

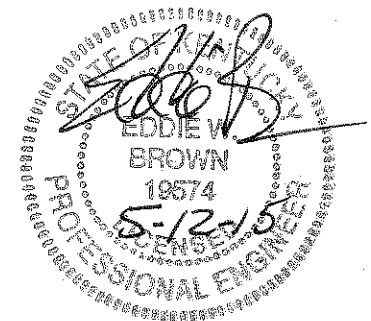
CONTRACT DOCUMENTS AND SPECIFICATIONS

EAST LAUREL WATER DISTRICT APPLE ORCHARD ROAD TRANSMISSION MAIN

Prepared By:

Kenvirons, Inc.
452 VERSAILLES ROAD
FRANKFORT, KENTUCKY 40601

PROJECT No. 2012141



MARCH 2015



TABLE OF CONTENTS

<u>Description</u>	<u>Section</u>	<u>Pages</u>
Advertisement for Bids	00100	1
Instruction to Bidders	00200	8
Bid Form	00410	5
Bid Bond	00430	2
Certification for Contracts, Grants and Loans		1
Certification Regarding Debarment		2
Compliance Statement		2
Notice of Award	00510	1
Agreement	00521	6
Notice to Proceed	00550	1
Performance Bond	00610	2
Payment Bond	00615	2
Certificate of Substantial Completion	00625	1
General Conditions	00710	58
Supplementary Conditions	00800	3
Change Order	00941	1
Partial Pay Estimate		2
Project Sign Detail		1
Prevailing Wage Determination		10
 Technical Specifications		
Special Conditions	00941	12
Special Construction Considerations	01002	2
Earthwork	02001	8
Access Road	02002	1
Seeding, Mulching and Cleanup	02003	3
Horizontal Directional Drilling	02072	6
Fence Construction	02100	3
Concrete	03001	28
Concrete Reinforcement	03002	4
Water Repellent Concrete Masonry Unit Walls	04051	2
Unit Masonry	04200	21
Anchor Bolts and Expansion Anchors	05002	2
Miscellaneous Metals	05003	3
Structural Steel	05120	11
Foamed-In-Place Masonry Wall Insulation	07214	4
Steel Doors and Frames	08110	14
Pump Station	11210	16
Integration of Telemetry Controls	11900	1
Waterlines	15100	24
Waterline Accessories	15101	6
Special Items of Construction	15102	12

Pressure Testing and Sterilization	15103	9
Meters and Services	15104	3
Electrical		
Electrical General Provisions	16000	11
Basic Materials and Methods	16051	2
Electrical Raceways	16110	7
Cable, Wire and Connectors	16120	4
Electrical Boxes and Fittings	16130	3
Electrical Equipment Supports	16135	1
Wiring Devices	16140	4
Motors	16150	4
Motor Starters.....	16155	3
Adjustable Frequency Drives (VFDs)	16157	7
Panelboards	16160	4
Safety and Disconnect Switches	16170	2
Fuses.....	16181	2
Miscellaneous Electrical Equipment	16200	3
Electrical Grounding	16450	5
Transformers	16460	2
Building Lighting Fixtures	16510	4
Surge Protective Devices	16800	7
Telemetry Control.....	16915	10
Controls.....	16920	5
Control and Instrumentation Cable and Wire.....	16941	2
APPENDIX A General Certification – Nationwide Permit #12		1 to 4
APPENDIX B List of Materials Supplied by MicroComm For Each Pump Station		1 to 3

**Section 00100
Advertisement for Bids**

**East Laurel Water District
Apple Orchard Road Transmission Main
Laurel County, Kentucky**

Separate Sealed BIDS for the construction of Apple Orchard Road Transmission Main will be received by the East Laurel Water District, 1670 Hal Rogers Parkway, P.O. Box 726, London, Kentucky 40743 until 1:00 P.M. local time, March 17, 2015 and then publicly opened and read aloud.

This contract consists of approximately 42,000 L.F. of 8-inch PVC water line, two pump stations and appurtenances.

The CONTRACT DOCUMENTS may be examined at the following locations:

EAST LAUREL WATER DISTRICT, 1670 HAL ROGERS PARKWAY, P.O. BOX 726, LONDON, KY 40743

KENVIRONS, INC., 452 VERSAILLES ROAD, FRANKFORT, KY 40601

F. W. DODGE/AGC, 950 CONTRACT STREET, LEXINGTON, KY 40505

Copies of the CONTRACT DOCUMENTS may be obtained from Lynn Imaging, 328 Old Vine Street, Lexington, KY 40507 (859-226-5850) and www.lynnimaging.com upon payment of a nonrefundable price of \$200.00 for each set plus any shipping charges.

Each Bidder must accompany his/her bid with a Bid Bond in amount of not less than five (5) percent of the base bid. No Bidder may withdraw his/her bid for a period of 90 days. The Bidder awarded the contract shall execute a 100% Performance Bond and a 100% Payment Bond and shall furnish insurance as required, in the General Conditions. This contract shall be completed within 210 calendar days after date of authorization to start work. Liquidated damages will be \$600 per calendar day.

Bidders must comply with the President's Executive Order Nos. 11246 and 11375, which prohibit discrimination in employment regarding race, creed, color, sex, or national origin. Bidders must comply with Section 3, Section 109, Title VI of the Civil Rights Act of 1964, the Anti-Kickback Act and the contract Work Hours Standard Act. Bidders must certify that they do not, and will not, maintain or provide for their employees any facilities that are segregated on a basis of race, color, creed, or national origin.

Any bid that is obviously unbalanced may be rejected. The East Laurel Water District reserves the right to reject any and all bids and waive informalities.

Small, minority and women's businesses and labor surplus area firms are encouraged to bid this project.

By: Doug Day, Chairman
East Laurel Water District



**Section 00200
Instructions to Bidders**

TABLE OF ARTICLES

	Page
Article 1 - Defined Terms	1
Article 2 - Copies of Bidding Documents	1
Article 3 - Qualifications of Bidders	1
Article 4 - Examination of Bidding Documents, Other Related Data, and Site	2
Article 5 - Pre-Bid Conference	4
Article 6 - Site and Other Areas	4
Article 7 - Interpretations and Addenda	4
Article 8 - Bid Security	4
Article 9 - Contract Times	5
Article 10 - Liquidated Damages	5
Article 11 - Substitute and "Or-Equal" Items	5
Article 12 - Subcontractors, Suppliers, and Others	5
Article 13 - Preparation of Bid	6
Article 14 - Basis of Bid; Comparison of Bids	6
Article 15 - Submittal of Bid	7
Article 16 - Modification and Withdrawal of Bid	7
Article 17 - Opening of Bids	7
Article 18 - Bids to Remain Subject to Acceptance	7
Article 19 - Evaluation of Bids and Award of Contract	7
Article 20 - Contract Security and Insurance	8
Article 21 - Signing of Agreement	8

ARTICLE 1 - DEFINED TERMS

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

- A. Issuing Office--The office from which the Bidding Documents are to be issued and where the bidding procedures are to be administered.

ARTICLE 2 - COPIES OF BIDDING DOCUMENTS

- 2.01 Complete sets of the Bidding Documents in the number and for the non-refundable deposit sum, if any, stated in the Advertisement for Bids may be obtained from the Issuing Office.
- 2.02 Complete sets of Bidding Documents must be used in preparing Bids; neither Owner nor Engineer assumes any responsibility for errors or misinterpretations resulting from the use of incomplete sets of Bidding Documents.
- 2.03 Owner and Engineer in making copies of Bidding Documents available on the above terms do so only for the purpose of obtaining Bids for the Work and do not confer a license or grant for any other use.

ARTICLE 3 - QUALIFICATIONS OF BIDDERS

- 3.01 To demonstrate Bidder's qualifications to perform the Work, within five days of Owner's request, Bidder shall submit written evidence such as financial data, previous experience, present commitments, and such other data as may be called for below.

- A. The Owner may make such investigations as deemed necessary to determine the ability of the bidder to perform the work, and the bidder shall furnish to the Owner all such information and data for this purpose as the Owner may request. The Owner reserves the right to reject any bid if the evidence submitted by, or investigation of, such bidder fails to satisfy the Owner that such bidder is properly qualified to carry out the obligations of the contract and to complete the work contemplated therein in a timely manner. Conditional bids will not be accepted.
- B. Bidder and any subcontractors the bidder uses must be acceptable to the Owner and have current eligibility for federal programs.
- C. Approval of any proposed subcontract award can not be given by the Owner unless and until the proposed subcontractor has submitted the Certifications and/or other evidence showing that it has fully complied with any reporting requirements to which it is or was subject.

ARTICLE 4 - EXAMINATION OF BIDDING DOCUMENTS, OTHER RELATED DATA, AND SITE

4.01 Subsurface and Physical Conditions

- A. The Supplementary Conditions identify:
 - 1. Those reports of explorations and tests of subsurface conditions at or contiguous to the Site that Engineer has used in preparing the Bidding Documents.
 - 2. Those drawings of physical conditions in or relating to existing surface and subsurface structures at or contiguous to the Site (except Underground Facilities) that Engineer has used in preparing the Bidding Documents.
- B. Copies of reports and drawings referenced in paragraph 4.01.A will be made available by Owner to any Bidder on request. Those reports and drawings are not part of the Contract Documents, but the "technical data" contained therein upon which Bidder is entitled to rely as provided in paragraph 4.02 of the General Conditions has been identified and established in paragraph 4.02 of the Supplementary Conditions. Bidder is responsible for any interpretation or conclusion Bidder draws from any "technical data" or any other data, interpretations, opinions, or information contained in such reports or shown or indicated in such drawings.

4.02 Underground Facilities

- A. Information and data shown or indicated in the Bidding Documents with respect to existing Underground Facilities at or contiguous to the Site is based upon information and data furnished to Owner and Engineer by owners of such Underground Facilities, including Owner, or others.

4.03 Hazardous Environmental Condition

- A. The Supplementary Conditions identify those reports and drawings relating to a Hazardous Environmental Condition identified at the Site, if any, that ENGINEER has used in preparing the Bidding Documents.
- B. Copies of reports and drawings referenced in paragraph 4.03.A will be made available by Owner to any Bidder on request. Those reports and drawings are not part of the Contract Documents, but the "technical data" contained therein upon which Bidder is entitled to rely as provided in paragraph 4.06 of the General Conditions has been identified and established in paragraph 4.06 of the Supplementary Conditions. Bidder is responsible for any interpretation or conclusion Bidder draws from any "technical data" or any other data, interpretations, opinions, or information contained in such reports or shown or indicated in such drawings.

