentary. Where one contradicts the other, notify the Architect/ Engineer for clarification prior to any installation.
- D. All applicable portions of the General and Specific Conditions are included herein by reference.

1.02 DEFINITIONS

- 1. Install: Receive, store, place, fix in position, secure, anchor, etc., including necessary appurtances and labor so the equipment or installation will function as specified and intended.
- 2. Furnish: Purchase and supply equipment and components, including shipping and receiving.
- 3. Provide: Furnish, install, connect, test, demonstrate and leave operational.
- 4. Wiring: Wire or cable installed in raceway with all required boxes, fittings, connectors, etc.
- 5. Work: Materials completely installed, including the labor involved.
- 6. Or approved equal: Equal in type, design, quality, appearance, etc. as determined by the Architect/Engineer.
- 7. Raceway: Galvanized rigid steel conduit (GRC), PVC coated GRC, schedule 40 Polyvinyl Chloride (PVC), flexible steel (FLX), sheathed flexible steel (SLT), code guage wireway (WW).

1.03 CODES AND REGULATIONS

- A. All work shall comply with all local laws, ordinances and regulations applicable to the electrical and fire alarm/life safety system installation, NFPA, OSHA, ANSI, [SBC,] [BOCA,] [UBC,] municipal ordinances governing electrical work, and with the requirements of the 2011 National Electrical Code or latest edition approved by the local authority having jurisdiction (LAHJ).

- B. Where different sections of any of the aforementioned codes and regulations, the specifications or the plans require different materials, methods of construction, or other requirements, the most restrictive or stringent shall govern. In any conflict between a general provision and a special provision, the special provision shall govern.
- C. Obtain all permits and licenses, and pay all fees as required for execution of the Contract. Arrange for necessary inspections required by the Architect, city, county, state and other local authorities having jurisdiction (LAHJ) and present certificates of approval to the Owner or his designated representative.
- D. Under no circumstances will asbestos, or asbestos related materials, be allowed on this project.
- E. Communicate with all required utility offices to meet utility schedules and regulations. Coordinate the local utility requirements with the requirements of these contract documents. Should conflicts arise, notify the Architect/Engineer immediately. Acquire services to avoid project delays. Conform to regulations of the local utility company with respect to metering, service entrance and service access.

1.04 SITE VISIT

All interested parties shall visit the site and thoroughly familiarize themselves with the local conditions and existing conditions which may affect the cost of the Work in advance of any project activity or submission of bids.

Where work under this Division requires extension, relocation, reconnection or modifications to the existing equipment or systems, the existing equipment or systems shall be restored to their original condition prior to completion of this Project.

No allowances will be made for lack of knowledge of job conditions which could reasonably be identified during site visit.

Verify the service entrance voltage and short circuit contribution with the serving power utility and provide written confirmation of same to the Engineer prior to submitting shop drawings or ordering any materials for use in the building served. Provide service entrance equipment fully rated to interrupt the available fault current from the serving utility.

1.05 DRAWINGS AND SPECIFICATIONS

- A. The Electrical Drawings are diagrammatic, and are not intended to show the exact location of raceways, outlets, boxes, bends, sleeves, fire sealant, couplings or other such elements except where dimensions are noted. Provide all required offsets, extensions or pull boxes required for a fully coordinated and operational system.
- B. The Drawings and Specifications shall both be considered as part of the Contract. Any work or material shown in one and omitted in the other, or which may fairly be implied by both or either, shall be provided in order to give a complete job.

Should conflicts exist between the Drawings and Specifications, notify the Architect/Engineer for clarification prior to installation.

Refer to the Architectural (Interiors), Structural and Mechanical plans, Civil, Kitchen and other project construction and shop drawings and details for dimensions, and fit the work to conform to the details of building construction.

Review the drawings for door swings, cabinets, millwork, counters and other built-in equipment. Coordinate installation of the electrical equipment with structural systems and mechanical systems such that full maintenance access is provided.

The right is reserved to shift any switch, receptacle, ceiling outlet or other outlet a maximum of 10'-0" from its location as shown before it is permanently installed, without incurring additions to the Contract in time or cost. In addition, refer to the Architectural Drawings for exact location of devices and equipment.

All conduit and wiring shown on the Electrical Drawings shall be provided under this Division regardless of its function.

Review the drawings and specifications provided for other systems for additional work which may be required under this Division. Provide service to and make connections to all such equipment requiring electrical service.

Equipment configuration is based upon one manufacturer's product. Where the equipment selected by the Contractor for use on this Project differs from the configuration shown, the Contractor shall be responsible for coordinating space requirements, connection arrangements, interfaces with mechanical and plumbing equipment and all other affected trades and providing access for future maintenance and repair. Submit proposed revisions for approval by the Architect/Engineer.

1.06 EQUIPMENT CONNECTIONS

- A. The horsepower, wattage (or amperes) of mechanical equipment indicated is the estimated requirement of equipment furnished under another Division. All wiring, protective devices and disconnect switches shall be of the voltage, size and ampacity required for the actual equipment installed, without increase or additional costs. In no case shall these items be of smaller capacity than permitted by National Electrical Code.
- B. Coordinate with other trades and review the drawings of other divisions. Conform with UL Listing and nameplate requirements for equipment furnished. Such adjustments shall be subject to the approval of the Architect/Engineer.

Provide suitable overcurrent protection and disconnecting means in conformance with the requirements of the NEC, for all items or equipment utilized on the project no matter how, or by whom, furnished. However, duplication, or redundancy, is not required. Coordinate said requirements with equipment furnished and with applicable trades.

Branch circuits supplying control panels and other equipment master and local unit locations and quantities shall be coordinated at the submittal stage and provided under Division 16. Provide emergency power where required to accomplish emergency equipment operations in accordance with Division 15 requirements. All control wiring for plumbing and heating, ventilation and air conditioning systems shall be installed under Division 15. Review Division 15 specifications and shop drawings for control systems to assure system compatibility between

equipment furnished under Division 16 and system wiring and controls furnished under Division 15.

Motor controllers shall be installed by Division 16 where automatic control of equipment is required, unless specified to be furnished as an integral part of packaged equipment. Power wiring to all motors and motor controllers and between motors and controllers shall be furnished under Division 16.

For each electrical connection required, provide pressure connectors, terminals (lugs), electrical insulating tape, heat-shrinkable insulating tubing, cable ties, solderless wire connectors, and other items required to complete splices and terminations of the necessary types. Cover splices or terminations with electrical insulation equivalent to insulation of conductors terminated.

1.07 ELECTRICAL OUTAGE SCHEDULING

- A. Electrical work requiring interruption of electrical power which would adversely affect the Owner's operation shall be done at times other than normal working hours. Coordinate with Owner to establish normal working hours for this facility.

PART 2 – PRODUCTS

2.01 STANDARDS FOR MATERIALS AND WORKMANSHIP

- A. All material shall be new and shall bear the inspection label of Underwriter's Laboratories, Inc. (UL).

The published standards and requirements of the National Electrical Manufacturer's Association (NEMA), Underwriters' Laboratories (UL), Electrical Testing Laboratories (ETL), American National Standards Institute (ANSI), Institute of Electrical and Electronic Engineers (IEEE), Insulated Cable Engineers Association (ICEA), National Fire Protection Association (NFPA) and the American Society for Testing and Materials (ASTM) shall govern and apply where such have been established for the particular material in question.

Specified catalog numbers and trade or manufacturers names are intended to describe the material, devices, or apparatus desired for type, construction features, electrical characteristics, ratings, operating functions, style and quality. Similar materials of other manufacturers, not less than specified quality, capacity or character may be substituted in conformity with the provisions of the General and Supplementary Conditions. Materials of the same type shall be the product of one manufacturer. Refer to Shop Drawing requirements.

Furnish all materials specified herein or indicated on the drawings.

All work shall be installed in a practical and workmanlike manner by competent workmen, skilled in their trade.

2.02 SHOP DRAWINGS

- A. Provide complete electrical characteristics for all equipment. Submit for approval data of the materials and equipment to be incorporated into the Work. Submittals shall include descriptive materials, catalog cuts, diagrams, performance characteristics, and charts published by the manufacturer indicating conformance to the specification and drawing requirements; model numbers alone will not be acceptable. Submittals shall be made by Specification section number, tabbed, within three ring binders, grouped and submitted in packages as indicated below.

Shop drawings shall be submitted for the following equipment and items suitably bound, and marked:

Package I:

- Section 16170 Motor and Feeder Disconnect Switches
- Section 16511 Interior Lighting
- Section 16520 Exterior Lighting
- Section 16620 Surge Protection

- B. Shop drawings and/or catalog data submittals on all items of equipment and materials shall be submitted in conformity with requirements of the General and Supplementary Conditions. Do not submit more than the required number of sets. Do not submit equipment or materials not requested in the Specifications.

All material lists and shop drawing submittals shall include a stamped indication by the Contractor signifying that the submittals have been previously reviewed for complete compliance with the Contract Documents, that all coordination required between trades prior to field installation has occurred and that the material being submitted is approved for installation. The stamped indication shall include the name of the contracting firm, the date of the review and the signature of the contractor. The Engineer will not review the shop drawing submittals without the contractor's stamped approval already on the shop drawings. The responsibility of complying with the Contract Documents will not be relieved by the Engineer's review.

All pricing is to be based upon the products, manufacturers, and processes described in the Contract Documents. Requests for approval of substitutions shall be written and in conformity with the provisions of the General and Supplemental Conditions. Do not submit any shop drawing or product data that does not conform to the contract documents.

Resubmittals, if necessary, shall be made as specified above. Resubmittals will highlight and indicate any and all revisions made thereto and shall be per Division 1.

The Contractor shall provide with the shop drawing submittal dimensioned layouts of all electrical rooms and spaces using the equipment he intends to furnish. Switchboard, panelboards, distribution panels, etc., will be rejected without dimensioned room layouts.

Samples of all materials proposed for use shall be presented to the Architect for his approval when requested.

Submittals shall be noted with any deviations, alterations or limitations of product from the specified materials. The product will be rejected upon failure to indicate this information. Any conflict or failure to perform comparably to the originally specified materials will result in product rejection. It will be the Contractor's responsibility to replace the alternate material or equipment with the originally specified one and to demolish, replace, repair and retest the equipment, including repair or replacement of any component of the building, finishes or other systems affected by said replacement, at no additional costs to the Owner.

2.03 SUPPORT FASTENER DEVICES

- A. Anchors for post tensioned concrete applications shall be cast in place continuous or spot insert channel providing a safety factor of 3 in 3000 lb hard rock concrete.
- B. Anchors for cast in place concrete shall be insert type expansion shields and bolts, lead shields and bolts or self drilling expansion shields and bolts. Powder actuated pins of 1500 pound pull out strength may be utilized in concrete.

Anchors for steel attachment shall be machine screws, bolts, or beam clamps.

Equipment mounted to drywall construction shall be secured to power channel (13/16" x 1 5/8" minimum). Secure channel to a minimum of two (2) dry wall studs with drywall screws and washers.

2.04 SUPPORTS

- A. Furnish and install under this contract all angle iron, channel iron, rods, threaded rod, supports or hangers required to install or mount all electrical equipment, material or related devices. Conduit shall not be supported from steel decking, roof decking, bridging, ceiling or ceiling support wires.

2.05 IDENTIFICATION (Per Section 16191)

2.06 AS-BUILT (RECORD) DRAWINGS

- A. Maintain on the job site at all times during construction a set of "As-Built" mylar sepias with all changes during construction marked thereon. This set shall be utilized for no other purpose. Include any addenda, change orders, field orders, project sketches or "marked-up" drawing prints as may be generated on the job site to assist in recording the changes.
- B. The "As-Built" sepias shall show all changes and deviations from the Contract Drawings including relocation of outlets, conduit and equipment. Record final dimensioned locations of switchboards, panelboards, transformers, disconnect switches, etc. Make sufficient measurements to locate all underground conduit. Show exact locations of underground cable and conduits, both interior and exterior, fully dimensioned from building column lines or permanent exterior structures. These drawings shall be available for reference at the time of final inspection.

At the completion of construction, the Contractor shall purchase a set of reproducibles from the Architect/Engineer at cost of printing and shipping. All changes noted above shall be incorporated thereon by the Contractor. The reproducible drawings, with one set of blueline prints thereof and the original sketches and marked-up "As-Built" prints shall be presented to the Owner.

2.07 MAINTENANCE AND INSTRUCTION MANUALS

- A. Submit to the Architect/Engineer, upon completion of the work and prior to final inspection, copies of maintenance and instruction manuals for equipment provided as outlined below:

Three sets of the following data are required:

Operating and maintenance instructions.
Spare parts list.
Copies of approved submittal data.
Copies of panelboard circuit directories reflecting all field changes.
Test reports of all tests performed.
Certificates of inspection from LAHJ.
Contact names and phone numbers for parts suppliers of submitted equipment.

Arrange each set of data in a orderly way and bind each set in a separate 3-ring hard-cover binder with appropriate label identifying the Project, Architect, Engineer, Contractor, Subcontractor and Date.

2.08 SUBMISSION OF DRAWINGS

A Submission of Engineer's drawings for shop drawings and unaltered Engineer's drawings for "As-Built" will not be acceptable.

2.09 SPARE PARTS AND ATTIC STOCK

A. Prior to final inspection, turn over to the Owner the following materials of the type and quantity specified. Material shall be new, in original shipping containers or cartons, of the same manufacture and type as installed on the Project. Obtain receipt for all materials turned over to the Owner.

Lamps
Fuses
Ballasts

2.10 COORDINATION

- A. Before any piping, conduit, outlets, equipment or lighting fixtures are located in any area, coordinate the space requirements with all trades. Such shall be arranged so that space conditions will allow all trades to install their work, and will also permit access for future maintenance and repair. Coordinate the installation of recessed electrical equipment with concealed ductwork, piping, insulation, structural appurtances and wall thickness.
- B. Piping, ductwork, conduit and equipment installed at variance with the above requirements shall be relocated and/or revised to conform with the above requirements without incurring additions to the Contract.

Coordination of space requirements with all trades shall be performed so that:

No piping or ductwork, other than electrical, shall be run within 42" of panelboards, switchboards or transformers.

No pipes or ducts that operate at a temperature in excess of 120 degrees F. shall be installed nearer than 3" to any electrical conductor.

Do not scale drawings. Obtain dimensions for layout of equipment from the Architectural drawings unless noted on the Electrical drawings.

2.11 PROTECTION OF MATERIALS

Refer to the general requirements section of the Specifications for storage, protection and handling requirements.

Provide dry, weathertight staging and storage for materials and equipment requiring protection from weather and moisture per manufacturer's recommendations. Install temporary lighting or heat sources to prevent moisture accumulation. Provide protection against direct sunlight, precipitation, wind, ice, fire or excessive heat. Store materials in original undamaged packaging with manufacturer's labels and seals intact. Containers which are broken, damaged or watermarked are not acceptable and are subject to rejection.

Materials and equipment will not be installed until the environmental conditions of the project are suitable to protect same per manufacturer's recommendations. Equipment or materials damaged or subjected to moisture, precipitation, direct sunlight, cold or heat are not acceptable and shall be removed from the project and replaced at no additional costs to the Owner.

All conduit and other openings shall be kept protected to prevent entry of foreign matter or construction debris. Fixtures, equipment, and apparatus shall be kept covered for protection against dirt, water, chemical or mechanical damage before and during construction.

The original finish, including shop coat of paint of fixtures, apparatus or equipment that has been damaged shall be restored without incurring additions to the Contract in time or price.

2.12 HOUSEKEEPING PADS

- A. Provide 6" minimum height concrete pad, integral with floor, under all floor mounted electrical equipment or apparatus.

2.13 CUTTING AND PATCHING

- A. The Contractor is responsible for all cutting and patching, including escutcheon plates where necessary, whether or not such cutting and patching is shown or indicated.

2.14 CLEANING AND PAINTING

- A. Remove foreign materials, drywall compound, overspray, oil, dirt and grease from all raceway, fittings, supports, boxes, cabinets, pull boxes, panelboard trims and equipment to provide clean surfaces for painting. Remove surface oxidation and restore galvanized surfaces with cold process galvanizing compounds. Touchup marred or scratched surfaces of fixtures, panelboard and cabinet trims, motor control centers, switchboards, cabinets, and equipment enclosures with paint furnished by the equipment manufacturer specifically for that purpose.
- B. Do not paint trim hinges, latches, clamps, locks, device covers or trim covers. Mask or remove such items prior to finishing.
- C. Unless otherwise noted herein, all painting shall conform to the "Painting" section of the specifications.
- D. Where plywood backboards are utilized to mount electrical or electronic equipment provided under Division 16, finish same with two (2) coats of light gray semi-gloss paint.

2.15 ACCESS TO ELECTRICAL ITEMS

- A. Install all concealed electrical equipment, junction and pull boxes, apparatus, or devices so as to maintain access for maintenance, operations and replacement. Access doors or covers shall be provided where required by NEC or LAHJ and shall be installed in accordance with manufacturer's instructions. Refer to the Architect for approved types, means, methods and appearance. Locate each access unit accurately in relation to electrical work requiring access.

2.16 ELECTRICAL ROOMS AND CLOSETS

- A. Manufacturer's equipment shall not be larger than that dimensioned, or scaled, on plans. Conflicts shall be brought to the attention of the Architect, for resolution prior to ordering equipment.

Clear working space in electric rooms and closets shall be no less than required by the N.E.C.

Submit for review, prior to construction or purchase of any equipment, scaled drawings of electrical rooms, closets, or spaces showing, in detail, planned installation locations of the equipment. These shall clearly show compliance with A and B above.

2.17 EQUIPMENT CONNECTIONS

- A. Review all divisions of specifications, where equipment requiring electrical service is specified, to determine the complete scope of work under this division of the specifications. Provide electrical connections and service to all equipment specified elsewhere requiring such connections or service.
- B. Connect all equipment requiring electrical connections, in accordance with the equipment manufacturer's requirements. Where equipment connections require specific locations, determine and coordinate same with submittals. Provide concealed service to central plant equipment locations and pads.

2.18 NAMEPLATES AND IDENTIFICATION

- A. Provide and install nameplates for transformers, switchboards, switchgear, power and lighting panels, disconnect switches, time switches, pull boxes, junction boxes, fire alarm equipment, contactors, relays and other unit equipment. Nameplates shall be affixed with epoxy cement.
- B. Install nameplates plumb and level.

2.19 EXCAVATION AND BACKFILLING

- A. Provide and perform all excavation required to install conduit, ductbanks and manholes indicated on the drawings and/or specified. Trenches shall be of uniform width required with minimum 8" clearance on both sides. Remove and dispose of all materials not to be used for backfill. Maintain dry excavations for electrical work, by removing water. Grade areas to prevent surface water from entering excavation. Remove any accumulated water by pumping. Perform all excavation by open cut. Excavate with vertical-sided excavations where possible. Where necessary, provide sheeting and cross-bracing to sustain sides

of excavations. Provide materials for shoring and bracing, such as sheet piling, uprights, stringers and cross-braces, in good serviceable condition. Establish requirements for trench shoring and bracing to comply with local codes and LAHJ. No tunneling shall be permitted.

The bottom of all trenches and excavation shall be graded to provide uniform bearing surface for conduits or ductbanks on undisturbed soil at every point along entire length. Tamp overexcavation with specified backfill materials. Remove unstable materials unsuitable for supporting equipment or installation and replace with specified materials for a minimum of twelve (12) inches below invert of equipment or installation.

Specified materials shall be utilized for backfilling, in not more than six (6) inch layers and tamped until the installation has cover of not less than the adjacent grade and not more than two (2) inches above same. Remove sheeting and cross-bracing during backfilling wherever such removal would not endanger the work or other property. Equalize backfilling operation to avoid shifting of materials and equipment installed. Compaction of backfill materials shall be at least equal to surrounding undisturbed material. Backfill trenches with concrete where excavations pass within 18" of footings or other utility lines. Do not settle backfill with water. Conform to compaction requirements and methods specified elsewhere.

PART 3 - EXECUTION

3.01 TESTS AND CERTIFICATIONS

A. Upon completion of the electrical work and prior to final inspection, conduct an operating test in the presence of the Owner and the Architect/Engineer or his designated representative.

The installation shall be demonstrated to operate in accordance with the Contract Documents. Any material or workmanship which does not meet with the approval of the Architect/Engineer shall be removed, repaired or replaced as directed without incurring additions to the Contract in time or cost. All electrical systems shall be tested for compliance with the specifications.

Furnish all instructions, tools, test equipment and personnel required for the test. Have sufficient tools and personnel available to remove equipment covers, coverplates, etc., as required for review of internal wiring and proper inspection. Provide hand tools, flashlights, ladders, outlet testers, VOM, meters and keys required to access and observe system operation and characteristics. Turn circuits on and off as directed and demonstrate operation of equipment as directed.

Contractor shall test all wiring and connections for continuity and grounds by megger testing. Upon indication of defective insulation, Contractor shall remove and replace the defective conductor and demonstrate by testing that the new conductor is acceptable. Record feeder load currents and line voltages measured at each transformer, switchboard and panelboard after installation of all equipment and lighting. Adjust transformer taps as required to provide optimum voltage levels. Adjust single phase load connections to balance feeder load and document on as-built drawings. Provide the Owner with full documentation of all testing for future reference.

Refer to the individual specification sections and the electrical systems testing section of the specifications for specific testing requirements.

The authorized manufacturer's service representative shall review systems and equipment for correct operation, conformance with specification requirements and manufacturer's requirements and submit certification indicating above mentioned conformances for the following systems:

Life Safety System

Interfaces to Mechanical & Building Systems

3.02 DEMONSTRATION AND INSTRUCTION

A. Present to the Owner and the Architect/Engineer or his designated representative a physical demonstration and oral instructions for proper operation and maintenance of each of the electrical equipment and systems installed. Authorized manufacturer's representatives familiar with the specified equipment shall conduct training for the following systems:

1. Life Safety System
2. Interfaces to Mechanical & Building systems

3.03 TEMPORARY WIRING

A. Provide a temporary electrical lighting and power distribution system of adequate size to properly serve the construction requirements, including adequate feeder sizes to prevent excessive voltage drop. Temporary work to be installed in accordance with the National Electrical Code, Article 305, and as required by OSHA or applicable local safety codes, rules and regulations.

3.04 WARRANTY

A. All systems and components shall be provided with a two-year warranty from the time of final acceptance. The warranty shall cover all defects in materials, design and workmanship. During this warranty period, all defects in materials and workmanship shall be corrected without incurring additions to the Contract. The correction shall include removing the defective part(s), replacing and installing the new parts (including shipping and handling), all required cutting, patching, repainting, or other work involved, including repair or restoration of any damaged sections or parts of the premises resulting from any fault included in the warranty, entirely at the expense of the Contractor.

In addition to this general warranty, present to the Architect any other guarantees or warranties from equipment or system manufacturers. These supplemental guarantees or warranties shall not invalidate the general warranty.

END OF SECTION

SECTION 16110

RACEWAY SYSTEMS

PART 1 – GENERAL

1.01 DESCRIPTION

All work specified in this Section shall comply with the provisions of Section 16010.

This Section covers the complete interior and exterior conduit and raceway systems.

PART 2 – PRODUCTS

2.01 CONDUIT (GRC)

- B. Galvanized rigid steel conduit (GRC) shall be low carbon, hot-dipped zinc galvanized steel to meet U.L. 6 Standards, ANSI C80.1 and shall have NPT (ANSI B1.20.1) full cut threaded joints, galvanized after forming. IMC shall carry U. L. Label. Conduit with integral couplings may be utilized for 2.5 inch sizes and above provided it conforms to U. L. Safety Standard #514-B. Use this standard unless in corrosive, hazardous areas, or wet areas, then use PVC coated GRC.

Plastic conduit (PVC) shall be schedule 40 PVC heavy wall type for 4" and smaller, Schedule 20 for 5" and larger. PVC shall be U.L. Listed, NEMA TC 2, sunlight resistant and suitable for use with 90 degree C conductors. Not to be used where exposed. Only use if encased in concrete.

Flexible metal conduit (FLX) shall be extra flexible, extra strength galvanized steel conduit tubing and shall meet U. L. Standard for Flexible Steel Conduit and U.L. Standard for Safety #1. The use of aluminum flexible conduit is not permitted.

Liquid-tight flexible metal conduit (WFX) shall be UL Listed with galvanized steel core of square locked or interlocked design, integral ground conductor and thermoplastic PVC (polyvinyl chloride) cover. The use of aluminum core or non-metallic types is not permitted.

ESteel conduit approved manufacturers are Allied, Triangle, Republic, Wheatland and Pittsburg.

PVC conduit approved manufacturers are Carlon, Triangle, and Johns-Manville.

PVC coated metallic conduit approved manufacturers are Robroy, Permacote and Occidental.

2.02 CONDUIT FITTINGS

- A. GRC and IMC conduit fittings shall be zinc-coated, ferrous metal and taper threaded type, U. L. Labeled.

PVC fittings, elbows and cement shall be NEMA TC3, produced by the same manufacturer. All joints shall be solvent welded in accordance with the manufacturer's recommendations.

Conduit connections to switchboards, motor control centers, transformers, panels, cabinets, and pull boxes shall have locknuts designed to bite into the metal.

Each conduit end shall be provided with either an insulated throat connector or separate locknut and insulated bushing. Bushing shall be installed before any wire is pulled.

Expansion fittings shall be provided in all conduit which crosses an expansion joint either in, across, or through same. Fittings shall be U.L. 467 and 514 Listed. Fittings shall contain an internal flexible metal braid to maintain system ground continuity.

Flexible conduit fittings shall be cast malleable iron or stamped steel type with integral fastener. Fittings shall be U.L. Listed for the application. The use of "squeeze" type cast or stamped steel connectors is not permitted.

Liquidtight flexible metal conduit fittings shall be liquidtight with neoprene bushing, nylon gland, tapered hub threads and outlet bushing. Fittings shall be U.L. Listed for the application. The use of non-metallic or thermo-plastic insert connectors is not permitted.

GRC and IMC fittings approved manufacturers are Appleton, Crouse-Hinds, O.Z. Gedney or Thomas & Betts.

2.03 SMOKE AND FIRE STOP FITTINGS

- A. If and where required, smoke and fire stop fittings shall be U.L. listed for that purpose. The fittings used to seal conduit either on the outside of the conduit or cable or internally shall have heat activated intumescent material which expands to fill all voids and shall be O.Z./Gedney "FIRE-SEAL" or Dow Corning silicone RTV foam with an hourly fire-rating equal to or higher than the rating of the floor, ceiling or wall through which the cable or conduit passes. The seals for conduit shall be of the flanged type. Penetration of any fire rated wall, floor, or ceiling shall use Through-Penetration Firestop Systems described in the current Underwriters Laboratories Building Materials Directory.

2.04 RACEWAY SUPPORTS

- C. Raceways and systems shall be supported independent of any other equipment or appurtenances except the building structure. Suspended ceiling systems will not be considered as structure for support purposes, even if so rated by the manufacturer.

All support components shall be zinc-coated or have equivalent corrosion protection.

Unprotected components shall be removed and replaced at no additional costs to the Owner.

Conduit support straps shall be single hole cast malleable iron or dual hole stamped steel type with zinc coating sized for type of raceway used. Conduit clamps for single conduit support shall be stamped steel with bolt & nut fastener and threaded rod support. Multiple conduit support channel straps shall be galvanized stamped steel two piece clamps with bolt & nut fasteners.

Conduit support channel shall be minimum 1 5/8" x 1 5/8" x 12 ga. rollformed pre-galvanized steel or painted steel conforming to ASTM A-570 Grade 33 or ASTM A-446 Grade A requirements. Channel cross section shall be increased to provide higher load bearing capability, if required by this installation. Channel shall have elongated holes at two (2) inch centers.

Drop wire type hangers will not be permitted. Any hanger which may distort the ceiling support structure will not be permitted. Lathers channel and chain are not acceptable for conduit hangers.

Furnish and install under this contract all angle iron, channel iron, rods, threaded rod, supports or hangers required to install or mount all electrical equipment, material or related devices. Conduit shall not be supported from steel decking, roof decking, bridging, ceiling or ceiling support wires.

Before any piping, conduit, outlets, equipment or lighting fixtures are located in any area, coordinate the space requirements with all trades. Such shall be arranged so that space conditions will allow all trades to install their work, and will also permit access for future maintenance and repair. Coordinate the installation of recessed electrical equipment with concealed ductwork, piping, insulation, structural appurtenances and wall thickness.

Support branch circuit conduits and raceways at intervals not exceeding ten (10) feet and within three (3) feet of each termination. Support feeder conduit and raceway at intervals not exceeding twelve (12) feet and within three (3) feet of each termination.

Piping, ductwork, conduit and equipment installed at variance with the above requirements shall be relocated and/or revised to conform with the above requirements without incurring additions to the Contract.

Raceway installed within reinforcing steel of elevated or slab on grade concrete construction shall be tied to the re-steel at intervals not exceeding three (3) feet.

2.05 SUPPORT FASTENER DEVICES

A. Anchors for post tensioned concrete applications shall be cast in place continuous or spot insert channel providing a safety factor of 3 in 3000 lb hard rock concrete.

D. Anchors for cast in place concrete shall be insert type expansion shields and bolts, lead shields and bolts or self drilling expansion shields and bolts. Powder actuated pins of 1500 pound pull out strength may be utilized in concrete.

Anchors for wood construction shall be lag bolts or power driven wood screws.

Anchors in hollow masonry shall be toggle bolts.

Anchors for steel attachment shall be machine screws, bolts, or beam clamps.

Equipment mounted to drywall construction shall be secured to power channel (13/16" x 1 5/8" minimum). Secure channel to a minimum of two (2) dry wall studs with drywall screws and washers.

Under no circumstance will nylon or composition type tie wraps or straps be permitted for use in supporting electrical raceway. Utilize galvanized tie wire or prefabricated steel clips for such support.