- 4.04 Provisions concerning responsibilities for the adequacy of data furnished to prospective Bidders with respect to subsurface conditions, other physical conditions and Underground Facilities, and possible changes in the Bidding Documents due to differing or unanticipated conditions appear in paragraphs 4.02, 4.03, and 4.04 of the General Conditions. Provisions concerning responsibilities for the adequacy of data furnished to prospective Bidders with respect to a Hazardous Environmental Condition at the Site, if any, and possible changes in the Contract Documents due to any Hazardous Environmental Condition uncovered or revealed at the Site which was not shown or indicated in the Drawings or Specifications or identified in the Contract Documents to be within the scope of the Work appear in paragraph 4.06 of the General Conditions.
- 4.05 On request, Owner will provide Bidder access to the Site to conduct such examinations, investigations, explorations, tests, and studies as Bidder deems necessary for submission of a Bid. Bidder shall fill all holes and clean up and restore the Site to its former condition upon completion of such explorations, investigations, tests, and studies. Bidder shall comply with all applicable Laws and Regulations relative to excavation and utility locates.
- 4.06 Reference is made to Article 7 of the Supplementary Conditions for the identification of the general nature of other work that is to be performed at the Site by Owner or others (such as utilities and other prime contractors) that relates to the Work contemplated by these Bidding Documents. On request, Owner will provide to each Bidder for examination access to or copies of Contract Documents (other than portions thereof related to price) for such other work.
- 4.07 It is responsibility of each Bidder before submitting a Bid to:
- A. Examine and carefully study the Bidding Documents, the other related data identified in the Bidding Documents, and any Addenda;
 - B. Visit the Site and become familiar with and satisfy Bidder as to the general, local, and Site conditions that may affect cost, progress, and performance of the Work;
 - C. Become familiar with and satisfy Bidder as to all Federal, State, and local Laws and Regulations that may affect cost, progress, or performance of the Work;
 - D. Carefully study all: (1) reports of explorations and tests of subsurface conditions at or contiguous to the Site and all drawings of physical conditions in or relating to existing surface or subsurface structures at or contiguous to the Site (except Underground Facilities) which have been identified in the Supplementary Conditions as provided in paragraph 4.02 of the General Conditions, and (2) reports and drawings of Hazardous Environmental Conditions at the Site which have been identified in the Supplementary Conditions as provided in paragraph 4.06 of the General Conditions;
 - E. Obtain and carefully study (or accept consequences for not doing so) all additional or supplementary examinations, investigations, explorations, tests, studies, and data concerning conditions (surface, subsurface, and Underground Facilities) at or contiguous to the Site which may affect cost, progress, or performance of the Work or which relate to any aspect of the means, methods, techniques, sequences, and procedures of construction to be employed by Bidder, including applying any specific means, methods, techniques, sequences, and procedures of construction expressly required by the Bidding Documents, and safety precautions and programs incident thereto;
 - F. Agree at the time of submitting its Bid that no further examinations, investigations, explorations, tests, studies, or data are necessary for the determination of its Bid for performance of the Work at the price(s) bid and within the times and in accordance with the other terms and conditions of the Bidding Documents;

- G. Become aware of the general nature of the work to be performed by Owner and others at the Site that relates to the Work as indicated in the Bidding Documents;
 - H. Correlate the information known to Bidder, information and observations obtained from visits to the Site, reports and drawings identified in the Bidding Documents, and all additional examinations, investigations, explorations, tests, studies, and data with the Bidding Documents;
 - I. Promptly give Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Bidder discovers in the Bidding Documents and confirm that the written resolution thereof by Engineer is acceptable to Bidder; and
 - J. Determine that the Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for the performance of the Work.
- 4.08 The submission of a Bid will constitute an incontrovertible representation by Bidder that Bidder has complied with every requirement of this Article 4, that without exception the Bid is premised upon performing and furnishing the Work required by the Bidding Documents and applying any specific means, methods, techniques, sequences, and procedures of construction that may be shown or indicated or expressly required by the Bidding Documents, that Bidder has given Engineer written notice of all conflicts, errors, ambiguities, and discrepancies that Bidder has discovered in Bidding Documents and the written resolutions thereof by Engineer are acceptable to Bidder, and that the Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performing and furnishing the Work.

ARTICLE 5 - PRE-BID CONFERENCE

- 5.01 A pre-Bid conference will not be held

ARTICLE 6 - SITE AND OTHER AREAS

- 6.01 The Site is identified in the Bidding Documents. Easement for permanent structures or permanent changes in existing facilities are to be obtained and paid for by Owner unless otherwise provided in the Bidding Documents. All additional lands and access thereto required for temporary construction facilities, construction equipment, or storage of materials and equipment to be incorporated in the Work are to be obtained and paid for by Contractor.

ARTICLE 7 - INTERPRETATIONS AND ADDENDA

- 7.01 All questions about the meaning or intent of the Bidding Documents are to be submitted to Engineer in writing. Interpretations or clarifications considered necessary by Engineer in response to such questions will be issued by Addenda mailed or delivered to all parties recorded by Engineer as having received the Bidding Documents. Questions received less than five days prior to the date for opening of Bids may not be answered. Only questions answered by Addenda will be binding. Oral and other interpretations or clarifications will be without legal effect.
- 7.02 Addenda may be issued to clarify, correct, or change the Bidding Documents as deemed advisable by Owner or Engineer.

ARTICLE 8 - BID SECURITY

- 8.01 A Bid must be accompanied by Bid security made payable to Owner in an amount of 5% of Bidder's maximum Bid price and in the form of a certified check or a Bid bond (EJCDC No. C-430, 2002 Edition) issued by a surety meeting the requirements of paragraphs 5.01 and 5.02 of the General Conditions.

- 8.02 The Bid security of the Successful Bidder will be retained until such Bidder has executed the Contract Documents, furnished the required contract security and met the other conditions of the Notice of Award, whereupon the Bid security will be returned. If the Successful Bidder fails to execute and deliver the Contract Documents and furnish the required contract security within 10 days after the Notice of Award, Owner may annul the Notice of Award and the Bid security of that Bidder will be forfeited. The Bid security of other Bidders whom Owner believes to have a reasonable chance of receiving the award may be retained by Owner until the earlier of seven days after the Effective Date of the Agreement or 91 days after the Bid opening, whereupon Bid security furnished by such Bidders will be returned.
- 8.03 Bid security of other Bidders whom OWNER believes do not have a reasonable chance of receiving the award will be returned within seven days after the Bid opening.

ARTICLE 9 - CONTRACT TIMES

- 9.01 The number of days within which, or the date by which, the Work is to be substantially completed. Upon substantial completion, if necessary, a date for final completion and payment should be determined between the Owner, Contractor and Engineer based on remaining work, market and weather conditions.

ARTICLE 10 - LIQUIDATED DAMAGES

- 10.01 Provisions for liquidated damages are set forth in the Agreement.

ARTICLE 11 - SUBSTITUTE AND "OR-EQUAL" ITEMS

- 11.01 The Contract, if awarded, will be on the basis of materials and equipment specified or described in the Bidding Documents, or "or-equal" materials and equipment as defined in paragraph 6.05 of the General Conditions, or those substitute materials and equipment approved by the Engineer and identified by Addendum. The materials and equipment described in the Bidding Documents establish a standard of required type, function and quality to be met by any proposed substitute or "or-equal" item. No item of material or equipment will be considered by Engineer as a substitute or equal until after the bids have been opened and the contract has been awarded. The burden of proof of the merit of the proposed item, and cost for review of a proposed substitute item, is upon the Bidder. Engineer's decision of approval or disapproval of a proposed item will be final. Bidders shall not rely upon approvals made in any other manner. Any reduction made in contract price due to approval of a substitute item or equal, will be subtracted from the bidders contract and placed into contingency funds for the project.

ARTICLE 12 - SUBCONTRACTORS, SUPPLIERS, AND OTHERS

- 12.01 If the Supplementary Conditions require the identity of certain Subcontractors, Suppliers, individuals, or entities to be submitted to Owner in advance of a specified date prior to the Effective Date of the Agreement, the apparent Successful Bidder, and any other Bidder so requested, shall within five days after Bid opening, submit to Owner a list of all such Subcontractors, Suppliers, individuals, or entities proposed for those portions of the Work for which such identification is required. Such list shall be accompanied by an experience statement with pertinent information regarding similar projects and other evidence of qualification for each such Subcontractor, Supplier, individual, or entity if requested by Owner. If Owner or Engineer, after due investigation, has reasonable objection to any proposed Subcontractor, Supplier, individual, or entity, Owner may, before the Notice of Award is given, request apparent Successful Bidder to submit a substitute, without an increase in the Bid.
- 12.02 If apparent Successful Bidder declines to make any such substitution, Owner may award the Contract to the next lowest responsible Bidder that proposes to use acceptable Subcontractors,

Suppliers, individuals, or entities. Declining to make requested substitutions will not constitute grounds for forfeiture of the Bid security of any Bidder. Any Subcontractor, Supplier, individual, or entity so listed and against which Owner and Engineer makes no written objection prior to the giving of the Notice of Award will be deemed acceptable to Owner and Engineer subject to revocation of such acceptance after the Effective Date of the Agreement as provided in paragraph 6.06 of the General Conditions.

12.03 Contractor shall not be required to employ any Subcontractor, Supplier, individual, or entity against whom Contractor has reasonable objection.

12.04 The Contractor shall not award work to Subcontractor(s) in excess of the limits stated in SC 6.06.

ARTICLE 13 - PREPARATION OF BID

13.01 The Bid form is included with the Bidding Documents. Additional copies may be obtained from Engineer.

13.02 All blanks on the Bid form shall be completed by printing in ink or by typewriter and the Bid signed in ink. Erasures or alterations shall be initialed in ink by the person signing the Bid Form. A Bid price shall be indicated for each Bid item listed therein, or the words "No Bid," "No Change," or "Not Applicable" entered.

13.03 A Bid by a corporation shall be executed in the corporate name by the president or a vice-president or other corporate officer accompanied by evidence of authority to sign. If required by State where work is to be performed, the corporate seal shall be affixed and attested by the secretary or an assistant secretary. The corporation business address and state of incorporation shall be provided on the Bid Form.

13.04 A Bid by a partnership shall be executed in the partnership name and signed by a partner (whose title must appear under the signature), accompanied by evidence of authority to sign. The business address of the partnership shall be provided on the Bid Form.

13.05 A Bid by a limited liability company shall be executed in the name of the firm by a member and accompanied by evidence of authority to sign. The state of formation of the firm and the business address of the firm must be provided on the Bid Form.

13.06 A Bid by an individual shall show the Bidder's name and business address.

13.07 A Bid by a joint venture shall be executed by each joint venturer in the manner indicated on the Bid form. The business address of the joint venture must be provided on the Bid Form.

13.08 All names shall be typed or printed in ink below the signatures.

13.09 The Bid shall contain an acknowledgment of receipt of all Addenda, the numbers and dates of which shall be filled in on the Bid form.

13.10 The address and telephone number for communication regarding the Bid shall be shown.

13.11 The Bid shall contain evidence of Bidder's authority and qualification to do business in the state where the Project is located or covenant to obtain such qualification prior to award of the Contract. Bidder's state contractor license number for the state of the Project, if any, shall also be shown on the Bid Form.

ARTICLE 14 - BASIS OF BID; COMPARISON OF BIDS

14.01 Unit Price

- A. Bidders shall submit a Bid on a unit price basis for each item of Work listed in the Bid schedule.
- B. The total of all bid prices will be the sum of the products of the estimated quantity of each item and the corresponding unit price. The final quantities and Contract Price will be determined in accordance with paragraph 11.03 of the General Conditions.
- C. Discrepancies between the multiplication of units of Work and unit prices will be resolved in favor of the unit prices. Discrepancies between the indicated sum of any column of figures and the correct sum thereof will be resolved in favor of the correct sum. Discrepancies between words and figures will be resolved in favor of the words.