PART 3 - EXECUTION

3.01 CONDUIT

A. Rigid galvanized conduit or intermediate metal conduit shall be used for service entrance and all feeders and branch circuits where exposed to damage or moist conditions.

- B. EMT shall be used for feeders, branch circuits, fire alarm and telephone when not underground or in concrete in contact with the earth. Raceway underground or in concrete in contact with the earth shall be rigid galvanized conduit, intermediate metal conduit or Schedule 40 PVC. Conduit exiting elevated slabs or slab on grade shall be IMC. PVC conduit exiting slab is not permitted.
- C. Conduit shall be continuous from outlet to outlet, from outlet to cabinet, junction box and pull box. Conduit shall enter and be secured to all boxes, etc., in such a manner that each system will be electrically continuous from service to all outlets. All conduit from cabinets and junction boxes shall terminate in approved outlet box or conduit fittings. Conduit connections to any box which has no threaded hub shall be double locknotted and bushing installed.
- D. Provide junction boxes or pull boxes where shown and where necessary to avoid excessively long runs or too many bends between outlets. The conduit sizes shown may be increased if desired to facilitate the pulling of cables.
- E. All conduit shall be concealed unless indicated otherwise. Install exposed conduit parallel with or at right angles to the building walls and support from walls or ceilings at intervals required by Code with approved galvanized malleable iron or stamped steel clamps or hangers. Concealed conduit above the ceiling shall be supported independent of ceiling construction. Where ceilings of lay-in type are used, conduit must be installed minimum six (6) inches above ceiling structure to permit removal of ceiling panels and lighting fixtures.
- F. Use threaded rods and hangers consisting of double-nutted threaded rods and channel or angles of 12 gauge minimum steel for supporting multiple conduit. Refer to drawing details.
- G. Minimum size conduit for exposed branch circuits shall not be smaller than 1/2". Raceway installed in concrete slabs shall be minimum 3/4". Home runs shall extend from outlets shown to panel designated. Home runs shown shall not be combined. Home run conduit shall not be smaller than 3/4".

Type GRC and IMC conduit shall be cut and threaded with similar die heads. Deburr outside of all cuts prior to cutting threads. Cut threads one thread short so that they meet in the coupling and all threads are covered when wrench tight. Deburr inside of end after cutting threads. Right and left hand couplings shall not be used; conduit couplings of the Erikson Type shall be used at locations requiring such joints. Utilize only rigid type hand benders, "Chicago" type benders or power benders with required IMC shoes. DO NOT attempt to bend IMC with "hickey" type hand benders. Any such bends will be replaced at no additional costs to the Owner. Utilize only U.L. Listed conduit fittings, elbows and junction boxes (IMC or GRC types).

All conduit for future use and for special systems such as telephone, data or TV wire shall be left with No. 16 gauge wire or approved pull cord pulled in them.

Expansion fittings shall be installed in all conduit penetrations through, around or in expansion joints, and all straight runs in excess of 150 feet. Watertight flexible metallic conduit, connectors and couplings may be utilized for exposed transitions. U.L. 467 & 514 Listed fittings are required in slab.

Provide non-hardening elastic type duct seal compound, Neer No. DC, 3M Co. "Scotchfil," or Gardner Bender duct seal, for each conduit entering the building from outside, for

each conduit entering refrigerated spaces, for each conduit entering exterior equipment and for each conduit passing from one space into another which is normally at a lower temperature. Conduits entering refrigerated spaces shall be IMC.

Provide intermediate metal conduit and watertight conduit hubs on conduit terminating in a box or cabinet exposed to the weather or damp locations.

Space in sleeves or around conduit that pass through fire resistive or fire rated walls, partitions, floors or ceilings shall be closed by packing with an U.L. labeled fire resistive material, or provide mechanical fire stop fittings that will maintain the rating of the barrier penetrated. Conform with local authority requirements and UL Building Materials Directory.

Coordinate the conduit routing and installation location with the actual electrical equipment furnished. Review submittals for termination locations. Coordinate with all Specification Divisions and submittals to determine termination and access locations. Coordinate installation sequence with all other trades to avoid conflicts and provide the fastest overall installation schedule.

Dented, misformed or flattened conduits are not permitted and shall be removed and replaced.

Protect conduits against dirt, plaster, and construction debris with the use of conduit plugs. Tape is not acceptable. Plugs shall remain in place until all masonry or/and drywall construction is complete. Protect conduit stubups during construction from damage, and replace any bent conduits.

Conduits serving roof mounted equipment shall pass through roof curb where such is provided. Roof penetrations outside this equipment will not be permitted.

Separate raceway systems shall be provided for power systems and for control, signal and communications systems. Do not install above systems cables in the same raceway as branch circuit or feeder cables.

Service entrance and fire pump feeders shall be installed "Outside" of the building as defined by NFPA and the N.E.C. Provide concrete encasement where required to conform with Code requirements.

All conduits installed exposed shall be IMC to a minimum elevation of ten (10) feet AFF. Exposed boxes shall be type FS cast metal.

Where hazardous locations, as classified by the National Electrical Code, exist, all raceway and fittings and the installation of these materials shall comply with Article 500 requirements.

All conduits for interior wiring systems operating above 600 volts shall be galvanized rigid conduit, painted red at access points and labeled per OSHA requirements..

Maintain minimum three (3) inch clearance when raceway crosses piping and/or systems operating above 75°F and provide twelve (12) inches separation when installed parallel to hot piping, flues or appliances operating above 75°F.

Nonmetallic fittings shall be applied with compatible solvent welding cement and shall be fitted while solvent is liquid. Overwrap all fittings used in concrete encasement with suitable tape. Provide o-rings at terminal points to provide watertight seal.

3.02 FLEXIBLE CONDUIT

- A. Watertight flexible metallic conduit shall be used in making short flexible connections to all motors, transformers, bus duct switches, kitchen equipment and rotating or vibrating machinery or equipment. The flexible conduit at these locations shall be as short as possible, but shall have a minimum length of 12". Flexible metallic conduit shall be used in making connections to heaters, fixed equipment or flush mounted light fixtures.
- B. A green stranded bonding jumper shall be installed inside of all flexible conduit that extends directly from a non-flex conduit to a rotating or vibrating machine. Where a junction box is used, the green stranded bonding jumper shall be installed inside the flexible conduit and attached to the junction box and to the machine

3.03 CONDUIT PROTECTION

- A. All threaded joints in galvanized rigid conduit that is encased in concrete shall have a U.L. listed joint compound applied. All conduit installed outside the building underground shall be buried a minimum of 30" below finished grade but in no case shall be buried deeper than 48". Where conduit inside building is installed below the floor slab, the vapor barrier shall be run below the conduit concrete encasement. Conduit installed in any slab, where permitted above, shall be above the bottom steel and below the top steel. No conduit shall be spaced less than 3" apart. Submit conduit layout to structural consultant for review and approval prior to rough-in.
- B. Conduit shall be secured in place and protected where necessary to prevent damage to work during construction. The ends of all conduit shall be plugged with suitable caps (not tape) to avoid filling with any foreign matter. All conduit shall be blown out and swabbed clear of water and trash prior to pulling wire.
- C. Provide identifying marker tape the entire length of each conduit installed in the ground outside the building. The tape shall be constructed of inert polyethylene, resistant to acids, alkalis, etc., in the soil, and shall be a minimum 4 mil thickness. The tape shall be yellow, 6" wide, and shall have the words, "CAUTION - ELECTRIC LINE BURIED BELOW," imprinted with contrasting permanent ink. The imprint shall repeat itself for the entire length of the tape. The tape shall be buried at a maximum of 18" below finished grade, above a portion of the earth fill. Identify all underground and underslab conduit locations on as-built drawings for future reference.
- D. Damaged, oxidized, warped or improperly stored raceway will be removed from the jobsite and replaced with new materials. Non-metallic conduit stored on site prior to installation shall be stored on a flat surface off the ground and shall be protected from direct sunlight and debris.

3.03 CORING, CUTTING AND PATCHING

- A. Perform all coring, cutting and patching of existing walls and floors in order to install the work. Set sleeves for conduit accurately before the concrete floors are poured, or set boxes on the forms so as to leave openings in the floors in which the required sleeves can be subsequently located. Fill in the voids around the sleeves with concrete.
- B. Should the performance of this preliminary work be neglected and should cutting be required in order to install conduit, then the expense of the cutting and restoring of

surfaces to their original conditions shall be accomplished without incurring additions to the Contract.

3.04 BELOW GRADE RACEWAY INSTALLATION

- A. Provide and perform all excavation required to install conduit, ductbanks and manholes indicated on the drawings and/or specified. Trenches shall be of uniform width required with minimum 8" clearance on both sides. Remove and dispose of all materials not to be used for backfill. Maintain dry excavations for electrical work, by removing water. Grade areas to prevent surface water from entering excavation. Remove any accumulated water by pumping. Perform all excavation by open cut. Excavate with vertical-sided excavations where possible. Where necessary, provide sheeting and cross-bracing to sustain sides of excavations. Provide materials for shoring and bracing, such as sheet piling, uprights, stringers and cross-braces, in good serviceable condition. Establish requirements for trench shoring and bracing to comply with local codes and LAHJ. No tunneling shall be permitted.
- B. The bottom of all trenches and excavation shall be graded to provide uniform bearing surface for conduits or ductbanks on undisturbed soil at every point along entire length. Tamp overexcavation with specified backfill materials. Remove unstable materials unsuitable for supporting equipment or installation and replace with specified materials for a minimum of twelve (12) inches below invert of equipment or installation.
- C. Specified materials shall be utilized for backfilling, in not more than six (6) inch layers and tamped until the installation has cover of not less than the adjacent grade and not more than two (2) inches above same. Remove sheeting and cross-bracing during backfilling wherever such removal would not endanger the work or other property. Equalize backfilling operation to avoid shifting of materials and equipment installed. Compaction of backfill materials shall be at least equal to surrounding undisturbed material. Backfill trenches with concrete where excavations pass within 18" of footings or other utility lines. Do not settle backfill with water. Conform to compaction requirements and methods specified elsewhere.
- D. Concrete encased underground ductbanks shall be installed where indicated on the drawings. Ductbank conduits shall be non-metallic type EB, thin wall PVC with concrete encasement.
Stagger couplings of adjacent conduit runs by a minimum of two (2) feet. Provide pre-fabricated conduit supports installed per manufacturer's recommendation. Anchor ductbank assembly in trench to avoid "floating" during concrete pour.

Changes in direction shall be made by the installation of long sweep bends of minimum twenty-five (25) foot radius. All 90 degree ells shall be long sweep type of minimum twenty-four (24) inch radius.

Below all paving and traffic areas, all ductbank shall be reinforced with the installation of No. 5 rebar six (6) inches on center at each corner and on all sides, parallel to duct, and with continuous No. 3 rebar perpendicular to duct

on sixteen (16) inch centers. Concrete cover for reinforced ductbanks shall be minimum six (6) inches with at least three (3) inches above rebar. Reinforcing of duct bank shall continue at least ten (10) feet to each side of required areas.

All ductbanks shall be sloped to drain toward manholes and shall be laid with minimum grade of four (4) inches per hundred feet.

END OF SECTION

SECTION NO. 16120

WIRES AND CABLES 600V

PART 1 – GENERAL

1.01 DESCRIPTION:

- A. All work specified in this Section shall comply with the provisions of Section 16010.
- B. This Section covers the furnishing, installation and connections of the building wiring system. Interior wiring, power distribution, lighting, appliance and equipment, motor and exterior wiring systems extending beyond the building are included.

PART 2 - PRODUCTS

2.01 CONDUCTORS

- A. Conductors shall be copper of 98% conductivity, soft temper, 600 volt insulation. Sizes specified are American Wire Gage (AWG) for No. 4/0 and smaller and thousand circular mils (kcmil) for all sizes larger than No. 4/0.
- B. Conductors No. 10 and smaller shall be solid and type "THHN" / THWN" insulation. No. 8 and larger shall be stranded and type "THHN" / "THWN" or "XHHW" insulation.
- C. All wire and cable shall be U. L. Listed and shall bear the U. L. Label.
- D. All conductors shall have size, grade of insulation, voltage and manufacturer's name permanently marked on the exterior at maximum 24 inch intervals.
- E. Conductor size shall be a minimum of No. 12 AWG. Conductor size shall be not less than indicated on the drawings. The minimum size of all emergency circuits shall be No. 10 AWG.
- F. Fixture wire shall be No. 14 AWG silicone rubber insulated, stranded fixture wire, Type SFF-2 (150 degrees C.).
- G. Control conductors for use on 120 volt control wiring shall be No. 14 AWG stranded Type THHN/THWN, unless indicated otherwise on the drawings or as required to avoid excessive voltage drop.

2.02 CONNECTOR

Termination's and connections shall be made with U. L. Listed connectors applied per manufacturer's recommendations.

Connections of #10 AWG and smaller size power and lighting branch circuit conductors shall be made with insulated spring steel wire nut connectors. Size #8 AWG and larger connections shall be made with hydraulically applied compression type connectors with insulated covers.

Connections of special system conductors shall be made via dedicated terminal strips labeled to indicate wire number and system type. Wire nut connections in system junction box are not acceptable.

2.03 ACCEPTABLE MANUFACTURERS

- A. Wire and Cable products:
 - 1. Southwire Co. Rome Cable
 - 2. Alcan Cable Carol Cable
 - 3. AFC Cable Systems American Insulated Wire
 - 4. Cerro Wire & Cable General Cable
 - 5. Triangle PWC Cabelec
 - 6. Okonite
- B. Signal Cable products:
 - 1. Belden Continental
 - 2. Dekoron West Penn
- C. Connector products:
 - 1. AMP Burndy
 - 2. Eagle Gould
- D. Ideal Joslyn
 - 1. O-Z Gedney Thomas & Betts
 - 2. IIsco Buchanan
 - 3. King
- E. Wire management products:
 - 1. AMP Thomas & Betts
 - 2. Panduit Wieland
- F. Wire & Cable identification products:
 - 1. Thomas & Betts SM series Wieland C type
 - 2. Brady type XC
- G. Wire Pulling lubrication products:
 - 1. Ideal Yellow 77 Electro Y ER EAS
 - 2. Burndy Silkon

PART 3 - EXECUTION

3.01 WIRING

- A. All conductors shall be installed in conduit, unless noted otherwise. All conductors shall be pulled in at the same time. No conductors shall be pulled into the conduit until the conduit system is complete and plaster/drywall construction has dried. Clean, swab and evacuate conduit system before pulling in conductors. Do not exceed the manufacturer's maximum pulling tension.

- B. Conductors shall be continuous from outlet to outlet and from outlet to junction box or pull box. All splices and joints shall be carefully and securely made to be mechanically and electrically solid with proper U. L. Listed connectors. Where connection is made to any terminals of more than 30 amperes capacity and where conductors larger than No. 10 are connected to any terminal, copper terminal lugs shall be secured to the conductors. Where multiple connections are made to the same terminal, individual lugs for each conductor shall be used.
- C. Each conduit shall have a minimum of three (3) conductors pulled in unless that particular conduit is noted as being for systems other than electrical circuitry and/or future use or unless noted otherwise. Grounding conductors are not shown in wire count, but are required from circuit origin to last device.
- D. Conductors for lighting and receptacle circuits shall have color coded jackets. The wiring shall be color coded with the same color used with its respective phase through the entire job as follows:

208/120 Volt Systems	Type	480/277 Volt Systems
Black	Phase A	Brown
Red	Phase B	Orange
Blue	Phase C	Yellow
White	Neutral	Gray
Green	Ground	Green/tracer
White/Green Stripe	IG Neutral	
Green/White Stripe	IG Ground	

- E. The feeder and service entrance conductors shall be color coded by the use of one (1) inch wide colored plastic tape applied within 6" of each conductor end.
- F. Branch circuit conductors shall not be smaller than No. 12 and where the home run from panel to first device exceeds 60'-0", the conductors from home run outlet to panel shall be No. 10 minimum.
- G. Branch circuit wiring which supplies more than one fluorescent fixture through wireway of other fixtures shall be rated for use at 105 degrees C.
- H. For branch circuits terminating in outlet without device, leave minimum of 12" of slack wire coiled for connection of equipment.
- I. All conductors shall be identified with proper circuit numbers at all access points, terminals, junction boxes and at panelboards within 6" of conductor ends.
- J. Special systems conductors shall be color coded in accordance with system manufacturer's recommendations or in a manner approved by the Engineer.
- K. Furniture system branch circuits shall have minimum #10 neutral home run conductors pulled to system junction box.
- L. Maintain phase rotation established at service entrance point throughout entire project.

- M. Taps and splices, where permitted by these specifications, shall be performed with an encapsulating watertight connection kit which insulates and moisture seals the connection.
- N. Grounding conductors are not indicate in the wire count shown on the drawings, but are required in all branch circuit and feeder installations. Provide insulated ground conductor (sized per NEC requirements) in all raceways.

3.02 CONTROL WIRING

- A. Control wiring is defined as the wiring which provides connections between control circuit elements and does not provide the power circuit.
- B. Generally, control wiring is specified in Division 15; however, where a control device such as a push-button, thermostat, firestat, etc. is to be installed in the power circuit, these devices shall be received, stored and installed as part of the work of this Division.
- C. Control wiring and conduit for control wiring shown on the electrical drawings shall be provided regardless of its function.

3.03 CONNECTIONS

- A. All connectors shall be U.L. Listed and shall be utilized in full accordance with manufacturer's requirements.
- B. Splices shall be made only where specifically approved by the Engineer. Conductors shall be continuous from origin to first outlet box or manhole. Splices made exterior to the structure, or below grade, shall be compression type connections with insulated, waterproof covers. Submit splicing requests for review and approval prior to installation.
- C. Termination lugs shall be applied to all single cables #8 and larger, and shall be compression type fittings. The use of mechanical type lugs, kerneys or other pressure type connections will not be permitted.
- D. All compression connections shall be long barrel type installed using hydraulic tools designed for the purpose.
- E. Insulated spring steel wire nut connectors shall be used for branch circuit connections of #10 and smaller conductors. Connections of #8 and larger sizes shall be made with compression type connections with insulated covers. Where exposed to moisture or corrosion spring steel wire nut connectors shall be silicone filled.
- F. Control and special system riser and junction boxes shall be fitted with terminal strips and all conductors shall be labeled per system requirements. The installation of wirenuts in special system riser and junction boxes is not acceptable.

3.04 IDENTIFICATION

- A. All conductors shall be identified with full circuit number at all access points, boxes, and at panelboards within 6 inches of conductor end. Identification shall be permanently marked PVC split sleeve or tubing type.
- B. Tape or laminated type wire markers are not acceptable.

- C. Permanently mark the junction box cover with the circuit numbers for all conductors contained within. Utilize black marker for normal power and red marker for emergency power and fire alarm.

3.05 WIRE MANAGEMENT

- A. Power and control wiring shall be in separate conduit/raceways.
- B. Any knockout, cutout or slot containing wiring shall be fitted with bushing or continuous grommet strip to avoid fraying or abrasion.
- C. Train and lace all conductors within panelboard or control enclosures with cable ties or spiral wrapping.
- D. Spare conductors installed shall be identified and capped.

END OF SECTION

SECTION NO. 16130

BOXES AND FITTINGS

PART 1 - GENERAL

1.01 DESCRIPTION

- A. All work specified in this Section shall comply with the provisions of Section 16010.
- B. This Section covers the installation of all outlet boxes, pull boxes, junction boxes and wiring troughs or other boxes throughout the wiring system, including supports.

1.02 GENERAL MATERIAL REQUIREMENTS

- A. All boxes shall be U. L. Listed and labeled.
- B. Boxes shall be of one-piece construction, fabricated from NEC gauge galvanized steel, unless rustproof cast metal boxes are specified or required by NEC, or unless otherwise shown on the drawings.

PART 2 - PRODUCTS

2.01 OUTLETS

- A. Outlet boxes and covers shall be of such form and dimensions as to be adapted to their specified usage, locations, size and quantity of conduit, and size and quantity of conductors entering the boxes.
- B. Outlet boxes for flush mounted light fixtures shall be four inch square boxes 1 1/2" deep, with blank cover, installed adjacent to fixture served. Connection to fixture shall be with flexible steel conduit and fixture wire.
- C. Flush ceiling outlets for surface or pendant mounted lighting fixtures shall be one-piece 4" square or octagonal pressed steel boxes, minimum two (2) inch depth.
- D. Boxes for devices in unfinished masonry walls or stud walls shall be 4" square boxes with a square cornered tile wall cover (plaster ring), set flush with masonry or drywall construction. Where only one conduit enters box or one wiring device is provided, 2 3/4" deep box may be used. Outlet boxes for dimmers, GFI outlets, and all other conditions shall be full depth. Use multigang boxes where more than one device is mounted together under common coverplate. Do not use sectional switch boxes.
- E. Boxes in concrete ceiling slab shall be octagonal, concrete-tight two (2) inch deep concrete boxes. Welded boxes are not acceptable.
- F. All outlet boxes in plaster, drywall, stucco or masonry walls or ceiling shall be provided with plaster rings.

- G. Junction boxes and all outlets not indicated as containing wiring devices or lighting fixtures shall have covers. Covers for outlets in walls shall be as specified for wall switches and receptacles.
- H. Outlet boxes exposed to the weather, under raised floor, used in exterior wiring system and outlet boxes for vaportight lighting fixtures and devices shall be of cast corrosion resistant type.
- I. In special "Fire Rated" partitions, outlets shall comply with ASTM No. E119 and maintain fire barrier ratings.
- J. Utility (handy) boxes with matching covers may be used in mechanical and electrical spaces for switches and 15A/120V receptacles.
- K. Where special purpose devices are utilized and require larger outlet box than specified herein, provide outlet box suitable for specific device. These outlet boxes shall be of the same type as specified herein for the installation required. Coordinate requirements prior to rough-in installation.

2.02 JUNCTION AND PULL BOXES

- A. Dimensions of pull boxes and junction boxes shall not be less than those dimensions required by the National Electrical Code (NEC) for the number, size and position of conductors and raceway entering the box. Only a single extension ring shall be permitted on a box to increase the volume.
- B. Pull boxes required in finished spaces shall be installed out of sight lines and located per Architect's direction. Box shall be flush mounted cabinets provided with trim, hinged door and flush latch and lock to match panel trim for flush mounted electrical panelboard.
- C. Pull boxes for installation of vertical riser conductors shall be provided with suitable supports for all conductors as required by the NEC.
- D. Pull boxes for horizontal feeders containing more than one feeder shall be compartmented by barriers (or feeder conductors shall be fire-taped) and provided with minimum 1 5/8" x 1 5/8" fiberglass channel strut (removable) for support of conductors. Wood supports within pull boxes are not acceptable.
- E. Provide box covers for all junction and pull boxes of same materials and construction as box. Identify feeder or branch circuit conductors contained within on outside of cover for surface mounted boxes and within cover on flush mounted boxes.

2.03 EXTERIOR PULL BOXES & HANDHOLES

- A. Exterior pull boxes shall be Quazite "PC" style Gasketed boxes, resistant to sunlight exposure, weathering and chemicals, with solid base, penta-head security bolts, heavy duty rated cover with logo to suit purpose, with compressive strength of 11,000 psi, or approved equal. Size shall be minimum 12"w x 18"d x 12"h unless noted otherwise. Set assembly at final finished grade elevation.

- B. Exterior handholes shall be Quazite "PG" style stackable service box assemblies resistant to sunlight exposure, weathering and chemicals, with solid base, penta-head security bolts, heavy duty rated cover with logo to suit purpose, with compressive strength of 11,000 psi, or approved equal. Size shall be minimum 24"w x 36"d x 18"h unless noted otherwise. Provide extensions as required to bring assembly to final finished grade elevation.

2.04 CONDUIT BODIES & FITTINGS

- A. Conduit bodies and fittings shall be NEMA FB-1 zinc coated steel or malleable iron, taper threaded type, of material matching conduit type with gasketed cover containing captive screws.

2.05 WIRING TROUGH

- A. Wiring trough shall be NEMA 1, unless noted otherwise, hinged cover with captive screws, grey enamel finished inside and outside, 16 or 14 gauge steel as per NEC requirements. Size of trough based on NEC requirements.

2.06 PULL BOXES & ENCLOSURES

- A. Pull boxes for feeder and power conductors shall be NEMA 1 with 14 or 12 gauge galvanized steel bodies and 12 or 10 gauge galvanized steel screw covers. Seams shall be continuously welded and ground smooth. Cover screws shall be captive, stainless steel type. Provide oil-resistant gasket and adhesive. Size pull boxes as specified.
- B. Enclosures for termination of special systems wiring shall be NEMA 1 panel enclosures with 14 gauge steel bodies and removable hinged doors. Provide back panel of 14 gauge steel construction and wiring terminal blocks. Enclosures shall be painted ANSI 61 and panels shall be white enamel. Size enclosures for quantity of terminations required plus 25% spare capacity.

2.07 ACCEPTABLE MANUFACTURERS

- A. Exterior junction boxes & handholes:
 - Quazite
 - Nelson
 - Killark
 - Associated Plastics
- E. Wiring troughs:
 - Electromate
 - Square D
 - Universal
 - Hoffman

Wiegmann
General Metals
Keystone

B. Pull boxes & enclosures:

Hoffman
Electromate
Wiegmann
Universal
American Electric
Crouse-Hinds
Square D

PART 3 – EXECUTION

3.01 INSTALLATION

- A. Provide galvanized steel or cast type boxes for all outlets, and for junction or pull boxes. All boxes shall be accessible and sized per NEC requirements. Provide access panels in any non-accessible spaces to allow access to boxes installed.
- B. Provide an UL listed outlet box for each ceiling mounted fan assembly shown.
- C. Where outlets are supplied from conduit run in or below floor slabs, the conduit shall be stubbed up at the location shown and the wall built up around the conduit.
- D. Where outlets are shown as being adjacent and different mounting heights are specified for each, they shall be mounted one directly over the other, on the centerline of the group.
- E. Where low voltage device is to be installed in common boxes with line voltage device (or devices of different operating voltage), provide insulated barrier within boxes to establish separate compartments.
- F. Remove only knockouts required and plug all unused openings per NEC 370-18/373-4 requirements.
- G. Extend branch circuit grounding conductor to each box. Provide grounding pigtail via dedicated fastener.
- H. Install pull boxes only in unfinished spaces or concealed above accessible ceilings. Provide pull boxes when any of the following conditions apply:
 - 1. Where indicated on the drawings.
 - 2. Where conduit run exceeds 150 feet from access point to access point.
 - 3. Where conduit run contains in excess of 360 degrees bend or offset.

4. To facilitate conductor installation or to insure that manufacturer's maximum pulling tension is not exceeded.
 - I. Where requirements of the special system or telephone installer/vendor dictate raceway access or provisions.
 - J. Do not splice conductors in pull boxes. Splices are not permitted in pull boxes except where specifically approved in writing by the Engineer. Where splices are permitted, make splices as specified in Wire & Cable Specifications.
 - K. Where pull boxes are required, one shall be furnished for each individual branch circuit, feeder or special system. It shall contain only the individual circuit, feeder or special system. A combined pull box for multiple branch circuit conduits or feeders is not permitted, unless approved by the Engineer. Where permitted, multiple circuits within pull box shall:
 1. Circuit conductors and feeders shall be individually laced with nylon straps and nylon identification tabs. Conduits shall enter pull box in such manner that conduits enter and exit in the same plane (both horizontal and vertical).
 2. Feeder circuits shall be separated by full height and length sheet metal (NEC gage) or polyester resin barrier secured with angle brackets.
 - L. Where exterior junction or pull boxes are required, install in the following manner:
 1. Exterior junction or pull boxes shall be mounted flush with finished grade, unless noted otherwise. Coordinate with the final grade elevation.
 2. Heavy traffic rated covers shall be provided in sidewalks, paved areas or within six (6) feet of same.
 3. Seal conduit entries into boxes with duct seal to prevent entrance of water, after conductors are installed.
 4. Taps and splices, where permitted by these specifications, shall be performed with an encapsulating watertight connection kit which insulates and moisture seals the connection.
 - M. After completion, clean all work of dirt, construction debris, paint and refuse.

3.02 COVERS

- A. All junction boxes, utility boxes, etc., shall be covered with a coverplate. The coverplate shall be a finished plate as specified elsewhere unless designated otherwise.
- B. Coverplates shall be mounted vertically unless designated otherwise.
- C. Permanently mark each junction box and pull box cover with the circuit numbers for all conductors contained within. Utilize indelible ink black marker for normal power and red marker for emergency power and fire alarm.

- D. All junction boxes and pull boxes for wiring systems above 600 volts shall be painted red and identified with high voltage warning labels in accordance with OSHA standards. Raceway shall be identified with the same labels installed every twenty (20) linear feet.

3.03 EQUIPMENT ANCHORING

A. Support all boxes from structure:

1. Secure to hollow masonry with toggle bolts.
2. Secure to heavy gage metal with bolts or clamps.
3. Anchors for solid masonry and concrete shall be self-drilling or insert expansion shields with bolts or powder actuated drive pin studs (except in post-tension construction).
4. Secure outlet boxes to dry wall studs with steel mounting bracket screwed into stud having support leg to restrain box.
5. Where box is suspended below structure, support from structure with threaded steel rod secured with double nuts. Pull boxes larger than 18" x 18" x 8" shall be supported from power strut and threaded steel rod suspension. Provide seismic bracing where required by local authority.

- B. All items of electrical equipment, such as enclosures, panels, troughs, pull boxes, etc., shall be securely anchored to the building structure. The anchoring shall be accomplished by utilizing a minimum size of 3/8" steel anchor bolts in the structure and to the item of equipment. A minimum of two (2) anchor bolts shall be provided on each side of each item of equipment with the following exceptions:

Exception No. 1: If the equipment manufacturer includes more than two (2) anchor holes per side in the base or base frame of the equipment item, then there shall be one anchor for each anchor hole.

Exception No. 2: If the equipment manufacturer recommends a particular quantity greater than two (2) per side, then that quantity of anchors shall be provided.