ARTICLE 15 - SUBMITTAL OF BID

- 15.01 With each copy of the Bidding Documents, a Bidder is furnished one separate unbound copy of the Bid Form, and the Bid bond form. The unbound copy of the Bid Form is to be completed and submitted with all the attachments outlined in Article 7 of the Bid Form.
- 15.02 A Bid shall be submitted no later than the date and time prescribed and at the place indicated in the Advertisement for Bids and shall be enclosed in an opaque sealed envelope plainly marked with the Project title (and, if applicable, the designated portion of the Project for which the Bid is submitted), the name and address of Bidder, and shall be accompanied by the Bid security and other required documents. If a Bid is sent by mail or other delivery system, the sealed envelope containing the Bid shall be enclosed in a separate envelope plainly marked on the outside with the notation "BID-ENCLOSED." When using the mail or other delivery system, the Bidder is totally responsible for the mail or other delivery system delivering the Bid at the place and prior to the time indicated in the Advertisement for Bid. A mailed Bid shall be addressed to Owner at address in Article 1.01 of Bid Form.

ARTICLE 16 - MODIFICATION AND WITHDRAWAL OF BID

- 16.01 A Bid may be modified or withdrawn by an appropriate document duly executed in the manner that a Bid must be executed and delivered to the place where Bids are to be submitted prior to the date and time for the opening of Bids.
- 16.02 If within 24 hours after Bids are opened any Bidder files a duly signed written notice with Owner and promptly thereafter demonstrates to the reasonable satisfaction of Owner that there was a material and substantial mistake in the preparation of its Bid, that Bidder may withdraw its Bid, and the Bid security will be returned. Thereafter, if the Work is rebid or negotiated, that Bidder will be disqualified from further bidding on the Work. This provision to withdraw a Bid without forfeiting the Bid security does not apply to Bidder's errors in judgment in preparing the Bid.

ARTICLE 17 - OPENING OF BIDS

- 17.01 Bids will be opened at the time and place indicated in the Advertisement for Bids and, unless obviously non-responsive, read aloud publicly. An abstract of the amounts of the Bids and major alternates, if any, will be made available to Bidders after the opening of Bids.

ARTICLE 18 - BIDS TO REMAIN SUBJECT TO ACCEPTANCE

- 18.01 All Bids will remain subject to acceptance for 90 days.

ARTICLE 19 - EVALUATION OF BIDS AND AWARD OF CONTRACT

- 19.01 Owner reserves the right to reject any or all Bids, including without limitation, nonconforming, nonresponsive, unbalanced, or conditional Bids. Owner further reserves the right to reject the Bid of any Bidder whom it finds, after reasonable inquiry and evaluation, to be non-responsible. Owner also reserves the right to waive all informalities not involving price, time, or changes in the Work and to negotiate contract terms with the Successful Bidder.
- 19.02 More than one Bid for the same Work from an individual or entity under the same or different names will not be considered. Reasonable grounds for believing that any Bidder has an interest in more than one Bid for the Work may be cause for disqualification of that Bidder and the rejection of all Bids in which that Bidder has an interest.
- 19.03 In evaluating Bids, Owner will consider whether or not the Bids comply with the prescribed requirements, and such alternates, unit prices and other data, as may be requested in the Bid Form or prior to the Notice of Award.
- 19.04 In evaluating Bidders, Owner will consider the qualifications of Bidders and may consider the qualifications and experience of Subcontractors, Suppliers, and other individuals or entities proposed for those portions of the Work for which the identity of Subcontractors, Suppliers, and other individuals or entities must be submitted as provided in the Supplementary Conditions.
- 19.05 Owner may conduct such investigations as Owner deems necessary to establish the responsibility, qualifications, and financial ability of Bidders, proposed Subcontractors, Suppliers, individuals, or entities to perform the Work in accordance with the contract Documents.
- 19.06 If the Contract is to be awarded, Owner will award the Contract to the responsible Bidder whose Bid, conforming with all the material terms and conditions of the Instructions to Bidders, is lowest in price and in the best interest of the Owner by considering other factors such as work history, recommendations, etc.

ARTICLE 20 - CONTRACT SECURITY AND INSURANCE

- 20.01 Article 5 of the General Conditions, as may be modified by the Supplementary Conditions, sets forth Owner's requirements as to performance and payment bonds and insurance. When the Successful Bidder delivers the executed Agreement to Owner, it must be accompanied by such bonds.

ARTICLE 21 - SIGNING OF AGREEMENT

- 21.01 When Owner gives a Notice of Award to the Successful Bidder, it shall be accompanied by the required number of unsigned counterparts of the Agreement with the other Contract Documents which are identified in the Agreement as attached thereto. Within 10 days thereafter, Successful Bidder shall sign and deliver the required number of counterparts of the Agreement and attached documents to Owner. Within ten days thereafter, Owner shall deliver one fully signed counterpart to Successful Bidder with a complete set of the Drawings with appropriate identification.
- 21.02 This Contract is expected to be funded with funds provided by the United States Department of Agriculture, Rural Development (RD). Refer to Article 18 of General Conditions for information on the Federal Requirements.

Section 00410 Bid Form

Project Identification: **APPLE ORCHARD ROAD TRANSMISSION MAIN**

Contract Identification and Number: **APPLE ORCHARD ROAD TRANSMISSION MAIN**

ARTICLE 1 - BID RECIPIENT

1.01 This Bid Is Submitted To: East Laurel Water District
1670 Hal Rogers Parkway
London, Kentucky 40703

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

ARTICLE 2 - BIDDER'S ACKNOWLEDGMENTS

2.01 Bidder accepts all of the terms and conditions of the Advertisement and Instructions to Bidders, including without limitations those dealing with the dispositions of Bid security. The Bid will remain subject to acceptance for 90 days after the Bid opening, or for such longer period of time that Bidder may agree to in writing upon request of Owner.

ARTICLE 3 - BIDDER'S REPRESENTATIONS

3.01 In submitting this Bid, Bidder represents that:

A. Bidder has examined and carefully studied the Bidding Documents, the other related data identified in the Bidding Documents, and the following Addenda, receipt of which is hereby acknowledged.

Addendum No.	Addendum Date
_____	_____
_____	_____
_____	_____
_____	_____

B. Bidder has visited the Site and become familiar with and is satisfied as to the general, local, and Site conditions that may affect cost, progress, and performance of the Work.

C. Bidder is familiar with and is satisfied as to all Federal, State, and local Laws and Regulations that may affect cost, progress, and performance of the Work.

D. Bidder has carefully studied all: (1) reports of explorations and tests of subsurface conditions at or contiguous to the Site and all drawings of physical conditions in or relating to existing surface or subsurface structures at or contiguous to the Site (except Underground Facilities)

which have been identified in SC-4.02, and (2) reports and drawings of a Hazard Environmental Condition, if any, which has been identified in SC-4.06.

- E. Bidder has obtained and carefully studied (or accepts the consequences for not doing so) all additional or supplementary examinations, investigations, explorations, tests, studies, and data concerning conditions (surface, subsurface and Underground Facilities) at or contiguous to the Site which may affect cost, progress, or performance of the Work or which relate to any aspect of the means, methods, techniques, sequences, and procedures of construction to be employed by the Bidder, including applying the specific means, methods, techniques, sequences, and procedures of construction expressly required by the Bidding Documents to be employed by Bidder, and safety precautions and programs incident thereto.
- F. Bidder does not consider that any further examinations, investigations, explorations, tests, studies, or data are necessary for the determination of this Bid for performance of the Work at the price(s) bid and within the times and in accordance with the other terms and conditions of the Bidding Documents.
- G. Bidder is aware of the general nature of the Work to be performed by Owner and others at the Site that relates to the Work as indicated in the Bidding Documents.
- H. Bidder has correlated the information known to Bidder, information and observations obtained from visits to the Site, reports and drawings identified in the Bidding Documents, and all additional examinations, investigations, explorations, tests, studies, and data with the Bidding Documents.
- I. Bidder has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Bidder has discovered in the Bidding Documents, and the written resolution thereof by Engineer is acceptable to Bidder.
- J. The Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for the performance of the Work for which this Bid is submitted.
- K. Bidder will submit written evidence of its authority to do business in the State where the Project is located not later than the date of its execution of the Agreement.

ARTICLE 4 - FURTHER REPRESENTATIONS

4.01 Bidder further represents that:

- A. This Bid is genuine and not made in the interest of or on the behalf of any undisclosed individual or entity and is not submitted in conformity with any agreement or rules of any group, association, organization, or corporation;
- B. Bidder has not directly or indirectly induced or solicited any other Bidder to submit a false or sham Bid;
- C. Bidder has not solicited or induced any individual or entity to refrain from bidding; and
- D. Bidder has not sought by collusion to obtain for itself any advantage over any other Bidder or over Owner.

ARTICLE 5 - BASIS OF BID

5.01 Bidder will complete the Work in accordance with the Contract Documents for the following price(s):

Note: Bids shall include sales tax and all other applicable taxes.

Base Project					
No.	Item Description	Unit	Quantity	Unit Price	Item Price
1	8" PVC SDR-17 Water Line	LF	41,340	_____	_____
2	8" Ductile Iron CI 350 w/Nitrile Gaskets	LF	685	_____	_____
3	8" Ductile Iron CI 350 with locking Gaskets	LF	115	_____	_____
4	6" PVC SDR-17 Water Line	LF	300	_____	_____
5	Bored Steel Encasement for 8" Pipe	LF	575	_____	_____
6	Open Cut Steel Encasement for 8" Pipe	LF	65	_____	_____
7	8" Gate Valve	EA	19	_____	_____
8	6" Gate Valve	EA	2	_____	_____
9	Leak Detection Meter	EA	1	_____	_____
10	16" x 8" Tie-In	EA	2	_____	_____
11	8" x 8" Tie-In	EA	1	_____	_____
12	8" x 6" Tie-In	EA	1	_____	_____
13	Directional Drill for 8" Pipe				
	13a. 10" Directional Drill No. 1	LS	1	_____	_____
	13b. 8" Directional Drill No. 2	LS	1	_____	_____
	13c. 8" Directional Drill No. 3	LS	1	_____	_____
	13d. 8" Directional Drill No. 4	LS	1	_____	_____
	13e. 8" Directional Drill No. 5	LS	1	_____	_____
	13f. 8" Directional Drill No. 6	LS	1	_____	_____
14	Fire Hydrant	EA	20	_____	_____
15	Air Release Valve Assembly	EA	5	_____	_____
16	8" Free Bore	LF	435	_____	_____

17	KY 830 Booster Pump Station	LS	1	_____	_____
18	KY 80 Booster Pump Station	LS	1	_____	_____
19	Telemetry	LS	1	35,790.00	35,790.00
20	Crushed Stone (Driveways)	LF	710	_____	_____
21	Light Duty Bituminous Pavement Replacement	LF	250	_____	_____
Total Base Bid				\$	_____

ARTICLE 6 - TIME OF COMPLETION

- 6.01 Bidder agrees that the Work will be substantially complete in accordance with paragraph 14.07.B of the General Conditions on or before the date, or within the number of calendar days indicated in the Agreement.
- 6.02 Bidder accepts the provisions of the Agreement as to liquidated damages in the event of failure to complete the work within the Contract Times.