END OF SECTION

SECTION NO. 16140

WIRING DEVICES

PART 1 - GENERAL

1.01 DESCRIPTION

All work specified in this Section shall comply with the provisions of Section 16010.

This Section covers wiring devices and cover plates including receptacles, switches, dimmer controls, plugs, plug connectors, floor outlets, concealed service floor outlets and poke-through device assemblies.

PART 2 - PRODUCTS

2.01 MANUFACTURED WIRING DEVICES

- A. Provide manufactured wiring devices and cover plates, in types, colors, and electrical ratings for applications indicated and complying with NEMA Standard WD 1. Where types and grades are not indicated, provide specification grade selection as determined to fulfill wiring requirements, and complying with NEC and NEMA standards for wiring devices. Provide white color devices and cover plates except as noted otherwise. Color selection shall be verified with the Owner prior to purchase and installation.
- E. The devices specified herein are the products of one manufacturer. Provide heavy-duty specification grade devices selected from approved manufacturer listing.

2.02 WALL SWITCHES

- A. Wall switches shall be Institutional, heavy-duty specification grade, plastic body, nylon or lexan toggle, totally enclosed base & cover, quiet type, self-grounding, back wired, 277 volts AC and 20A rating.

Single Pole:	Hubbell No. 1221
Double Pole:	Hubbell No. 1222
Three-way:	Hubbell No. 1223
Four-way:	Hubbell No. 1224

- B. Flush motor switches shall have a red pilot light and overload protection for actual fractional horsepower motors furnished. Square D FSJ-1P or approved equal.

2.03 RECEPTACLES

- F. Duplex receptacles shall be heavy-duty specification grade, plastic base, nylon face, two-pole, three wire, self-grounding, back/side wired, 125 volts AC and NEMA 5-15R (15A) or NEMA 5-20R (20A) rating as indicated on drawings.

Duplex NEMA 5-15R	Hubbell 5262
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Duplex NEMA 5-20R

Hubbell 5362

Isolated ground duplex receptacles shall be orange heavy-duty specification grade, plastic base, nylon face, two-pole, three wire, self-grounding, back/side wired, 125 volts AC and NEMA 5-15R (15A) or NEMA 5-20R (20A) rating as indicated on drawings.

Duplex IG NEMA 5-15R

Hubbell IG5262

Duplex IG NEMA 5-20R

Hubbell IG5362

Ground fault circuit interrupting (GFCI) duplex receptacles shall be heavy-duty, industrial specification grade, plastic base, nylon face, two-pole, three wire, supplied with pre-stripped wire leads, feed-through protection, 125 volts AC and NEMA 5-15R (15A) or NEMA 5-20R (20A) rating as indicated on drawings.

Duplex GFCI NEMA 5-15R

Hubbell GF5262

Duplex GFCI NEMA 5-20R

Hubbell GF5362

Single receptacles shall be heavy-duty specification grade, plastic base, nylon face, two-pole, three wire, self-grounding, back/side wired, 125 volts AC and NEMA 5-20R (20A) rating.

Single NEMA 5-20R

Hubbell 5361

Clock outlets shall be specification grade, plastic base, phenolic face, two-pole, three wire, side wired, stainless steel plate with recessed outlet, 125 volts AC and NEMA 5-15R (15A) rating.

Clock outlet NEMA 5-15R

Hubbell 5235

Special purpose outlets shall be heavy-duty specification grade, plastic base, nylon face, poles as noted, wires as noted, grounding type, back/side wired, with voltage and capacity rating noted. Conform to NEMA configuration requirements.

Exterior flush mounted duplex outlets shall be GFCI heavy-duty, industrial specification grade, plastic base, nylon face, two-pole, three wire, supplied with pre-stripped wire leads, feed-through protection, 125 volts AC and NEMA 5-15R (15A) recessed mounted in TayMac gasketed enclosure model Masque 72206 or approved equal. Unit assembly shall protrude no more than 1/2" and shall be rainproof in use per NEC 410-57. Provide color as specified by the Architect.

2.03 COVERPLATES

- G. Coverplates for flush mounted devices shall be one piece standard size high impact smooth nylon surface. Color shall match wiring device finishes. Device plates for masonry walls shall be jumbo type.

Telephone/data outlet coverplates shall be the same finish as above and have two (2) modular jack openings with blank fillers as required.

Coverplates for flush mounted GFCI devices shall be premarked "GFCI PROTECTED".

Coverplates for flush mounted IG devices shall be premarked "ISOLATED GROUND".

Coverplates for flush mounted EMERGENCY POWER devices shall be premarked "EMERGENCY".

2.04 PLUGS & CONNECTORS

- A. Plugs and connectors shall be of nylon construction, heavy duty specification grade, brass contacts and terminations, conforming to UL 94 & 498, with cord grips, 600 VAC working range, straight blade or locking type and NEMA type as noted.

2.05 FLOOR OUTLETS

- A. Where installation of floor mounted device box requires penetration of a fire rated floor slab, the installation shall be made with a fire rated floor fitting, U. L. Listed for use in this specific fire rated floor design. Fire barrier shall be rated to prohibit passage of smoke when heat is not present.
- H. If and where required, floor outlets shall be single gang floor boxes, Steel city No. 601 Series, complete with cast iron body, vertical angular adjustment, with brass frame, brass floorplate (#P60-CACP for duplex receptacle and #P60-3/4-2-CACP for phone/data) and gasket. Larger than standard tapings shall be furnished where required. Adjacent boxes shall be installed on minimum 7" centers.

2.06 POKE-THROUGH ASSEMBLIES

- A. Flush poke-through fittings shall be U. L. Listed for fire rating, with retaining ring, suitable for use in three (3) inch core or insert, consisting of flush service fitting, poke-through device and outlet box. Fittings shall be U. L. Listed for dual service use (power and phone/data) in a single service fitting and shall have neoprene seals at base of fitting. Minimum spacing shall be two (2) feet between similar fittings. Specific fitting requirements shall be as specified on the drawings. Carpet flange with epoxy finish shall be provided.

2.07 ACCEPTABLE MANUFACTURERS

- A. Wiring devices & cover plates
 - Arrow-Hart
 - Eagle
 - Leviton
 - Square D
 - Sierra
 - Hubbell
 - Pass & Seymour
 - TayMac
- B. Wall dimmers
 - Lutron
 - Hunt
 - Prescolite
 - Lightolier
- Plugs & connectors
 - Arrow-Hart
 - Hubbell
 - Pass & Seymour
 - Eagle
 - Leviton

- A. Install wiring devices as indicated, in compliance with manufacturer's written instructions, applicable requirements of NEC and NECA's "Standard of Installation", and in accordance with recognized standard industry practices to fulfill project requirements.
- I. Where more than one wiring device is indicated at a location, the devices shall be gang-mounted in combined multi-gang boxes and covered jointly by a common coverplate. Provide barriers as required by the devices and voltages being used.

Install wiring devices only in electrical outlet boxes which are clean, free from construction debris, drywall compound and dirt. At final inspection all wiring devices shall be clean, free of paint overspray, unbroken and in new condition.

Ground all wiring devices by electrically continuous, pigtail connection such that removal of device does not open grounding path to any downstream device. Connect the grounding screw of each device to the equipment grounding conductor.

Prior to energizing circuits, test wiring system for electrical continuity, freedom from faults, and proper polarity of connections. After energizing circuits, test wiring devices to demonstrate compliance with these requirements.

3.04COVERPLATES

- J. All junction boxes, outlet boxes, multi-gang switch boxes, utility boxes, etc., shall be covered with a coverplate. The coverplate shall be a finished plate as specified unless designated otherwise.

Coverplates shall be mounted vertically unless designated otherwise.

Do not install cover plates until after painting and/or other finish work is complete.

Where the cover plate does not completely cover the wall opening, replace the plate with an oversized (midi or jumbo) plate or repair the wall opening. Where one oversize plate is used, replace all cover plates in the room with the oversize plates.

Remove concrete protectors and clean all floor boxes after concrete pour. Adjust boxes to be flush with finish floor elevation.

At final inspection, all wiring devices and cover plates shall be clean, without paint overspray, undamaged and unscratched or broken.

END OF SECTION

SECTION NO. 16170

MOTOR AND FEEDER DISCONNECT SWITCHES

PART 1 – GENERAL

1.01 DESCRIPTION

All work specified in this Section shall comply with the provisions of Section 16010.

This Section covers disconnect switches for electrical equipment, 600 volts or less, and fuses mounted in the disconnect switches.

Furnish and install disconnect switches for the following conditions:

Where indicated on the drawings or schedules.

For all motor controllers unless installation conforms to exceptions in the NEC.

For all motors located out-of-sight of its motor controller except as specifically stated in these documents.

Where required by the National Electrical Code.

PART 2 - PRODUCTS

2.01 QUALITY ASSURANCE

A. Industry Reference Standards:

1. Underwriters Laboratories Inc. Publications:
UL 98 Enclosed Switches
UL 198.2 High Interrupting Fuses, Current Limiting Type
UL 198.4 Class R Fuses
2. National Fire Protection Association (NFPA):
NFPA 70, 1993.
3. National Electrical Manufacturers Association:
KS-1 Enclosed Switches
PUB 250 Enclosures for Electrical Equipment
4. American National Standards Institute:
C97.1 Low Voltage Cartridge Fuses (600 v)

K. All equipment furnished shall be U.L. Listed and Labeled.

2.02 DISCONNECT SWITCHES

Disconnect switches shall be "heavy-duty" type enclosed switches of quick-make, quick-break construction. Current carrying parts shall be copper, with silver tungsten type switch contacts and positive pressure type reinforced fuse clips. Switches

shall be horsepower rated type HD where motor is served and rated for either 250 volt AC or 600 volt AC as required for voltages utilized. Size in accordance with the NEC. Lugs shall be UL listed for copper and aluminum cable.

Switches shall be furnished in NEMA 3R enclosure unless noted otherwise. Switches located on the exterior of the building or in "wet" locations shall have NEMA 3R enclosures. When subject to splashing water, seepage of water, or falling or hose-directed water, switches shall be furnished in NEMA 4 enclosures. When located in an industrial plant subject to fibers, lint, dust, dirt, etc., switches shall be furnished in NEMA 12 enclosures.

Fused disconnect switches shall have rejection type fuse clips with dual element, current limiting fuses of rating shown.

Furnish a solid neutral bus or lug for each switch being installed in a circuit which contains a neutral conductor.

Furnish an equipment grounding conductor lug bonded to the switch enclosure by dedicated fastener.

Disconnect switches shall be non-fusible type safety switch, unless fused type is specified or indicated on the drawings, with the number of poles required to disconnect all ungrounded conductors serving equipment.

Provide multi-pole disconnect switches for all dual speed motors to disconnect all ungrounded conductors serving equipment.

Switches shall have the following features:

Line terminal shields on line and load lugs.

Padlocking provisions shall be provided for padlocking in the "Off" position.

Each switch shall have defeatable door interlock mechanism to prevent door from being opened when switch is in closed position.

Provide arc chute for each pole.

Provide nameplate for each switch as previously specified.

Fusible switches through 600 ampere shall be provided with rejection clips to accept RK1 or RK5 fuses only. Fusible switches larger than 600 ampere shall be suitable for Class L fuses. Furnish and install a complete set of fuses in each disconnect switch sized as indicated on the drawings. Fuses serving predominantly motor or transformer loads shall be dual element, time-delay type, otherwise non-time delay type is required. Fuses shall be current limiting type.

2.03 ACCEPTABLE MANUFACTURERS

A. Acceptable disconnect switch manufacturers are:

General Electric	Square D
Cutler Hammer	Siemens-Allis
Allen-Bradley	Appleton Electric
Crouse-Hinds	Furnas
Westinghouse	

L. Acceptable fuse manufacturers are:

Chase-Shawmut	Buss
GEC Alsthom	

Equipment supplied under this section shall be the same manufacturer as the Service and Distribution Equipment.

PART 3 - EXECUTION

3.01 INSTALLATION

- M. Locate disconnect switches to provide working clearance and full accessibility as required by the NEC.

Unless indicated otherwise on the drawings, locate disconnect switches adjacent to equipment served.

Provide power wiring to and install all disconnect switches and extend feeders to motors or other loads, unless integrally factory mounted on a piece of equipment.

Provide power wiring to all roof mounted equipment via roof curb openings provided. Do not penetrate roof membrane with conduit stubups.

Coordinate exact location of motor termination boxes with raceway roughin provisions to insure correct installation

Connect all heating and air conditioning equipment and have this equipment complete and ready for operation. Contractor shall be responsible for checking equipment manufacturer submittal data to obtain exact location of all electrical connections for equipment before installation.

A short section of watertight metallic flexible conduit shall be used at each motor connection.

Restore factory finish to all equipment provided herein and touch up scratched or marred surfaces to match original finish. Clean enclosure interior and exterior of dirt, paint, and construction debris.

Maintain conductor phase relationship originating at service entrance throughout motor control center. Group and strap all conductors installed in starter and wiring gutters with nylon straps. Install only one conductor under each terminal. Connect extra conductors via terminal strips. Form and train conductors neatly in enclosures parallel and at right angles to sides of box. Uninsulated conductors shall not extend more than 1/8" from terminal lug.

Do not splice conductors in enclosure. Connections shall be made in suitable junction box located exterior of switch

Conductors not terminating in switch shall not extend through or enter switch enclosure

3.02 MOUNTING AND SUPPORT

- A. Locate switches to provide working clearance and fully accessible as required by the NEC. Do not mount switches directly to or on any mechanical equipment.
- N. Enclosure shall be secured to structure by a minimum of four (4) fastening devices. Disconnect switches 600 ampere and larger shall have a minimum of eight (8) fastening devices. A fender washer (minimum 1 1/4" OD) shall be used between head of screw and enclosure.

Install equipment with operating handle at 5'-0" AFF, unless otherwise noted.

Where enclosure is not indicated on a wall or structure, construct a metal channel (power strut) free standing frame secured to floor, pad, or building structure. In exterior applications, all support structure shall be galvanized.

Where disconnect switch is mounted on drywall partitions, provide 3/4" painted plywood backboard exceeding switch size by one (1) foot in each direction, secured to drywall studs and fasten switch to backboard.

Provide specified nameplates on feeder switches, fused disconnect switches and non-fused disconnect switches.

END OF SECTION

SECTION NO. 16171

VARIABLE FREQUENCY DRIVES

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. General: This specification defines the minimum requirements for Variable Frequency Drives (VFD) and accessories for speed control of either constant or variable torque loads.

1.02 RELATED WORK: NONE.

1.03 REFERENCES:

- A. UL 508C
- B. CE
- C. NEC
- D. ISO 9001
- E. IEEE519-1992

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:

- A. Danfoss, Allen-Bradley, Cutler-Hammer, Square D, Siemens, or approved equal.