ARTICLE 7 - ATTACHEMENTS TO THIS BID

- 7.01 The following documents are attached to and made a condition of the Bid:
 - A. Required Bid security in the form of a Bid Bond (EJCDC No. C-430) or Certified Check (circle type of security provided);
 - B. If Bid amount exceeds \$10,000, signed Compliance Statement (RD 400-6). Refer to specific equal opportunity requirements set forth in paragraph 18.10 of the General Conditions;
 - C. If Bid amount exceeds \$25,000, signed Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion – Lower Tier Covered Transactions (AD-1048);
 - D. If Bid amount exceeds \$100,000, signed RD Instruction 1940-Q, Exhibit A-1, Certification for Contracts, Grants and Loans. Refer to paragraph 18.11 of the General Conditions.

ARTICLE 8 - DEFINED TERMS

- 8.01 The terms used in this Bid with the initial capitol letters have the meanings indicated in the Instructions to Bidders, the General Conditions, and the Supplementary Conditions.

ARTICLE 9 - BID SUBMITTAL

9.01 This Bid submitted by:

Name (typed or printed): _____

By: _____

(Individual's signature)

(SEAL)

Doing business as: _____

Bidder's Business address:

Business Phone No. (____) _____

Business FAX No. (____) _____

Business E-Mail Address _____

State Contractor License No. _____ (If applicable)

Employer's Tax ID No. _____

Phone and FAX Numbers, and Address for receipt of official communications, if different from
Business contact information:

9.02 Bid submitted on _____, 20__.



**Section 00430
Bid Bond**

Any singular reference to Bidder, Surety, Owner, or other party shall be considered plural where applicable.

BIDDER (Name and Address):

SURETY (Name and Address of Principal Place of Business):

OWNER (Name and Address): East Laurel Water District
1670 Hal Rogers Parkway
London, Kentucky 40743

BID

Bid Due Date: _____, 2015
Project (Brief Description Including Location): Apple Orchard Road Transmission Main
Laurel County, Kentucky

BOND

Bond Number: _____
Date (Not later than Bid due date): _____
Penal sum _____
(Words) (Figures)

Surety and Bidder, intending to be legally bound hereby, subject to the terms printed on the reverse side hereof, do each cause this Bid Bond to be duly executed on its behalf by its authorized officer, agent, or representative.

BIDDER

SURETY

Bidder's Name and Corporate Seal (Seal)

Surety's Name and Corporate Seal (Seal)

By: _____
Signature and Title

By: _____
Signature and Title
(Attach Power of Attorney)

Attest: _____
Signature and Title

Attest: _____
Signature and Title

Note: Above addresses are to be used for giving required notice.

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

CERTIFICATION FOR CONTRACTS, GRANTS AND LOANS

The undersigned certifies, to the best of his or her knowledge and belief, that:

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

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

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

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

(name)

(date)

(title)

oOo



U.S. DEPARTMENT OF AGRICULTURE

**CERTIFICATION REGARDING DEBARMENT, SUSPENSION, INELIGIBILITY
AND VOLUNTARY EXCLUSION - LOWER TIER COVERED TRANSACTIONS**

This certification is required by the regulations implementing Executive Order 12549, Debarment and Suspension, 7 CFR Part 3017, Section 3017.510, Participants' responsibilities. The regulations were published as Part IV of the January 30, 1989, Federal Register (pages 4722-4733). Copies of the regulations may be obtained by contacting the Department of Agriculture agency with which this transaction originated.

(BEFORE COMPLETING CERTIFICATION, READ INSTRUCTIONS ON REVERSE)

- (1) The prospective lower tier participant certifies, by submission of this proposal, that neither it nor its principals is presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participation in this transaction by any Federal department or agency.
- (2) Where the prospective lower tier participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

Organization Name

PR/Award Number or Project Name

Name(s) and Title(s) of Authorized Representative(s)

Signature(s)

Date

Instructions for Certification

1. By signing and submitting this form, the prospective lower tier participant is providing the certification set out on the reverse side in accordance with these instructions.
2. The certification in this clause is a material representation of fact upon which reliance was placed when this transaction was entered into. If it is later determined that the prospective lower tier participant knowingly rendered an erroneous certification, in addition to other remedies available to the Federal Government, the department or agency with which this transaction originated may pursue available remedies, including suspension and/or debarment.
3. The prospective lower tier participant shall provide immediate written notice to the person to which this proposal is submitted if at any time the prospective lower tier participant learns that its certification was erroneous when submitted or has become erroneous by reason of changed circumstances.
4. The terms "covered transactions," "debarred," "suspended," "ineligible," "lower tier covered transactions," "participant," "person," "primary covered transaction," "principal," "proposal," and "voluntarily excluded," as used in this clause, have the meanings set out in the Definitions and Coverage sections of rules implementing Executive Order 12549. You may contact the person to which this proposal is submitted for assistance in obtaining a copy of those regulations.
5. The prospective lower tier participant agrees by submitting this form that, should the proposed covered transaction be entered into, it shall not knowingly enter into any lower tier covered transaction with a person who is debarred, suspended, declared ineligible, or voluntarily excluded from participation in this covered transaction, unless authorized by the department or agency with which this transaction originated.
6. The prospective lower tier participant further agrees by submitting this form that it will include this clause titled "Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion - Lower Tier Covered Transactions," without modification, in all lower tier covered transactions and in all solicitations for lower tier covered transactions.
7. A participant in a covered transaction may rely upon a certification of a prospective participant in a lower tier covered transaction that it is not debarred, suspended, ineligible, or voluntarily excluded from the covered transaction, unless it knows that the certification is erroneous. A participant may decide the method and frequency by which it determines the eligibility of its principals. Each participant may, but is not required to, check the Nonprocurement List.
8. Nothing contained in the foregoing shall be construed to require establishment of a system of records in order to render in good faith the certification required by this clause. The knowledge and information of a participant is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.
9. Except for transactions authorized under paragraph 5 of these instructions, if a participant in a covered transaction knowingly enters into a lower tier covered transaction with a person who is suspended, debarred, ineligible, or voluntarily excluded from participation in this transaction, in addition to other remedies available to the Federal Government, the department or agency with which this transaction originated may pursue available remedies, including suspension and/or debarment.

COMPLIANCE STATEMENT

This statement relates to a proposed contract with _____

(Name of borrower or grantee)

who expects to finance the contract with assistance from either the Rural Housing Service (RHS), Rural Business-Cooperative Service (RBS), or the Rural Utilities Service (RUS) or their successor agencies, United States Department of Agriculture (whether by a loan, grant, loan insurance, guarantee, or other form of financial assistance). I am the undersigned bidder or prospective contractor, I represent that:

1. I have have not, participated in a previous contract or subcontract subject to Executive Order 11246 (regarding equal employment opportunity) or a preceding similar Executive Order.
2. If I have participated in such a contract or subcontract, I have, have not, filed all compliance reports that have been required to file in connection with the contract or subcontract.

If the proposed contract is for \$50,000 or more and I have 50 or more employees, I also represent that:

3. I have, have not previously had contracts subject to the written affirmative action programs requirements of the Secretary of Labor.
4. If I have participated in such a contract or subcontract, I have, have not developed and placed on file at each establishment affirmative action programs as required by the rules and regulations of the Secretary of Labor.

I understand that if I have failed to file any compliance reports that have been required of me, I am not eligible and will not be eligible to have my bid considered or to enter into the proposed contract unless and until I make an arrangement regarding such reports that is satisfactory to either the RHS, RBS or RUS, or to the office where the reports are required to be filed.

I also certify that I do not maintain or provide for my employees any segregated facilities at any of my establishments, and that I do not permit my employees to perform their services at any location, under my control, where segregated facilities are maintained. I certify further that I will not maintain or provide for my employees any segregated facilities at any of my establishments, and that I will not permit my employees to perform their services at any location, under my control, where segregated facilities are maintained. I agree that a breach of this certification is a violation of the Equal Opportunity clause in my contract. As used in this certification, the term "segregated facilities" means any waiting rooms, work areas, restrooms and wash rooms, restaurants and other eating areas time clocks, locker rooms and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing facilities provided for employees which are segregated by explicit directive or are in fact segregated on the basis of race, creed, color, or national origin, because of habit, local custom, or otherwise. I further agree that (except where I have obtained identical certifications for proposed subcontractors for specific time periods) I will obtain identical certifications from proposed subcontractors prior to the award of subcontracts exceeding \$10,000 which are not exempt from the provisions of the Equal Opportunity clause; that I will retain such certifications in my files; and that I will forward the following notice to such proposed subcontractors (except where the proposed subcontractors have submitted identical certifications for specific time periods): (See Reverse).

According to the Paperwork Reduction Act of 1995, an agency may not conduct or sponsor, and a person is not required to respond to a collection of information unless it displays the valid OMB control number. The valid OMB control number for this information collection is 0575-0018. The time required to complete this information collection is estimated to average 10 minutes per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information.

**NOTICE TO PROSPECTIVE SUBCONTRACTORS OF REQUIREMENTS FOR
CERTIFICATIONS OF NON-SEGREGATED FACILITIES**

A certification of Nonsegregated Facilities, as required by the May 9, 1967, order (32F.R. 7439, may 19, 1967) on Elimination of Segregated Facilities, by the Secretary of Labor, must be submitted prior to the award of a subcontract exceeding \$ 10,000 which is not exempt from the provisions of the Equal Opportunity clause. The certification may be submitted either for each subcontract or for all subcontracts during a period (i.e., quarterly, semiannually, or annually).

NOTE: The penalty for making false statements in offers is prescribed in 18 U.S.C. 1001.

Date _____

(Signature of Bidder or Prospective Contractor)

Address (including Zip Code)

Section 00510

Notice of Award

To: _____

PROJECT Description: Apple Orchard Road Transmission Main

The Owner has considered the Bid submitted by you for the above described Work in response to its Advertisement for Bids dated _____, 2015 and Information for Bidders.

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

You are required by the Information for Bidders to execute the Agreement and furnish the required Contractor's Performance Bond, Payment Bond and certificates of insurance within ten (10) calendar days from the date of this Notice to you.

If you fail to execute said Agreement and to furnish said Bonds within ten (10) days from the date of this Notice, said Owner will be entitled to consider all your rights arising out of the Owner's acceptance of your Bid as abandoned and as a forfeiture of your Bid Bond. The Owner will be entitled to such other rights as may be granted by law.

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

Dated this ___ day of _____, 2015

_____ East Laurel Water District
Owner

By: _____

Title: _____ Chairman

ACCEPTANCE OF NOTICE

Receipt of the above NOTICE OF AWARD is hereby acknowledged by _____ this the ___ day of _____, 2015.

By: _____

Title: _____



**AGREEMENT
BETWEEN OWNER AND CONTRACTOR
FOR CONSTRUCTION CONTRACT (STIPULATED PRICE)
FUNDING AGENCY EDITION**

THIS AGREEMENT is by and between _____ East Laurel Water District _____ (“Owner”) and

_____ (“Contractor”).

Owner and Contractor, in consideration of the mutual covenants hereinafter set forth, agree as follows:

ARTICLE 1 – WORK

1.01 Contractor shall complete all Work as specified or indicated in the Contract Documents. The Work is generally described as follows:

Apple Orchard Road Transmission Main

ARTICLE 2 – THE PROJECT

2.01 The Project for which the Work under the Contract Documents may be the whole or only a part is generally described as follows:

Apple Orchard Road Transmission Main

ARTICLE 3 – ENGINEER

3.01 The Project has been designed by Kenvirons, Inc. (Engineer), who is to act as Owner’s representative, assume all duties and responsibilities, and have the rights and authority assigned to Engineer in the Contract Documents in connection with the completion of the Work in accordance with the Contract Documents.

ARTICLE 4 – CONTRACT TIMES

4.01 *Time of the Essence*

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

4.02 *Days to Achieve Substantial Completion*

A. The Work will be substantially completed within **210** days after the date when the Contract Time commence to run as provided in Paragraph 2.03 of the General Conditions, and completed and ready for final payment at a date determined by Owner, Contractor, and Engineer after substantial completion, based on remaining work, weather and market conditions.

4.03 *Liquidated Damages*

Contractor and Owner recognize that time is of the essence on this Project and that Owner will suffer financial loss if the Work is not completed within the time specified in Paragraph 4.02 above, plus any extensions allowed in accordance with Article 12 of the General Conditions. Accordingly, Contractor shall pay Owner

\$600 for each day that expires after the time specified in Paragraph 4.02 until the Work is substantially complete. After substantial completion, retainage may be reduced to an amount agreed upon by Owner, Contractor, and Engineer. It should be no less than 150% of the amount required for completion and ready for final payment. Liquidated damages may not be assessed after substantial completion has been achieved.

ARTICLE 5 – CONTRACT PRICE

5.01 Owner shall pay Contractor for completion of the Work in accordance with the Contract Documents an amount in current funds equal to the sum of the amounts determined pursuant to Paragraphs 5.01.A below:

A. For all Work, at the prices stated in Contractor's Bid, attached in Section 00410.

ARTICLE 6 – PAYMENT PROCEDURES

6.01 *Submittal and Processing of Payments*

A. Contractor shall submit Applications for Payment in accordance with Article 14 of the General Conditions. Applications for Payment will be processed by Engineer as provided in the General Conditions.

6.02 *Progress Payments; Retainage*

A. Owner shall make progress payments on account of the Contract Price on the basis of Contractor's Applications for Payment on or about the 25th day of each month during performance of the Work as provided in Paragraphs 6.02.A.1 and 6.02.A.2 below. All such payments will be measured by the schedule of values established as provided in Paragraph 2.07.A of the General Conditions (and in the case of Unit Price Work based on the number of units completed) or, in the event there is no schedule of values, as provided in the General Requirements:

1. Prior to Substantial Completion, progress payments will be made in an amount equal to the percentage indicated below but, in each case, less the aggregate of payments previously made and less such amounts as Engineer may determine or Owner may withhold, including but not limited to liquidated damages, in accordance with Paragraph 14.02 of the General Conditions:
 - a. 95 percent of Work completed (with the balance being retainage); and
 - b. 95 percent of cost of materials and equipment not incorporated in the Work (with the balance being retainage).
2. Upon Substantial Completion, Owner shall pay an amount sufficient to increase total payments to Contractor to 95 percent of the Work completed, plus any reduction in retainage that has been agreed upon by Owner, Contractor, and Engineer.

6.03 *Final Payment*

A. Upon receipt of the final Application for Payment accompanied by Engineer's recommendation of payment in accordance with Paragraph 14.07 of the General Conditions, Owner shall pay Contractor as provided in Paragraph 14.07 of the General Conditions the remainder of the Contract Price as recommended by Engineer as provided in said Paragraph 14.07, less any sum Owner is entitled to set off against Engineer's recommendation, including but not limited to liquidated damages.

ARTICLE 7 – INTEREST

7.01 All moneys not paid when due as provided in Article 14 of the General Conditions shall bear interest at the maximum legal rate.

ARTICLE 8 – CONTRACTOR'S REPRESENTATIONS

8.01 In order to induce Owner to enter into this Agreement Contractor makes the following representations:

- A. Contractor has examined and carefully studied the Contract Documents and the other related data identified in the Bidding Documents.
- B. Contractor has visited the Site and become familiar with and is satisfied as to the general, local, and Site conditions that may affect cost, progress, and performance of the Work.
- C. Contractor is familiar with and is satisfied as to all federal, state, and local Laws and Regulations that may affect cost, progress, and performance of the Work.
- D. Contractor has obtained and carefully studied (or assumes responsibility for doing so) all examinations, investigations, explorations, tests, studies, and data concerning conditions (surface, subsurface, and Underground Facilities) at or contiguous to the Site which may affect cost, progress, or performance of the Work or which relate to any aspect of the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor, including any specific means, methods, techniques, sequences, and procedures of construction expressly required by the Bidding Documents, and safety precautions and programs incident thereto.
- E. Contractor does not consider that any further examinations, investigations, explorations, tests, studies, or data are necessary for the performance of the Work at the Contract Price, within the Contract Times, and in accordance with the other terms and conditions of the Contract Documents.
- F. Contractor is aware of the general nature of work to be performed by Owner and others at the Site that relates to the Work as indicated in the Contract Documents.
- G. Contractor has correlated the information known to Contractor, information and observations obtained from visits to the Site, reports and drawings identified in the Contract Documents, and all additional examinations, investigations, explorations, tests, studies, and data with the Contract Documents.
- H. Contractor has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Contractor has discovered in the Contract Documents, and the written resolution thereof by Engineer is acceptable to Contractor.
- I. The Contract Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performance and furnishing of the Work.

ARTICLE 9 – CONTRACT DOCUMENTS

9.01 *Contents*

- A. The Contract Documents consist of the following:
 - 1. This Agreement (pages 1 to 6, inclusive).
 - 2. Performance bond (pages 1 to 2, inclusive).
 - 3. Payment bond (pages 1 to 2, inclusive).

4. Other bonds (pages ____ to ____, inclusive).
 - a. ____ (pages ____ to ____, inclusive).
 - b. ____ (pages ____ to ____, inclusive).
 - c. ____ (pages ____ to ____, inclusive).
 5. General Conditions (pages 1 to 58, inclusive).
 6. Supplementary Conditions (pages 1 to 3, inclusive).
 7. Specifications as listed in the table of contents of the Project Manual.
 8. Drawings consisting of 24 sheets with each sheet bearing the following general title: Apple Orchard Road Transmission Main
 9. Addenda (numbers __, inclusive).
 10. Exhibits to this Agreement (enumerated as follows):
 - a. Contractor's Bid (pages 1 to ____, inclusive and included in Section 00410).
 - b. Documentation submitted by Contractor prior to Notice of Award (pages ____ to ____, inclusive).
 - c. _____.
 11. The following which may be delivered or issued on or after the Effective Date of the Agreement and are not attached hereto:
 - a. Notice to Proceed (pages 1 to 1, inclusive).
 - b. Work Change Directives.
 - c. Change Order(s).
- B. The documents listed in Paragraph 9.01.A are attached to this Agreement (except as expressly noted otherwise above).
- C. There are no Contract Documents other than those listed above in this Article 9.
- D. The Contract Documents may only be amended, modified, or supplemented as provided in Paragraph 3.04 of the General Conditions.

ARTICLE 10 – MISCELLANEOUS

10.01 Terms

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

10.02 *Assignment of Contract*

- A. No assignment by a party hereto of any rights under or interests in the Contract will be binding on another party hereto without the written consent of the party sought to be bound; and, specifically but without limitation, moneys that may become due and moneys that are due may not be assigned without such consent (except to the extent that the effect of this restriction may be limited by law), and unless specifically stated to the contrary in any written consent to an assignment, no assignment will release or discharge the assignor from any duty or responsibility under the Contract Documents.

10.03 *Successors and Assigns*

- A. Owner and Contractor each binds itself, its partners, successors, assigns, and legal representatives to the other party hereto, its partners, successors, assigns, and legal representatives in respect to all covenants, agreements, and obligations contained in the Contract Documents.

10.04 *Severability*

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

IN WITNESS WHEREOF, Owner and Contractor have signed this Agreement in four copies. One counterpart each has been delivered to Owner, Contractor, Engineer, and Agency. All portions of the Contract Documents have been signed, initialed, or identified by Owner and Contractor or identified by Engineer on their behalf.

This Agreement is dated _____, 2015. This Agreement shall not be effective unless and until Agency's designated representative concurs.

OWNER: East Laurel Water District

CONTRACTOR:

By: _____

By: _____

Title: Chairman

Title: _____

[CORPORATE SEAL]

[CORPORATE SEAL]

Attest: _____

Attest: _____

Title: _____

Title: _____

Address for giving notices:

Address for giving notices:

East Laurel Water District

1670 Hal Rogers Parkway

London, Kentucky 40743

Agent for service of process:

(If Contractor is a corporation or a partnership, attach evidence of authority to sign.)

Agency Concurrence:

As lender or insurer of funds to defray the costs of this Contract, and without liability for any payments thereunder, the Agency hereby concurs in the form, content, and execution of this Agreement.

Agency: USDA Rural Development

By: _____

Date: _____

Title: State Engineer

**Section 00550
Notice to Proceed**

TO: _____ DATE: _____

Project: Apple Orchard Road

Transmission Main

You are hereby notified to commence WORK in accordance with the Agreement dated _____, 2015 on or before _____, 2015 and you are to complete the WORK within 210 consecutive calendar days thereafter. The date of completion of all WORK is therefore _____, 2015.