2.02 GENERAL:

- A. Furnish complete VFD as specified herein or in the equipment schedule for loads designated to be variable speed. VFD's shall be user-selectable for either constant or variable torque loads.
- B. The VFD shall convert incoming fixed frequency three-phase AC power into a variable frequency and voltage for controlling the speed of three-phase AC induction motors. The VFD shall be a twelve-pulse or greater input design. The VFD shall be of a PWM output design utilizing current IGBT inverter technology and voltage vector control of the output PWM waveform and shall output a waveform that closely approximates a sine wave.
- C. The VFD shall be provided with an enclosure that is rated NEMA Type 3R. A VFD that is mounted in a separate enclosure is not acceptable. The enclosure shall be suitable for installations that require protection against windblown dust and rain or splashing water. All cast aluminum parts shall be powder-coated with a durable epoxy that is capable of withstanding harsh environments.

- D. The manufacturer of the VFD shall demonstrate a continuous period of manufacturing and development of VFD's for a minimum of 40 years. VFD's that are brand-labeled are not acceptable.
- E. The VFD shall produce an output waveform capable of handling maximum motor cable distances of up to 1,000 ft. (unshielded) without tripping or derating.
- F. The VFD shall output a voltage-vector switching algorithm, or equivalent, in both variable and constant torque modes. It shall further output rated RMS fundamental voltage. This allows the motor to operate at a lower temperature rise, extending its thermal life. VFD's that cannot produce rated RMS fundamental output voltage or require the input voltage to be increased above motor nameplate value to achieve rated RMS fundamental output voltage are not acceptable. VFD's that utilize Sine-Coded PWM or Look-up tables shall not be acceptable.
- G. An Automatic Energy Optimization (AEO) selection feature shall be provided in the VFD to minimize energy consumption in variable torque applications. This feature shall optimize motor magnetization voltage and shall dynamically adjust output voltage in response to load, independent of speed. Output voltage adjustment based on frequency alone is not acceptable for single motor VT configurations.
- H. An Automatic Motor Adaptation (AMA) function shall measure motor stator resistance and reactance to optimize performance and efficiency. It shall not be necessary to spin the motor shaft or de-couple the motor from the load to accomplish this optimization. Additionally, the parameters for motor resistance and motor reactance shall be user-programmable.
- I. The VFD selected must be able to source the motor's full load nameplate amperage (fundamental RMS) on a continuous basis, and be capable of running the motor at its nameplate RPM, voltage, current, and slip without having to utilize the service factor of the motor.
- J. The VFD shall offer a programmable motor parameter that allows the total number of poles of a motor to be programmed to optimize motor performance.
- K. VFD shall automatically boost power factor at lower speeds.
- L. The VFD will be capable of running either variable or constant torque loads. In variable torque applications, the VFD shall provide a CT-start feature and be able to provide full torque at any speed up to the base speed of the motor. In either CT or VT mode, the VFD shall be able to provide its full rated output current continuously and 110% of rated current for 60 seconds.
- M. Switching of the input power to the VFD shall be possible without interlocks or damage to the VFD at a minimum interval of 2 minutes.

- N. Switching of power on the output side between the VFD and the motor shall be possible with no limitation or damage to the VFD and shall require no additional interlocks.
- O. The VFD shall have temperature controlled cooling fans for quiet operation, minimized internal losses, and greatly increased fan life.
- P. The VFD shall include an integral RFI filter conforming to the A2 standard as a minimum. VFD enclosures shall be made of metal to minimize RFI and provide additional immunity.
- Q. VFD shall provide full galvanic isolation with suitable potential separation from the power sources (control, signal, and power circuitry within the drive) to ensure compliance with PELV requirements and to protect PLC's and other connected equipment from power surges and spikes.
- R. All inputs and outputs shall be optically isolated. Isolation boards between the VFD and external control devices shall not be required.
- S. There shall be six fully programmable digital inputs for interfacing with the systems external control and safety interlock circuitry. Two of these inputs shall be programmable as inputs or outputs.
- T. The VFD shall have two analog signal inputs. Inputs shall be programmable for 4-20 mA.
- U. One programmable analog output shall be provided for indication of the drive status. This output shall be programmable for output speed, voltage, frequency, motor current and output power. The analog output signal shall be 4-20 mA.
- V. The VFD shall provide two user programmable relays with 75 selectable functions. Two form 'C' 230VAC/2A rated dry contact relay outputs shall be provided.
- W. An embedded cascade pump controller shall be included to provide lead pump alternation and provide control for up to 3 total pumps. The VFD Pump and 2 other pumps can be controlled by a softstarter.
- X. The VFD shall accept a N.C. motor over-temperature switch input, as well as possess the capability to accept a motor thermistor input.
- Y. Run permissive circuit shall be provided to accept a "system ready" signal to ensure that the VFD does not start until auxiliary equipment are in the proper state for VFD operation. The run permissive circuit shall also be capable of sending an output signal as a start command to actuate external equipment before allowing the VFD to start, if required.
- Z. The VFD shall be equipped with a standard RS-485 serial communications port and front-of-drive accessible USB port. A ModBus RTU communications shall be integrally mounted.

- AA. A Windows® compatible software program to display all monitoring, fault, alarm, and status signals shall be available. This software program shall allow parameter changes, storage of all VFD operating and setup parameters, and remote operation of the VFD. The software shall connect to the VFD with a standard USB cable.

2.03 HARMONICS

- A. The VFD shall provide internal DC link reactors to minimize power line harmonics and to provide near unity power factor. DC Link reactor shall be installed so that power fluctuations to the DC Capacitors shall be reduced to increase Capacitor life. VFD's without a DC link reactor shall provide a 5% impedance line side reactor and provide spare capacitors.

2.04 PROTECTIVE FEATURES:

- A. VFD shall have input surge protection utilizing MOV's, spark gaps, and Zener diodes to withstand surges of 2.3 times line voltage for 1.5 msec.
- B. Printed Circuit boards shall be conformal coated to reduce the corrosion effect from environmental gases and other conditions. The conformal coating must meet IEC 61721-3-3, Class 3C2.
- C. VFD shall include circuitry to detect phase imbalance and phase loss on the input side of the VFD.
- D. VFD shall include current sensors to monitor all three-output phases to detect and report phase loss or unbalance or other power issues to the motor. The VFD will identify which of the output phases is low or lost.
- E. VFD shall auto-derate the output voltage and frequency to the motor if an input phase is lost. This result will maintain operation without decreasing the life expectancy of the VFD. The use of this feature shall be user selectable and export a warning during the event.
- F. VFD shall auto-derate the output voltage and frequency to the motor in the presence of sustained ambient temperatures higher than the normal operating range, so as not to trip on an inverter temperature fault. The use of this feature shall be user-selectable and a warning will be exported during the event. Function shall reduce switching frequency before reducing motor speed.
- G. VFD shall auto-derate the output frequency by limiting the output current before allowing the VFD to trip on overload. The speed of the load can be reduced, but not stopped.

2.05 INTERFACE FEATURES:

- A. VFD shall provide an alphanumeric backlit display keypad (LCP) which may be remotely mounted using a standard 9-pin cable. VFD may be operated with keypad disconnected or

- removed entirely. Keypad may be disconnected during normal operation without the need to stop the motor or disconnect power to the VFD.
- B. VFD Keypad shall feature an INFO key that, when pressed, shall display the contents of the programming manual for the parameter that is currently viewed on the display. The description shall explain the feature and how the settings can be made by the operator.
 - C. VFD shall display all faults in plain text; VFD's which can display only fault codes are not acceptable.
 - D. The keypad shall feature a 6-line graphical display and be capable of digitally displaying up to five separate operational parameters or status values simultaneously (including process values with the appropriate engineering unit) in addition to Hand/Off/Auto, Local/Remote, and operating status.
 - E. Two lines of the display shall allow "free text programming" so that a site description or the actual name of the equipment being controlled by the VFD can be entered into the display.
 - F. Keypad shall provide an integral H-O-A (Hand-Off-Auto) and Local-Remote selection capability, and manual control of speed locally without the need for adding selector switches, potentiometers, or other devices.
 - G. All VFD's shall be of the same series, and shall utilize a common control card and LCP (keypad/display unit) throughout the rating range. The control cards and keypads shall be interchangeable through the entire range of drives used on the project.
 - H. VFD keypad shall be capable of storing drive parameter values in non-volatile RAM uploaded to it from the VFD, and shall be capable of downloading stored values to the VFD to facilitate programming of multiple drives in similar applications, or as a means of backing up the programmed parameters.
 - I. VFD Display shall have the ability to display 5 different parameters pertaining to the VFD or the load including: current, speed, DC bus voltage, output voltage, input signal in mA, or other values from a list of 92 different user-selectable parameters.
 - J. VFD display shall indicate which digital inputs are active and the status of each relay.
 - K. It shall be possible to toggle between three status read-out screens by pressing the [Status] key. Various operating variables, even with different formatting, can be shown in each status screen.
 - L. VFD display shall indicate the value of any voltage or current signal, including the engineering units of measurement, connected to the analog input terminals.
 - M. VFD display shall indicate the value of the current at the analog output terminals, including the engineering units of measurement.
 - N. A red FAULT light, a yellow WARNING light and a green POWER-ON light shall be provided. These indications shall be visible both on the keypad and on the VFD when the keypad is removed.

- O. Two-level password protection shall be provided to prevent unauthorized changes to the programming of the VFD. The parameters can be locked via a digital input and/or the unit can be programmed not to allow an unauthorized user to change the parameter settings.
- P. A quick setup menu with factory preset parameters shall be provided on the VFD to facilitate commissioning. Use of macros shall not be required.
- Q. A digital elapsed time meter and kilowatt hour meter shall be provided in the display.
- R. VFD shall offer as standard an internal clock. The internal clock can be used for: Timed Actions, Energy Meter, Trend Analysis, date/time stamps on alarms, Logged data, Preventive maintenance, or other uses. It shall be possible to program the clock for Daylight Saving Time / summertime, weekly working days or non-working days including 20 exceptions (holidays, etc.). It shall be possible to program a Warning in case the clock has not been reset after a power loss.
- S. A battery back-up shall be provided to maintain internal clock operation during power interruptions. Battery life shall be no less than 10 years of normal operation.
- T. The VFD shall store in memory the last 10 faults with time stamp and recorded data.

2.06 SOFTWARE FEATURES:

- A. The VFD shall have an adjustable output switching frequency.
- B. Four complete programming parameter setups shall be provided, which can be locally selected through the keypad or remotely selected via digital input(s), allowing the VFD to be programmed for up to four alternate control scenarios without requiring parameter changes.
- C. In each programming set up, independent acceleration and deceleration ramps shall be provided. Acceleration and deceleration time shall be adjustable over the range from 0 to 3,600 seconds to base speed.
- D. The VFD shall have four programmable "Bypass frequencies" with adjustable bandwidths to prevent the driven equipment from running at a mechanically resonant frequency. The feature shall offer a Semi-Automatic program to simplify the set-up.
- E. In each programming setup, independent current limit settings, programmable between 50% and 110% of the drives output current rating, shall be provided.
- F. PID parameter settings shall be adjustable while the VFD is operating, to aid in tuning the control loop at start up. The VFD will also be capable of simultaneously displaying set-point reference and feedback values with appropriate engineering units, as well as output frequency, output current, and run status while programming the PID function.
- G. The VFD will include a "loss of follower" function to detect the loss of process feedback or reference signals with a live-zero value and a user-selectable

choice of responses (go to set speed, min speed, max speed, stop, stop, and trip).

- H. A Sleep Mode function shall be provided to reduce wear and heating of the pump and other equipment in periods where system demand is minimal. This function will operate in both open and closed loop modes:
 - 1. In closed loop process control, when the output speed drops to a user-programmed minimum value ("sleep frequency") for a specified time ("sleep mode timer"), the drive will enter a sleep mode and either go into standby, or boost mode before entering standby. The drive shall automatically restart the motor once the output of the PID processor exceeds a programmable value "wake up frequency".
 - a. Boost mode shall prevent short-cycling of the motor by temporarily adjusting the set-point by a user-programmable percentage. Upon reaching this value, the unit will go into standby.
 - 2. In open loop, the drive shall be capable of entering sleep mode if the input reference drops below a user-programmable value. When the input reference increases above a user-programmable reference, the drive will automatically start.
- I. An initial ramp function shall be available to provide a user-selectable ramp, up to 60 seconds, for applications requiring a faster or slower ramp than the normal ramp.
- J. A Dual Ramp feature shall include a Check Valve Ramp and a final Ramp feature. The Check Valve Ramp shall be programmable to gently seat a check valve and reduce the potential of damage from excess pressure while shutting-down the system. Both time and end speed shall be programmable. On the Final Ramp, the VFD shall be programmable to quickly stop the motor after seating of a check valve or for a more rapid stopping than the normal ramp down setting.
- K. VFD shall offer up to 4 separate PID controllers. One controller shall operate the drive in closed loop, while the other 3 provide control signals to other equipment. VFD's with PI controllers only are not acceptable.
- L. An auto tuning PI controller output feature shall provide automated PI controller settings. Once the user accepts the settings, the VFD will save the settings to memory.
- M. An empty pipe fill mode shall be available to fill an empty pipe in a short period of time, and then revert to the PID controller for stable operation. Pipe fill mode shall have a programmable time to reduce water hammer in the system or fill the pipe at a unit per time rate.
- N. Automatic "No-Flow Detection" shall be available to detect a no-flow situation in pump systems where all valves can be closed. This shall be functional in closed loop control or when controlled by an external signal.

- O. Dry-pump detection shall be available to detect if the pump has run dry. If this condition occurs, the drive will be safely stopped. A timer shall be included to prevent nuisance tripping.
- P. End-of-Pump curve detection shall stop motor when the pump is operating outside of its programmed pump curve.
- Q. VFD shall provide a flow compensation program to reduce energy by adjusting the setpoint to match changes in flow (friction loss). Flow compensation shall also operate in Cascade control mode.
- R. The VFD shall have a motor preheat function with the ability to be programmed to induce a small amount of current to the motor whenever it is at rest. This will prevent condensation inside the motor and help to extend its life without the need for space heaters or other external equipment.
- S. The VFD will include a user-selectable Auto-Restart function that enables the VFD to power up in a running condition after a power loss, to prevent the need to manually reset and restart the VFD.
- T. The VFD will include a user-selectable Reset function, which enables the selection of between zero and twenty restart attempts after any self-clearing fault condition (under-voltage, over-voltage, current limit, inverter overload, and motor overload), or the selection of an infinite number of restart attempts. The time between restart attempts shall be adjustable from 0 through 600 seconds.
- U. An automatic "on-delay" function may be selected from 0 to 120 seconds.
- V. VFD shall catch a rotating motor operating either in forward or reverse at up to full speed.

2.07 PACKAGING OPTIONS:

- A. Provide a manual bypass consisting of a door interlocked main fused-disconnect pad lockable in the off position, a built-in motor starter and a four position DRIVE/OFF/BYPASS/TEST switch controlling three contactors. In the DRIVE position, the motor is operated at an adjustable speed from the drive. In the OFF position, the motor and drive are disconnected. In the BYPASS position, the motor is operated at full speed from the AC power line and power is disconnected from the drive so that service can be performed. In BYPASS Position, a Softstarter will be in the circuit to allow the motor to avoid an across the line start. In the TEST position, the motor is operated at full speed from the AC line power. This allows the drive to be given an operational test while continuing to run the motor at full speed in bypass. Customer supplied normally closed dry contact shall be interlocked with the drives safety trip circuitry to stop the motor whether in DRIVE or BYPASS mode in case of an external safety fault.
- B. VFD and all required options will be incorporated by the VFD manufacturer into an integrated package, with a single input feed and main disconnect. Semi-conductor rated fuses shall be included to provide additional equipment protection. The VFD shall be rated for 100,000 AIC when the manufacturer's

recommended fuses are used. The VFD enclosure will be available as a NEMA 3R, or other as required by the specification drawings. All enclosures shall be UL Listed, and assembled by the VFD manufacturer in an ISO 9001 registered facility.

2.08 SERVICE CONDITIONS:

- A. The ambient operating temperature of the VFD shall be -10°C to 50°C (14 to 122°F), with a 24-hour average not to exceed 45°C. Storage temperatures shall be -13° F (-25° C) to 149/158° F (65/70° C).
- B. 0 to 95% relative humidity, non-condensing.
- C. Elevation to 3,300 feet (1000 meters) without derating.
- D. VFD shall provide full torque to the motor, given input voltage fluctuations of up to +10% to -15% of the rated input voltage (525 to 690VAC, 380 to 480VAC, or 200 to 240VAC). Line frequency variation of ± 2% shall be acceptable.
- E. No side clearance shall be required for cooling of the units.

PART 3 - EXECUTION

3.01 SUBMITTALS:

- A. Submit manufacturer's performance data including dimensional drawings, power circuit diagrams, installation and maintenance manuals, warranty description, VFD's FLA rating, certification agency file numbers, catalog information and catalog cut-sheets for all major components.
- B. All drawings shall be in an 8.5 X 11" reproducible format, and incorporate the manufacturer's title block on the drawing.
- C. This specification lists the minimum VFD performance requirements for this project. Each supplier shall list any exceptions to the specification. If no departures from the specification are identified, the supplier shall be bound by the specification.
- D. Three copies of all submittals shall be provided.
- E. Submit a computer generated Harmonic Distortion Analysis for the jobsite location.

3.02 QUALITY ASSURANCE:

- A. The manufacturer shall be both ISO-9001 and ISO-14001 certified.
- B. All products shall be CE marked; UL labeled, and meet the requirements of UL-508C and maintain cUL.
- C. To ensure quality and minimize infant-mortality failures on the jobsite, each VFD shall be completely tested by the manufacturer. The VFD shall operate a dynamometer at full load and speed under elevated temperature conditions.

- D. All optional features shall be functionally tested at the factory for proper operation.
- E. Factory test documentation shall be available upon request.

3.03 EXAMINATION:

- A. Contractor to verify that job site conditions for installation meet factory recommended and code-required conditions for VFD installation prior to start-up, including clearance spacing, temperature, contamination, dust, and moisture of the environment. Separate GRC conduit installation of the motor wiring, power wiring, and control wiring, and installation per the manufacturer's recommendations shall be verified.
- B. The VFD is to be covered and protected from installation dust and contamination until the environment is cleaned and ready for operation. The VFD shall not be operated while the unit is covered.

3.04 START-UP AND WARRANTY

- A. A factory-authorized service technician shall perform start-up on each drive ("Startup" shall not include installation or termination of either power or control wiring.) The service technician shall perform start-up on up to 8 drives per day. Start-up costs provided with the bid shall include time and travel for the estimated number of visits required, but shall not be less than at least one half-day with travel. Additional labor for other services be billed at the Manufacturer's published straight-time rates. Upon completion, a startup service report shall be provided.
- B. A 6-year ON-SITE, not depot repair, warranty shall be provided such that the owner is not responsible for any warranty costs including travel, labor, parts, or other costs for a full 6 years from the date of delivery of the Drive. The warranty shall cover all of the following Drive failures including line anomalies – lightning strikes, load anomalies, accidental exposure to moisture or corrosives and accidental collision or other physical damage; product misapplications, vandalism and chronic problems due to the misapplication are not covered. The cost of the warranty shall be included in the bid.

END OF SECTION

SECTION NO. 16191

IDENTIFICATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General and Special Conditions, apply to this Section.

1.02 SUMMARY

A. Identification shall include, but is not limited to, the following:

Engraved Nameplates

Tags

Related Sections:

Comply with Section 16010.

PART 2 - PRODUCTS

2.01 ENGRAVED NAMEPLATES:

Laminated rigid plastic nameplates shall be constructed as follow, unless otherwise indicated or required:

Each panelboard branch circuit shall be labeled by engraving.

Each equipment item shall identifying the designation of switchboard, motor control centers, panelboards, control panel, dry type transformers, and like devices, as indicated on the drawings. Nameplates for surface mounted equipment shall be located in clear view on the centerline of the equipment door or backboard approximately 2 to 3 inches from the top.

Unless otherwise indicated, each nameplate for manually operable control devices, pilot lights, local toggle switches (when function is not readily apparent) and like devices shall identify equipment served.

2.02 CONDUCTOR AND CABLE MARKINGS

A. Conductors shall be color-coded or have identification markings. Wire and cable shall be marked with plastic coated, self-sticking, custom machine printed heat-shrunk type sleeve markers. Markers shall indicate source feeder designation and load destination.

2.03 CONDUIT MARKINGS

- A. Conduits for installation outside the building, conduits, except for branch lighting circuit conduits, shall be tagged at each enclosure and like chambers with brass or stainless steel die-stamped system tags.

PART 3 - EXECUTION

3.01 NAMEPLATES

- A. Align nameplates parallel to backboard or enclosure edges.
- B. Attach to equipment.
- C. Clean each nameplate free of foreign matter.

3.02 MARKINGS AND TAGS

- A. Markings and tags shall be installed so that each can be read without disturbing terminals and as recommended by the manufacturer of the identification item.

3.03 CONTROL WIRING

- A. Control wiring shall be marked at each point of access with identical identification. Markers shall be the same type required for communications cables.

END OF SECTION

SECTION NO. 16511

INTERIOR LIGHTING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Interior luminaires and accessories.
- B. Emergency lighting units.
- C. Exit signs.
- D. Ballasts.
- E. Lamps.
- F. Luminaire accessories.

1.02 RELATED SECTIONS

- A. N/A

1.03 REFERENCES

- A. ANSI C82.1 - Ballasts for Fluorescent Lamps - Specifications.
- B. IES Lighting Handbook.
- C. NFPA 70 - National Electrical Code, 2011 edition
- D. NFPA 101 - Life Safety Code.
- E. UL 924 - Emergency Lighting and Power Equipment

1.04 SUBMITTALS FOR REVIEW

- A. Shop Drawings: Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.
- B. Product Data: Provide dimensions, ratings, and performance data.

1.05 SUBMITTALS FOR INFORMATION

- A. Submit manufacturer's installation instructions. Indicate application conditions and limitations of use. Include instructions for storage, handling, protection, examination, preparation, and installation of Product.

1.06 SUBMITTALS FOR CLOSEOUT

- A. Submit manufacturer's operation and maintenance instructions for each product.

1.07 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum five years' experience.

1.08 REGULATORY REQUIREMENTS

- A. Conform to requirements of NFPA 70.
- B. Conform to requirements of NFPA 101.
- C. Products: Listed and classified by Underwriters Laboratories, Inc. or other nationally recognized testing agency acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

1.09 EXTRA PRODUCTS

- A. Section 01770 - Closeout Procedures.
- B. Furnish two of each plastic lens type.
- C. Furnish two replacement lamps for each lamp type.
- D. Furnish two of each ballast type

1.10 Emergency lighting units provide emergency lighting to comply with NFPA 101 Life Safety Code.

PART 2 - PRODUCTS

2.01 LUMINAIRES

- A. Manufacturers: Furnish products as scheduled on electrical drawings, lighting fixture schedule.

2.02 REFLECTORS / LENS

- A. Prismatic diffusers shall be manufacturer's standard acrylic with #12 pattern.
- B. LED fixture optic shall be glass type to limit discoloration

2.03 EXIT SIGNS

- A. Manufacturer: Furnish products as scheduled on electrical drawings, lighting fixture schedule.
- B. Description: Exit sign fixture listed in compliance with UL 924 and NFPA 101 and with self-contained battery units providing 90 minutes or more of emergency illumination. Exit signs may be remote powered from a master sign as long as master and remotes comply with the above standards and have 90 minutes or more of emergency illumination. Exit signs may be either wedge shape edge-lit LED or aluminum housing LED type.
- C. Housing: Aluminum. May be brushed aluminum finish or coated with enamel or vinyl.

- D. Face: For wedge shape edge-lit exit signs, the face shall be non-yellowing acrylic. Dual face edge-lit exit signs shall have mirror finish. Single face edge-lit exit signs shall be clear. Aluminum housing type unit may have either white or aluminum finish..
- E. Directional Arrows: Chevron type located outside of the "EXIT" legend by 3/8 of an inch. Visible at either 100 feet per August, 1998 UL 924 requirements or at 40 feet and aspect ratio per June, 2001 UL 924 requirements. For aluminum housing type units, universal type for field adjustment unless otherwise specified. For edge-lit units, in direction as indicated on the drawings or as per NFPA 101.
- F. Mounting: Universal, for field selection. Exception: Edge-lit exit signs may have mounting as indicated on the drawings or universal mounting. Suspended ceiling or "hollow wall construction" ceiling mounted edge-lit units shall have recess mounting.
- G. Lamps: Light Emitting Diodes.
- H. Color: LED and letter color shall comply with local codes and standards. Where local codes and standards do not specify color, color shall be green.
- I. Battery shall be maintenance free and charger shall be solid state.
- J. Unit shall be protected by a low voltage disconnect circuit and overload protection.
- K. Brownout circuit shall activate unit even when a total power failure does not occur.

2.04 FLUORESCENT BALLASTS

- A. Manufacturers:
 - 1. MagneTek
 - 2. Advance Transformer
 - 3. Osram/Sylvania
 - 4. General Electric
- B. Description: ANSI C82.1, energy saving electronic rapid start type, suitable for standard T8 lamps or lamps specified, and with parallel lamp connections when for use with two or more lamps so that companion lamps remain lit when one of the lamps fails.
- C. Voltage: Match luminaire voltage as shown on E-207.
- D. Ballasts shall be thermally protected, Electronic Ballasts.
- E. Power factor should be equal to or greater than 0.90.

- F. Maximum lamp crest factor should be 1.7.
 - G. Total harmonic distortion should not exceed 20%.
 - H. Ballasts shall have a minimum noise level rating of "A" unless specifically noted otherwise. Where "A" rated ballasts are not available, the highest available rating shall be furnished and installed utilizing sound reducing mounts or enclosures which act as supplemental sound absorption media, to minimize transmitted sound levels from the fixture.
- 2.05 HIGH INTENSITY DISCHARGE (HID) BALLASTS (Not Applicable)
- 2.06 LAMPS
- A. All lamps should meet minimum Color Rendering Index (CRI) and Lumens Per Watt (LPW) requirements of the National Energy Policy Act of 1992. All lamps should be safety agency listed.
 - B. Lamps shall be rated horizontal, vertical or universal as required by fixture socket position.
 - C. Lamps for recessed cans should be the type recommended by the fixture manufacturer.
 - D. Fluorescent Lamps
 - 1. Manufacturers:
 - 2. GE
 - 3. Philips
 - 4. Osram Sylvania
 - 5. U-tubes and two, four, and eight foot luminaires shall use T8 fluorescent medium bi-pin lamps where electronic ballasts are used.
 - 6. Unless otherwise specified, T8 lamps shall have a Color Temperature of 3500 Kelvin and a Color Rendering Index of 75 or greater.
 - E. Light Emitting Diode (LED) Lamps shall have a color Temperature of 4000-6000Kelvin and a Color Rendering Index of 70 or greater. Lamp type as specified for luminaire
- 2.07 LOW VOLTAGE SWITCHES AND CONTACTORS
- A. Lighting contactors should be mechanically held, with ratings and number of poles as required.
- 2.08 SPECIAL REQUIREMENTS
- A. Pendant fixtures shall have ball aligner sockets secured to fixture studs in ceiling outlet boxes. Stems shall be painted the same color as fixture.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install suspended luminaires using pendants supported from swivel hangers. Provide pendant length required to suspend luminaire at indicated height.
- B. Support ceiling mounted luminaires independent of ceiling or ceiling tiles from structural members of building.
- C. Locate recessed ceiling luminaires as indicated on plan drawings.
- D. Install surface mounted luminaires and exit signs plumb and adjust to align with building lines and with each other. Surface mounted fluorescent fixtures shall be mounted with provisions for air circulation. Secure to prevent movement.
- E. All flex and stems utilized for electrical service to light fixtures shall contain an insulated grounding conductor secured to fixture body and junction box by means of bonding screws.
- F. Install wall mounted luminaires, emergency lighting units, power outage task lighting units, and exit signs at height as indicated on Drawings.
- G. Install accessories furnished with each luminaire.
- H. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaire.
- I. Bond products and metal accessories to branch circuit equipment grounding conductor.
- J. Fixtures in continuous rows, other than recessed grid type, shall be connected by nipples with locknuts and bushings and wired together through fixture channels.
- K. Install specified lamps in each emergency lighting unit, exit sign, and luminaire.

3.02 FIELD QUALITY CONTROL

- A. Operate each luminaire after installation and connection. Inspect for proper connection and operation.
- B. Activate test switch on emergency lighting units and exit signs to verify operation. Reset if necessary.

3.03 ADJUSTING

- A. Aim and adjust luminaires.
- B. Position exit sign directional arrows as required.

3.04 CLEANING

- A. Clean electrical parts to remove conductive and deleterious materials.
- B. Remove dirt and debris from enclosures.

C. Clean photometric control surfaces as recommended by manufacturer.

D. Clean finishes and touch up damage.

3.05 DEMONSTRATION AND INSTRUCTIONS

A. Demonstrate luminaire operation.

3.06 PROTECTION OF FINISHED WORK

A. Relamp luminaires that have failed lamps at substantial completion.

END OF SECTION

SECTION NO. 16520

EXTERIOR LIGHTING

PART 1 GENERAL

1.01 DESCRIPTION

- A. This section specifies the furnishing, installation, and connection of pole mounted luminaries, controls, poles and supports.

1.02 RELATED WORK

- A. Section 16010, Electrical General.
- B. Section 16110, Electrical Raceways: Conduits, fittings, and boxes for raceway systems.
- C. Section 16123, Building Wire and Cable, LOW VOLTAGE (600 VOLTS AND BELOW): Low voltage power and lighting wiring.

1.03 SUBMITTALS

- A. Submit in accordance with Div 1 Submittals, and 16010 Electrical General.
- B. Shop Drawings:
1. Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.
 2. Include electrical ratings, dimensions, mounting details, materials, required clearances, terminations, wiring and connection diagrams, photometric data, ballasts, poles, luminaries, lamps and controls.
 3. Point by point illumination level for all alternate luminaires from those shown on the light fixture schedule. Illumination data shall comply with IESNA Handbook for all applicable areas of use.
- C. Manuals: Two weeks prior to final inspection, submit four copies of operating and maintenance manuals to the Electrical Engineer. Include technical data sheets, wiring and connection diagrams, and information for ordering replacement parts.
- D. Certifications: Two weeks prior to final inspection, submit four copies of the following to the Electrical Engineer:
1. Certification that the materials are in accordance with the drawings and specifications.
 2. Certification, by the Contractor, that the complete installation has been properly installed and tested.