East Laurel Water District
Owner

By _____
Title Chairman

ACCEPTANCE OF NOTICE

Receipt of the above NOTICE TO PROCEED

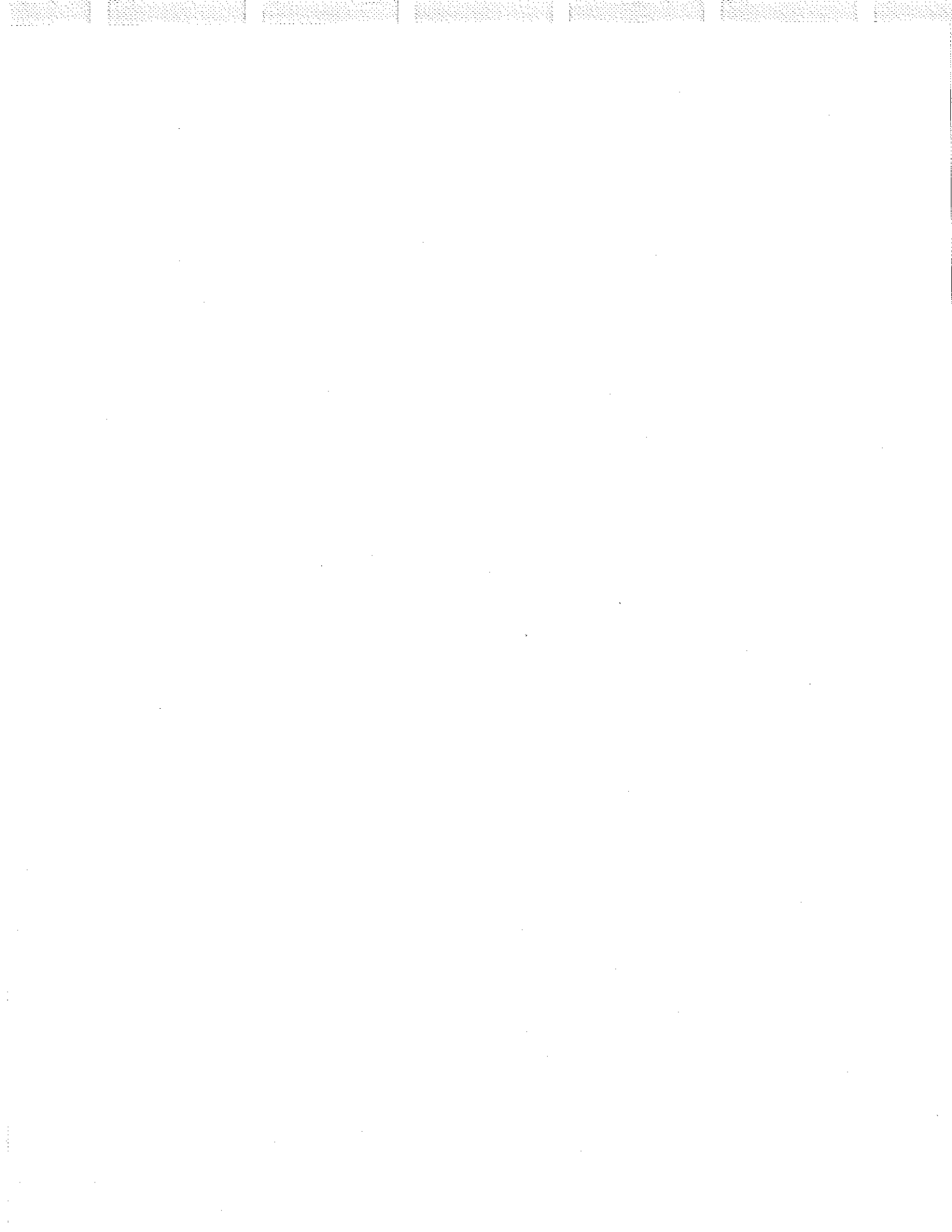
is hereby acknowledged by _____

this the ___ day of _____, 2015.

By _____

Title _____

Employer Identification
Number: _____



Section 00610
PERFORMANCE BOND

Any singular reference to Contractor, Surety, Owner, or other party shall be considered plural where applicable.

CONTRACTOR (Name and Address):

SURETY (Name and Address of Principal Place of Business):

OWNER (Name and Address): East Laurel Water District
1670 Hal Rogers Parkway
London, Kentucky 40743

CONTRACT

Date:
Amount:
Description (Name and Location): Apple Orchard Road Transmission Main
Laurel County, Kentucky

BOND

Bond Number:
Date (Not earlier than Contract Date):
Amount:
Modifications to this Bond Form:

Surety and Contractor, intending to be legally bound hereby, subject to the terms printed on the reverse side hereof, do each cause this Performance Bond to be duly executed on its behalf by its authorized officer, agent, or representative.

CONTRACTOR AS PRINCIPAL

SURETY

Company:

Signature: _____ (Seal)
Name and Title:

Surety's Name and Corporate Seal (Seal)

By: _____
Signature and Title
(Attach Power of Attorney)

(Space is provided below for signatures of additional parties, if required.)

Attest: _____
Signature and Title

CONTRACTOR AS PRINCIPAL

SURETY

Company:

Signature: _____ (Seal)
Name and Title:

Surety's Name and Corporate Seal (Seal)

By: _____
Signature and Title
(Attach Power of Attorney)

Attest: _____
Signature and Title:

EJCDC No. C-610 (2002 Edition)
Originally prepared through the joint efforts of the Surety Association of America, Engineers Joint Contract Documents Committee, the Associated General Contractors of America, and the American Institute of Architects.

1. Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to Owner for the performance of the Contract, which is incorporated herein by reference.
2. If Contractor performs the Contract, Surety and Contractor have no obligation under this Bond, except to participate in conferences as provided in Paragraph 3.1.
3. If there is no Owner Default, Surety's obligation under this Bond shall arise after:
 - 3.1. Owner has notified Contractor and Surety, at the addresses described in Paragraph 10 below, that Owner is considering declaring a Contractor Default and has requested and attempted to arrange a conference with Contractor and Surety to be held not later than 15 days after receipt of such notice to discuss methods of performing the Contract. If Owner, Contractor and Surety agree, Contractor shall be allowed a reasonable time to perform the Contract, but such an agreement shall not waive Owner's right, if any, subsequently to declare a Contractor Default; and
 - 3.2. Owner has declared a Contractor Default and formally terminated Contractor's right to complete the Contract. Such Contractor Default shall not be declared earlier than 20 days after Contractor and Surety have received notice as provided in Paragraph 3.1; and
 - 3.3. Owner has agreed to pay the Balance of the Contract Price to:
 1. Surety in accordance with the terms of the Contract;
 2. Another contractor selected pursuant to Paragraph 4.3 to perform the Contract.
4. When Owner has satisfied the conditions of Paragraph 3, Surety shall promptly and at Surety's expense take one of the following actions:
 - 4.1. Arrange for Contractor, with consent of Owner, to perform and complete the Contract; or
 - 4.2. Undertake to perform and complete the Contract itself, through its agents or through independent contractors; or
 - 4.3. Obtain bids or negotiated proposals from qualified contractors acceptable to Owner for a contract for performance and completion of the Contract, arrange for a contract to be prepared for execution by Owner and Contractor selected with Owner's concurrence, to be secured with performance and payment bonds executed by a qualified surety equivalent to the bonds issued on the Contract, and pay to Owner the amount of damages as described in Paragraph 6 in excess of the Balance of the Contract Price incurred by Owner resulting from Contractor Default; or
 - 4.4. Waive its right to perform and complete, arrange for completion, or obtain a new contractor and with reasonable promptness under the circumstances:
 1. After investigation, determine the amount for which it may be liable to Owner and, as soon as practicable after the amount is determined, tender payment therefor to Owner; or
 2. Deny liability in whole or in part and notify Owner citing reasons therefor.
5. If Surety does not proceed as provided in Paragraph 4 with reasonable promptness, Surety shall be deemed to be in default on this Bond 15 days after receipt of an additional written notice from Owner to Surety demanding that Surety perform its obligations under this Bond, and Owner shall be entitled to enforce any remedy available to Owner. If Surety proceeds as provided in Paragraph 4.4, and Owner refuses the payment tendered or Surety has denied liability, in whole or in part, without further notice Owner shall be entitled to enforce any remedy available to Owner.
6. After Owner has terminated Contractor's right to complete the Contract, and if Surety elects to act under Paragraph 4.1, 4.2, or 4.3 above, then the responsibilities of Surety to Owner shall not be greater than those of Contractor under the Contract, and the responsibilities of Owner to Surety shall not be greater than those of Owner under the Contract. To a limit of the amount of this Bond, but subject to commitment by Owner of the Balance of the Contract Price to mitigation of costs and damages on the Contract, Surety is obligated without duplication for:
 - 6.1. The responsibilities of Contractor for correction of defective Work and completion of the Contract;
 - 6.2. Additional legal, design professional, and delay costs resulting from Contractor's Default, and resulting from the actions or failure to act of Surety under Paragraph 4; and
 - 6.3. Liquidated damages, or if no liquidated damages are specified in the Contract, actual damages caused by delayed performance or non-performance of Contractor.
7. Surety shall not be liable to Owner or others for obligations of Contractor that are unrelated to the Contract, and the Balance of the Contract Price shall not be reduced or set off on account of any such unrelated obligations. No right of action shall accrue on this Bond to any person or entity other than Owner or its heirs, executors, administrators, or successors.
8. Surety hereby waives notice of any change, including changes of time, to Contract or to related subcontracts, purchase orders, and other obligations.
9. Any proceeding, legal or equitable, under this Bond may be instituted in any court of competent jurisdiction in the location in which the Work or part of the Work is located and shall be instituted within two years after Contractor Default or within two years after Contractor ceased working or within two years after Surety refuses or fails to perform its obligations under this Bond, whichever occurs first. If the provisions of this paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.
10. Notice to Surety, Owner, or Contractor shall be mailed or delivered to the address shown on the signature page.
11. When this Bond has been furnished to comply with a statutory requirement in the location where the Contract was to be performed, any provision in this Bond conflicting with said statutory requirement shall be deemed deleted herefrom and provisions conforming to such statutory requirement shall be deemed incorporated herein. The intent is that this Bond shall be construed as a statutory bond and not as a common law bond.
12. Definitions.
 - 12.1. Balance of the Contract Price: The total amount payable by Owner to Contractor under the Contract after all proper adjustments have been made, including allowance to Contractor of any amounts received or to be received by Owner in settlement of insurance or other Claims for damages to which Contractor is entitled, reduced by all valid and proper payments made to or on behalf of Contractor under the Contract.
 - 12.2. Contract: The agreement between Owner and Contractor identified on the signature page, including all Contract Documents and changes thereto.
 - 12.3. Contractor Default: Failure of Contractor, which has neither been remedied nor waived, to perform or otherwise to comply with the terms of the Contract.
 - 12.4. Owner Default: Failure of Owner, which has neither been remedied nor waived, to pay Contractor as required by the Contract or to perform and complete or comply with the other terms thereof.

FOR INFORMATION ONLY – Name, Address and Telephone
 Surety Agency or Broker
 Owner's Representative (engineer or other party)

Section 00615
PAYMENT BOND

Any singular reference to Contractor, Surety, Owner, or other party shall be considered plural where applicable.

CONTRACTOR (Name and Address):

SURETY (Name and Address of Principal Place of Business):

OWNER (Name and Address): East Laurel Water District
1670 Hal Rogers Parkway
London, Kentucky 40743

CONTRACT

Date:

Amount:

Description (Name and Location): Apple Orchard Road Transmission Main
Laurel County, Kentucky

BOND

Bond Number:

Date (Not earlier than Contract Date):

Amount:

Modifications to this Bond Form:

Surety and Contractor, intending to be legally bound hereby, subject to the terms printed on the reverse side hereof, do each cause this Payment Bond to be duly executed on its behalf by its authorized officer, agent, or representative.

CONTRACTOR AS PRINCIPAL

SURETY

Company:

Signature: _____ (Seal)

Name and Title:

(Seal)

Surety's Name and Corporate Seal

By: _____

Signature and Title

(Attach Power of Attorney)

(Space is provided below for signatures of additional parties, if required.)

Attest: _____

Signature and Title

CONTRACTOR AS PRINCIPAL

SURETY

Company:

Signature: _____ (Seal)

Name and Title:

(Seal)

Surety's Name and Corporate Seal

By: _____

Signature and Title

(Attach Power of Attorney)

Attest: _____

Signature and Title:

EJCDC No. C-615 (2002 Edition)

Originally prepared through the joint efforts of the Surety Association of America, Engineers Joint Contract Documents Committee, the Associated General Contractors of America, the American Institute of Architects, the American Subcontractors Association, and the Associated Specialty Contractors.

1. Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to Owner to pay for labor, materials, and equipment furnished by Claimants for use in the performance of the Contract, which is incorporated herein by reference.
2. With respect to Owner, this obligation shall be null and void if Contractor:
 - 2.1. Promptly makes payment, directly or indirectly, for all sums due Claimants, and
 - 2.2. Defends, indemnifies, and holds harmless Owner from all claims, demands, liens, or suits alleging non-payment by Contractor by any person or entity who furnished labor, materials, or equipment for use in the performance of the Contract, provided Owner has promptly notified Contractor and Surety (at the addresses described in Paragraph 12) of any claims, demands, liens, or suits and tendered defense of such claims, demands, liens, or suits to Contractor and Surety, and provided there is no Owner Default.
3. With respect to Claimants, this obligation shall be null and void if Contractor promptly makes payment, directly or indirectly, for all sums due.
4. Surety shall have no obligation to Claimants under this Bond until:
 - 4.1. Claimants who are employed by or have a direct contract with Contractor have given notice to Surety (at the addresses described in Paragraph 12) and sent a copy, or notice thereof, to Owner, stating that a claim is being made under this Bond and, with substantial accuracy, the amount of the claim.
 - 4.2. Claimants who do not have a direct contract with Contractor:
 1. Have furnished written notice to Contractor and sent a copy, or notice thereof, to Owner, within 90 days after having last performed labor or last furnished materials or equipment included in the claim stating, with substantial accuracy, the amount of the claim and the name of the party to whom the materials or equipment were furnished or supplied, or for whom the labor was done or performed; and
 2. Have either received a rejection in whole or in part from Contractor, or not received within 30 days of furnishing the above notice any communication from Contractor by which Contractor had indicated the claim will be paid directly or indirectly; and
 3. Not having been paid within the above 30 days, have sent a written notice to Surety and sent a copy, or notice thereof, to Owner, stating that a claim is being made under this Bond and enclosing a copy of the previous written notice furnished to Contractor.
5. If a notice by a Claimant required by Paragraph 4 is provided by Owner to Contractor or to Surety, that is sufficient compliance.
6. When a Claimant has satisfied the conditions of Paragraph 4, the Surety shall promptly and at Surety's expense take the following actions:
 - 6.1. Send an answer to that Claimant, with a copy to Owner, within 45 days after receipt of the claim, stating the amounts that are undisputed and the basis for challenging any amounts that are disputed.
 - 6.2. Pay or arrange for payment of any undisputed amounts.
7. Surety's total obligation shall not exceed the amount of this Bond, and the amount of this Bond shall be credited for any payments made in good faith by Surety.
8. Amounts owed by Owner to Contractor under the Contract shall be used for the performance of the Contract and to satisfy claims, if any, under any performance bond. By Contractor furnishing and Owner accepting this Bond, they agree that all funds earned by Contractor in the performance of the Contract are dedicated to satisfy obligations of Contractor and Surety under this Bond, subject to Owner's priority to use the funds for the completion of the Work.
9. Surety shall not be liable to Owner, Claimants, or others for obligations of Contractor that are unrelated to the Contract. Owner shall not be liable for payment of any costs or expenses of any Claimant under this Bond, and shall have under this Bond no obligations to make payments to, give notices on behalf of, or otherwise have obligations to Claimants under this Bond.
10. Surety hereby waives notice of any change, including changes of time, to the Contract or to related Subcontracts, purchase orders and other obligations.
11. No suit or action shall be commenced by a Claimant under this Bond other than in a court of competent jurisdiction in the location in which the Work or part of the Work is located or after the expiration of one year from the date (1) on which the Claimant gave the notice required by Paragraph 4.1 or Paragraph 4.2.3, or (2) on which the last labor or service was performed by anyone or the last materials or equipment were furnished by anyone under the Construction Contract, whichever of (1) or (2) first occurs. If the provisions of this paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.
12. Notice to Surety, Owner, or Contractor shall be mailed or delivered to the addresses shown on the signature page. Actual receipt of notice by Surety, Owner, or Contractor, however accomplished, shall be sufficient compliance as of the date received at the address shown on the signature page.
13. When this Bond has been furnished to comply with a statutory requirement in the location where the Contract was to be performed, any provision in this Bond conflicting with said statutory requirement shall be deemed deleted herefrom and provisions conforming to such statutory requirement shall be deemed incorporated herein. The intent is that this Bond shall be construed as a statutory Bond and not as a common law bond.
14. Upon request of any person or entity appearing to be a potential beneficiary of this Bond, Contractor shall promptly furnish a copy of this Bond or shall permit a copy to be made.
15. DEFINITIONS
 - 15.1. Claimant: An individual or entity having a direct contract with Contractor, or with a first-tier subcontractor of Contractor, to furnish labor, materials, or equipment for use in the performance of the Contract. The intent of this Bond shall be to include without limitation in the terms "labor, materials or equipment" that part of water, gas, power, light, heat, oil, gasoline, telephone service, or rental equipment used in the Contract, architectural and engineering services required for performance of the Work of Contractor and Contractor's Subcontractors, and all other items for which a mechanic's lien may be asserted in the jurisdiction where the labor, materials, or equipment were furnished.
 - 15.2. Contract: The agreement between Owner and Contractor identified on the signature page, including all Contract Documents and changes thereto.
 - 15.3. Owner Default: Failure of Owner, which has neither been remedied nor waived, to pay Contractor as required by the Contract or to perform and complete or comply with the other terms thereof.

FOR INFORMATION ONLY – Name, Address and Telephone
Surety Agency or Broker:
Owner's Representative (engineer or other party):

Section 00625 Certificate of Substantial Completion

Project: Apple Orchard Road Transmission Main	Owner: East Laurel Water District	Owner's Contract No.:
Contract:		Date of Contract:
Contractor:		Engineer's Project No.: 2012141

This [tentative] [definitive] Certificate of Substantial Completion applies to:

- All Work under the Contract Documents:
 The following specified portions:

Date of Substantial Completion

The Work to which this Certificate applies has been inspected by authorized representatives of Owner, Contractor and Engineer, and found to be substantially complete. The Date of Substantial Completion of the Project or portion thereof designated above is hereby declared and is also the date of commencement of applicable warranties required by the Contract Documents, except as stated below.

The warranty period will not start, nor will retainage be released until the final punch list items have been accepted and approved by the Owner and the Engineer.

The responsibilities between OWNER and CONTRACTOR for security, operation, safety, maintenance, heat, utilities, insurance and warranties shall be as provided in the Contract Documents except as amended as follows:

- Amended Responsibilities
 Not Amended

Owner's Amended Responsibilities:

Contractor's Amended Responsibilities:

The following documents are attached to and made part of this Certificate:

This Certificate does not constitute an acceptance of Work not in accordance with the Contract Documents nor is it a release of Contractor's obligation to complete the Work in accordance with the Contract Documents.

Executed by Engineer Date

Accepted by Contractor Date

Accepted by Owner Date



GENERAL CONDITIONS



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

STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT FUNDING AGENCY EDITION

Prepared by

ENGINEERS JOINT CONTRACT DOCUMENTS COMMITTEE

and

Issued and Published Jointly By



PROFESSIONAL ENGINEERS IN PRIVATE PRACTICE
a practice division of the
NATIONAL SOCIETY OF PROFESSIONAL ENGINEERS

AMERICAN COUNCIL OF ENGINEERING COMPANIES

AMERICAN SOCIETY OF CIVIL ENGINEERS

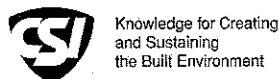
This document has been approved and endorsed by

The Associated General Contractors of America



and the

Construction Specification Institute



These General Conditions have been prepared for use with the Suggested Forms of Agreement Between Owner and Contractor Funding Agency Edition No. C-521 (2002 Edition). Their provisions are interrelated and a change in one may necessitate a change in the other. Comments concerning their usage are contained in the EJCDC Construction Documents, General and Instructions (No. C-001, 2002 Edition). For guidance in the preparation of Supplementary Conditions, see Guide to the Preparation of Supplementary Conditions (No. C-800, 2002 Edition).

Copyright © 2002 National Society of Professional Engineers
1420 King Street, Alexandria, VA 22314-2794
(703) 684-2882

American Council of Engineering Companies
1015 15th Street N.W., Washington, DC 20005
(202) 347-7474

American Society of Civil Engineers
1801 Alexander Bell Drive, Reston, VA 20191-4400
(800) 548-2723

TABLE OF CONTENTS

	Page
Article 1 – Definitions and Terminology.....	6
1.01 Defined Terms.....	6
1.02 Terminology.....	9
Article 2 – Preliminary Matters	10
2.01 Delivery of Bonds and Evidence of Insurance	10
2.02 Copies of Documents	10
2.03 Commencement of Contract Times; Notice to Proceed	11
2.04 Starting the Work	11
2.05 Before Starting Construction	11
2.06 Preconstruction Conference	11
2.07 Initial Acceptance of Schedules.....	11
Article 3 – Contract Documents: Intent, Amending, Reuse	12
3.01 Intent.....	12
3.02 Reference Standards.....	12
3.03 Reporting and Resolving Discrepancies	12
3.04 Amending and Supplementing Contract Documents.....	13
3.05 Reuse of Documents	13
3.06 Electronic Data.....	13
Article 4 – Availability of Lands; Subsurface and Physical Conditions; Hazardous Environmental Conditions; Reference Points14	
4.01 Availability of Lands.....	14
4.02 Subsurface and Physical Conditions	14
4.03 Differing Subsurface or Physical Conditions.....	14
4.04 Underground Facilities.....	16
4.05 Reference Points.....	16
4.06 Hazardous Environmental Condition at Site	17
Article 5 – Bonds and Insurance.....	18
5.01 Performance, Payment, and Other Bonds.....	18
5.02 Licensed Sureties and Insurers.....	18
5.03 Certificates of Insurance.....	19
5.04 Contractor’s Liability Insurance	19
5.05 Owner’s Liability Insurance.....	20
5.06 Property Insurance	20
5.07 Waiver of Rights.....	21
5.08 Receipt and Application of Insurance Proceeds	22
5.09 Acceptance of Bonds and Insurance; Option to Replace	22
5.10 Partial Utilization, Acknowledgment of Property Insurer.....	22
Article 6 – Contractor’s Responsibilities.....	22
6.01 Supervision and Superintendence	22
6.02 Labor; Working Hours.....	23
6.03 Services, Materials, and Equipment.....	23
6.04 Progress Schedule	23
6.05 Substitutes and “Or-Equals”	23
6.06 Concerning Subcontractors, Suppliers, and Others.....	25
6.07 Patent Fees and Royalties.....	26
6.08 Permits.....	27
6.09 Laws and Regulations	27
6.10 Taxes	27