1.04 APPLICABLE PUBLICATIONS

- A. Publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.
- B. American Society for Testing and Materials (ASTM):
 - A123/A123M-2001 Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
 - A153/A153M-2001 Zinc Coating (Hot-Dip) on Iron and Steel Hardware – AASHTO No.: M232
- 1. American Concrete Institute (ACI):
 - 318-2002.....Building Code Requirements for Structural Concrete
- 2. American National Standards Institute (ANSI):
 - C81.61-1990Electrical Lamp Bases
 - C136:31- 2001.....LED Luminaires for 100,000 hours
- 3. Illuminating Engineering Society of North America (IESNA)
 - HB-9-2000.....Lighting Handbook
- 4. National Electrical Manufacturers Association (NEMA):
 - C82.4-1992Ballasts for High-Intensity-Discharge Lamps (Multiple-Supply Type)
 - ICS 2-2000.....Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts
 - ICS 6-1993.....Industrial Control and Systems Enclosures
- 5. National Fire Protection Association (NFPA):
 - 70-2005.....National Electrical Code (NEC)
- 6. Underwriters Laboratories, Inc. (UL):
 - 496-1996.....Edison-Base Lamp holders
 - 1029-1994.....High-Intensity-Discharge Lamp Ballasts
 - 1598-2000.....Luminaries

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Steel Poles: Do not store poles on ground. Store poles so they are at least (one foot) above ground level and growing vegetation. Do not remove factory-applied pole wrappings until just before installing pole.

PART 2 - PRODUCTS

2.01 MATERIALS AND EQUIPMENT

- A. Materials and equipment shall be in accordance with NEC, UL, ANSI, and as shown on the drawings and specified.

2.02 POLES

- A. General:

1. Poles shall be steel, as shown on the drawings, and as specified. Finish shall be as specified on the drawings.
2. The pole and arm assembly shall be designed for wind loading of 100 miles per hour, with an additional 30 percent gust factor, supporting luminaire(s) having the effective projected areas indicated. The effective projected area of the pole shall be applied at the height of the pole base as shown on the drawings.
3. Poles shall be anchor-bolt type designed for mounting on top of extruded concrete columns for supply conductors. Poles shall have oval-shaped handhole having a minimum clear opening of 2.5 by 5 inches. Handhole cover shall be secured by tamper proof stainless steel captive screws.
4. Provide a steel grounding stud opposite hand hole openings.
5. Provide a base cover matching the pole in material and color to conceal the mounting hardware, pole-base welds to anchor bolts.
6. Hardware: All necessary hardware shall be 300 series stainless steel.

- B. Types:

1. Steel: Provide steel poles, primed and painted, corrosion resistant. Poles shall be seamless extruded or spun seamless type. Provide a pole grounding connection designed to prevent electrolysis when used with copper ground wire. Provide base covers for steel poles. Provide GRSC conduit in concrete column for power supply to upper deck pole mounted luminaires. Bond conduit to column rebars and stub out under upper deck concrete floor slab.

2.03 FOUNDATIONS FOR POLES

- A. Foundations shall be cast-in-place concrete.
- B. Foundations shall support the effective projected area of the specified pole, arm(s), and luminaire(s) under wind conditions previously specified in this section.

- C. Place concrete in spirally wrapped treated paper forms for round foundations, and construct forms for square foundations.
- D. Rub-finish and round all above-grade concrete edges to approximately 1/4 inch radius.
- E. Concrete shall have 3000-psi minimum 28-day compressive strength.
- F. Anchor bolt assemblies and reinforcing of concrete foundations shall be as shown on the drawings and meet ACI 318. Anchor bolts shall be in a welded cage or properly positioned by the tie wire to stirrups.
- G. Prior to concrete pour, install a copper clad steel ground rod, not less than 3/4-inch diameter by 10 feet long, below each foundation and bond it to concrete column continuous rebars. Bond the rod to the pole with not less than number 6 AWG bare copper wires. The method of bonding shall be approved for the purpose.

2.04 LUMINAIRES

- A. UL 1598, ANSI C136.17 and CSA-C22.2 number 250 for 40C. Luminaires shall be weatherproof, heavy duty, outdoor types designed for efficient light utilization; adequate dissipation of lamp and ballast heat and safe cleaning and re lamping Luminaire meets EMI compliance per FCC Title 47 CFR Part 15, Class A .
- B. IESNA HB-9 and RP-8 light distribution pattern types shall be as shown on the drawings.
 - 1. Incorporate ballasts in the luminaire housing except where otherwise shown on the drawings.
 - 2. Lenses shall be frame-mounted heat-resistant, borosilicate glass, prismatic refractors. Attach the frame to the luminaire housing by hinges or chain.
 - 3. Lamp sockets for high intensity discharge (H.I.D) fixture shall have locking type porcelain enclosures in conformance to the applicable requirements of ANSI C81.61 and UL 496.
 - 4. Pre-wire internal components to terminal strips at the factory.
 - 5. Bracket mounted luminaires shall have leveling provisions and clamp type adjustable slip-fitters with locking screws.
 - 6. Materials shall be rustproof. Latches and fittings shall be non-ferrous metal.
- C. Lamps:
 - 1. Install the proper lamps in every luminaire installed and every luminaire relocated or reinstalled.

2. Lamps to be general-service, outdoor lighting types.
 3. Metal-Halide Lamps:
 - a. 175 Watt: NEMA C78.1377.
 - b. 250 Watt: NEMA C78.1378.
 4. LED lamps shall have zero uplight for reduced light pollution, with glass optics for minimal dirt depreciation and limited discoloration. Minimal CRI shall be 70; LED color temperature shall range from 4000K to 6000K. LED Drivers shall be solid state type rated for 50,000hours with built in surge protection device designed to meet ANSI/IEEE C62.41-2002 for category C high.
- D. High Intensity Discharge Ballasts:
1. For low voltage systems, the ballasts shall be the high efficiency, high power factor, copper-wound constant wattage type and shall meet the requirements of UL 1029 and NEMA C82.4.
 - a. Ballasts shall operate the discharge lamp of the type, wattage, and voltage shown on the drawings.
 - b. Ballasts shall have individual overcurrent protection (inline fuse holder) as recommended by the ballast manufacturer.
 - c. Ballasts shall be capable of providing reliable starting of the lamps at minus 30 degrees C.
 - d. Open-circuit operation shall not reduce the average life.
 2. Locate protective devices for ballasts to be accessible if the devices are not integral with ballasts.
 3. Each ballast shall operate not more than one lamp except where otherwise shown on the drawings.
- E. Lighting Contactors:
1. NEMA ICS 2, mechanically held contactors. Rate contactors as indicated. Provide in NEMA enclosure conforming to NEMA ICS 6. Contactors shall have silver alloy double-break contacts and shall require no arcing contacts. Provide contactors with hand-off-automatic selector switch.
- F. Controls:
1. Each Lighting System:
 - a. Shall be controlled by one of the following methods as shown for each system on the drawings:

- 1) A photocell to act as the pilot device. The photocell shall be the type which fails safe to the closed position meeting UL 773 or 773A.
 - 2) The pilot devices shall control the power circuit through the contractor or relay as shown on the drawings.
- b. Mount and connect photocells and time clocks as shown on the drawings.
- c. Photocells shall have the following features:
- 1) Quick-response, cadmium-sulfide type.
 - 2) A 15 to 30 second, built-in time delay to prevent response to momentary lightning flashes, car headlights or cloud movements.
 - 3) Energizes the system when the north sky light decreases to approximately 1.5 foot-candles, and maintains the system energized until the north sky light increases to approximately 3 to 5 foot candles.
- d. Time clocks shall have the following features:
- 1) A 24-hour astronomic dial, motor-driven.
 - 2) A spring-actuated, reserve power mechanism for operating the timer during electrical power failures and that automatically winds the spring when the electrical power is restored.
- e. The arrangement and method of control and the control devices shall be as shown on the drawings.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install lighting in accordance with the NEC, as shown on the drawings, and in accordance with manufacturer's recommendations.
- B. Steel Poles:
1. Provide pole foundations with galvanized steel anchor bolts, threaded at the top end and bent 1.57 rad 90 degrees at the bottom end. Provide galvanized nuts, washers, and ornamental covers for anchor bolts. Thoroughly compact backfill with compacting arranged to prevent pressure between conductor, jacket, or sheath and the end of conduit ell. Adjust poles as necessary to provide a permanent vertical position with the bracket arm in proper position for luminaire location.
 2. After the poles have been installed, shimmed and plumbed, grout the spaces between the pole bases and the concrete base with non-shrink

concrete grout material. Provide a copper tube, of not less than 3/8-inch inside diameter, through the grout tight to the top of the concrete base for moisture weeping.

- C. Foundation Excavation: No foundation excavation is necessary. Pole bases will be poured atop of the extruded concrete columns.
- D. Photocell Switch Aiming: Aim switch facing north according to manufacturer's recommendations. Set adjustable window slide for proper foot-candles photocell turn-on.

3.02 GROUNDING

- A. Ground non-current-carrying parts of equipment including metal poles, luminaries, mounting arms, brackets, and metallic enclosures as specified in the documents. Where copper grounding conductor is connected to a metal other than copper, provide specially treated or lined connectors suitable and listed for this purpose.

END OF SECTION

SECTION NO. 16620

SURGE PROTECTION

PART 1 – GENERAL

1.01 DESCRIPTION

- A. All work specified in this Section shall comply with the provisions of Section 16010.
- B. This section describes the electrical and mechanical requirements for a modular, high-energy transient voltage surge suppressor system (abbreviated as TVSS throughout) including integrated TVSS in switchboards, distribution and panel boards. The system shall provide protection for sensitive electronic devices against the harmful effects of surges, transients and electrical line noise.

1.02 STANDARDS

- A. The most recent edition of the specified unit shall be designed, manufactured, tested and installed in compliance with the following standards:
 - 1) ANSI/IEEE C62.41 and C62.45
 - 2) Canadian Standards Association (CSA)
 - 3) Federal Information Processing Standards Publication 94 (FIPS PUB 94)
 - 4) National Electrical Manufacturers Association (NEMA)
 - 5) National Fire Protection Association (NFPA 20)
 - 6) National Electric Code
 - 7) Underwriters Laboratories (UL 1449 and 1283)
 - 8) Institute of Electrical and Electronic Engineers (IEEE)
 - 9) Occupational Safety and Health Act (OSHA)
- B. The system shall be UL listed and labeled under UL 1449 (Second Edition) Standard for Transient Voltage Surge Suppression including UL listed short circuit (fault) current rating and the ratings shall be permanently affixed to the TVSS. The units shall also be listed and labeled to UL1283 Standard for Electromagnetic Interference Filters, CE marked, and CSA listed.

1.03 QUALITY:

- A. The system shall meet the following requirements:

1. Protection Modes. In accordance with NEMA Standard LS 1, the unit shall provide protection in all modes. Wye-configured systems shall provide Line-to-Neutral, Line-to-Ground, and Neutral-to-Ground protection. Delta-configured systems shall provide Line-to-Line protection in ungrounded systems and Line-to-Line and Line-to-Ground protection in grounded systems.
2. The manufacturer shall own and operate a surge simulation system which creates an IEEE C62.41 Category C3 (20 KV/10 KA) surge event.
3. The transient voltage surge suppression system shall meet or exceed the following criteria:

Minimum per phase (L-N, L-G) surge capacity

	High Exposure	Medium Exposure	Low Exposure
Service Entrance	320KA/phase	240KA/phase	160KA/phase
Distribution Panels	160KA/phase	120KA/phase	120KA/phase
Branch Panels	120KA/phase	80KA/phase	80KA/phase

4. The UL 1449 suppression voltage rating for each mode of protection shall not exceed the following:

System Voltage		Surge Voltage Rating		
L-N	N-G	L-G	L-L	
120/240	330 volts	400 volts	400 volts	N/A
120/208	330 volts	400 volts	400 volts	N/A
240	800 volts	800 volts		
277/480	700 volts	800 volts	800 volts	N/A
480	1200 volts	1500 volts		

5. The unit shall be UL 1283 listed as an electromagnetic interference filter. The system shall provide 50-dB insertion loss from 100 kHz to 100 MHz when used in a coordinated facility system.
6. The TVSS and all components in the suppression path (including all current diversion components) maximum continuous operating voltage (MCOV) shall be not less than 115% or greater than 125% of the nominal phase to phase operating voltage.

7. The operating frequency range of the system shall be at least 47 - 63 Hz.
8. At service entrance, a UL listed rotary handle disconnect switch shall be provided as a means of disconnect.
9. The TVSS shall be modular in design. Modules shall be fused with a surge rated fuse and incorporate a thermal cutout device.

1.04 SUBMITTALS

- A. Equipment Manual. The manufacturer shall furnish with each unit delivered an equipment manual that details the installation, operation and maintenance instructions for the specified unit.
- B. Drawings. Electrical and mechanical drawings shall be provided by the manufacturer with the submittal and with each unit delivered that show unit dimensions, weights, mounting provisions, connection details and layout diagram of the unit.
- C. UL 1449 Suppression Voltage Rating. Documentation of unit and system's UL 1449 suppression voltage rating shall be included as required product data submittal information. A line item by line item specification compliance matrix is required in the submittal package to assist the engineer in the equipment approval process.

1.05 WARRANTY

- A. The manufacturer shall provide a full five-year parts and labor warranty from date of shipment against any part failure when installed in compliance with manufacturer's written instructions, UL Listing requirements and any applicable national, state or local electrical codes. Direct factory trained, must be available for 48-hour assessment. A 24-hour 800 number must be available to support warranty.

1.06 ENCLOSURE

- A. The TVSS enclosure shall be designed for wall mounting and shall be rated NEMA 12. Enclosures that have disconnects shall have type "J" replaceable fuses combined with the disconnect and the system designed so that when the disconnect is in the energized position, the door cannot be opened.

PART 2 - PRODUCTS

2.01 STANDARD FEATURES

- A. The TVSS shall include an 8 digit surge event counter with 10 yr. batteries to maintain accurate counts in the event of total loss of power.
- B. Also the TVSS must have electrically isolated Form C dry contacts, one normally open and one normally closed to allow connection to the building management system.

2.02 OPTIONAL FEATURES

- A. The TVSS system shall be provided with a monitoring panel complete with mounting bezel and an integral status panel containing externally visible LED status indicators that monitor the on-line status of each phase of the unit.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. External mounted TVSS shall follow manufacturer's recommendation with lead lengths as short (less than 24") and straight as possible and gently twisted together.

3.02 ACCEPTABLE MANUFACTURERS

- A. The unit shall be designed and manufactured in the USA by a qualified manufacturer of the suppression filter system equipment. The qualified manufacturer shall have engaged in the commercial design and manufacture of such products for a minimum of five (5) years.
- B. Acceptable manufacturers are Liebert, United Power, Current Technology, Cutler Hammer.

END OF SECTION