6.11	Use of Site and Other Areas.....	27
6.12	Record Documents.....	28
6.13	Safety and Protection.....	28
6.14	Safety Representative.....	29
6.15	Hazard Communication Programs.....	29
6.16	Emergencies.....	29
6.17	Shop Drawings and Samples.....	29
6.18	Continuing the Work.....	31
6.19	Contractor's General Warranty and Guarantee.....	31
6.20	Indemnification.....	31
6.21	Delegation of Professional Design Services.....	32
Article 7 – Other Work at the Site.....		32
7.01	Related Work at Site.....	32
7.02	Coordination.....	33
7.03	Legal Relationships.....	33
Article 8 – Owner's Responsibilities.....		33
8.01	Communications to Contractor.....	33
8.02	Replacement of Engineer.....	34
8.03	Furnish Data.....	34
8.04	Pay When Due.....	34
8.05	Lands and Easements; Reports and Tests.....	34
8.06	Insurance.....	34
8.07	Change Orders.....	34
8.08	Inspections, Tests, and Approvals.....	34
8.09	Limitations on Owner's Responsibilities.....	34
8.10	Undisclosed Hazardous Environmental Condition.....	34
8.11	Evidence of Financial Arrangements.....	34
Article 9 – Engineer's Status During Construction.....		35
9.01	Owner's Representative.....	35
9.02	Visits to Site.....	35
9.03	Project Representative.....	35
9.04	Authorized Variations in Work.....	35
9.05	Rejecting Defective Work.....	35
9.06	Shop Drawings, Change Orders and Payments.....	36
9.07	Determinations for Unit Price Work.....	36
9.08	Decisions on Requirements of Contract Documents and Acceptability of Work.....	36
9.09	Limitations on Engineer's Authority and Responsibilities.....	36
Article 10 – Changes in the Work; Claims.....		37
10.01	Authorized Changes in the Work.....	37
10.02	Unauthorized Changes in the Work.....	37
10.03	Execution of Change Orders.....	37
10.04	Notification to Surety.....	37
10.05	Claims.....	38
Article 11 – Cost of the Work; Allowances; Unit Price Work.....		38
11.01	Cost of the Work.....	38
11.02	Allowances.....	40
11.03	Unit Price Work.....	41
Article 12 – Change of Contract Price; Change of Contract Times.....		41
12.01	Change of Contract Price.....	41
12.02	Change of Contract Times.....	42

12.03	Delays.....	42
Article 13	– Tests and Inspections; Correction, Removal or Acceptance of Defective Work	43
13.01	Notice of Defects.....	43
13.02	Access to Work	43
13.03	Tests and Inspections	43
13.04	Uncovering Work.....	44
13.05	Owner May Stop the Work.....	44
13.06	Correction or Removal of Defective Work	45
13.07	Correction Period	45
13.08	Acceptance of Defective Work.....	46
13.09	Owner May Correct Defective Work.....	46
Article 14	– Payments to Contractor and Completion.....	46
14.01	Schedule of Values.....	46
14.02	Progress Payments	46
14.03	Contractor’s Warranty of Title.....	49
14.04	Substantial Completion	49
14.05	Partial Utilization	49
14.06	Final Inspection.....	50
14.07	Final Payment.....	50
14.08	Final Completion Delayed	51
14.09	Waiver of Claims	51
Article 15	– Suspension of Work and Termination.....	51
15.01	Owner May Suspend Work.....	51
15.02	Owner May Terminate for Cause.....	52
15.03	Owner May Terminate For Convenience	52
15.04	Contractor May Stop Work or Terminate.....	53
Article 16	– Dispute Resolution.....	53
16.01	Methods and Procedures	53
Article 17	– Miscellaneous	54
17.01	Giving Notice	54
17.02	Computation of Times.....	54
17.03	Cumulative Remedies	54
17.04	Survival of Obligations	54
17.05	Controlling Law	54
17.06	Headings.....	54
Article 18	– Federal Requirements	54
18.01	Agency Not a Party	54
18.02	Contract Approval.....	55
18.03	Conflict of Interest	55
18.04	Gratuities	55
18.05	Audit and Access to Records.....	55
18.06	Small, Minority and Women’s Businesses	55
18.07	Anti-Kickback	56
18.08	Clean Air and Pollution Control Acts.....	56
18.09	State Energy Policy	56
18.10	Equal Opportunity Requirements.....	56
18.11	Restrictions on Lobbying	56
18.12	Environmental Requirements.....	57

Section 00710 GENERAL CONDITIONS

ARTICLE 1 – DEFINITIONS AND TERMINOLOGY

1.01 *Defined Terms*

- A. Wherever used in the Bidding Requirements or Contract Documents and printed with initial capital letters, the terms listed below will have the meanings indicated which are applicable to both the singular and plural thereof. In addition to terms specifically defined, terms with initial capital letters in the Contract Documents include references to identified articles and paragraphs, and the titles of other documents or forms.
1. *Addenda* – Written or graphic instruments issued prior to the opening of Bids which clarify, correct, or change the Bidding Requirements or the proposed Contract Documents.
 2. *Agency* – The Federal or state agency named as such in the Agreement.
 3. *Agreement* – The written instrument which is evidence of the agreement between Owner and Contractor covering the Work.
 4. *Application for Payment* – The form acceptable to Engineer which is to be used by Contractor during the course of the Work in requesting progress or final payments and which is to be accompanied by such supporting documentation as is required by the Contract Documents.
 5. *Asbestos* – Any material that contains more than one percent asbestos and is friable or is releasing asbestos fibers into the air above current action levels established by the United States Occupational Safety and Health Administration.
 6. *Bid* – The offer or proposal of a Bidder submitted on the prescribed form setting forth the prices for the Work to be performed.
 7. *Bidder* – The individual or entity who submits a Bid directly to Owner.
 8. *Bidding Documents* – The Bidding Requirements and the proposed Contract Documents (including all Addenda).
 9. *Bidding Requirements* – The Advertisement or Invitation to Bid, Instructions to Bidders, bid security of acceptable form, if any, and the Bid Form with any supplements.
 10. *Change Order* – A document recommended by Engineer which is signed by Contractor and Owner and Agency and authorizes an addition, deletion, or revision in the Work or an adjustment in the Contract Price or the Contract Times, issued on or after the Effective Date of the Agreement.
 11. *Claim* – A demand or assertion by Owner or Contractor seeking an adjustment of Contract Price or Contract Times, or both, or other relief with respect to the terms of the Contract. A demand for money or services by a third party is not a Claim.
 12. *Contract* – The entire and integrated written agreement between the Owner and Contractor concerning the Work. The Contract supersedes prior negotiations, representations, or agreements, whether written or oral.
 13. *Contract Documents* – Those items so designated in the Agreement. Only printed or hard copies of the items listed in the Agreement are Contract Documents. Approved Shop Drawings, other Contractor's submittals, and the reports and drawings of subsurface and physical conditions are not Contract Documents.

14. *Contract Price* – The moneys payable by Owner to Contractor for completion of the Work in accordance with the Contract Documents as stated in the Agreement (subject to the provisions of Paragraph 11.03 in the case of Unit Price Work).
15. *Contract Times* – The number of days or the dates stated in the Agreement to: (i) achieve Milestones, if any, (ii) achieve Substantial Completion; and (iii) complete the Work so that it is ready for final payment as evidenced by Engineer's written recommendation of final payment.
16. *Contractor* – The individual or entity with whom Owner has entered into the Agreement.
17. *Cost of the Work* – See Paragraph 11.01.A for definition.
18. *Drawings* – That part of the Contract Documents prepared or approved by Engineer which graphically shows the scope, extent, and character of the Work to be performed by Contractor. Shop Drawings and other Contractor submittals are not Drawings as so defined.
19. *Effective Date of the Agreement* – The date indicated in the Agreement on which it becomes effective, but if no such date is indicated, it means the date on which the Agreement is signed and delivered by the last of the two parties to sign and deliver.
20. *Engineer* – The individual or entity named as such in the Agreement.
21. *Field Order* – A written order issued by Engineer which requires minor changes in the Work but which does not involve a change in the Contract Price or the Contract Times.
22. *General Requirements* – Sections of Division 1 of the Specifications. The General Requirements pertain to all sections of the Specifications.
23. *Hazardous Environmental Condition* – The presence at the Site of Asbestos, PCBs, Petroleum, Hazardous Waste, or Radioactive Material in such quantities or circumstances that may present a substantial danger to persons or property exposed thereto in connection with the Work.
24. *Hazardous Waste* – The term Hazardous Waste shall have the meaning provided in Section 1004 of the Solid Waste Disposal Act (42 USC Section 6903) as amended from time to time.
25. *Laws and Regulations; Laws or Regulations* – Any and all applicable laws, rules, regulations, ordinances, codes, and orders of any and all governmental bodies, agencies, authorities, and courts having jurisdiction.
26. *Liens* – Charges, security interests, or encumbrances upon Project funds, real property, or personal property.
27. *Milestone* – A principal event specified in the Contract Documents relating to an intermediate completion date or time prior to Substantial Completion of all the Work.
28. *Notice of Award* – The written notice by Owner to the Successful Bidder stating that upon timely compliance by the Successful Bidder with the conditions precedent listed therein, Owner will sign and deliver the Agreement.
29. *Notice to Proceed* – A written notice given by Owner to Contractor fixing the date on which the Contract Times will commence to run and on which Contractor shall start to perform the Work under the Contract Documents.
30. *Owner* – The individual or entity with whom Contractor has entered into the Agreement and for whom the Work is to be performed.

31. *PCBs* – Polychlorinated biphenyls.
32. *Petroleum* – Petroleum, including crude oil or any fraction thereof which is liquid at standard conditions of temperature and pressure (60 degrees Fahrenheit and 14.7 pounds per square inch absolute), such as oil, petroleum, fuel oil, oil sludge, oil refuse, gasoline, kerosene, and oil mixed with other non-Hazardous Waste and crude oils.
33. *Progress Schedule* – A schedule, prepared and maintained by Contractor, describing the sequence and duration of the activities comprising the Contractor's plan to accomplish the Work within the Contract Times.
34. *Project* – The total construction of which the Work to be performed under the Contract Documents may be the whole, or a part.
35. *Project Manual* – The bound documentary information prepared for bidding and constructing the Work. A listing of the contents of the Project Manual, which may be bound in one or more volumes, is contained in the table(s) of contents.
36. *Radioactive Material* – Source, special nuclear, or byproduct material as defined by the Atomic Energy Act of 1954 (42 USC Section 2011 et seq.) as amended from time to time.
37. *Related Entity* – An officer, director, partner, employee, agent, consultant, or subcontractor.
38. *Resident Project Representative* – The authorized representative of Engineer who may be assigned to the Site or any part thereof.
39. *Samples* – Physical examples of materials, equipment, or workmanship that are representative of some portion of the Work and which establish the standards by which such portion of the Work will be judged.
40. *Schedule of Submittals* – A schedule, prepared and maintained by Contractor, of required submittals and the time requirements to support scheduled performance of related construction activities.
41. *Schedule of Values* – A schedule, prepared and maintained by Contractor, allocating portions of the Contract Price to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.
42. *Shop Drawings* – All drawings, diagrams, illustrations, schedules, and other data or information which are specifically prepared or assembled by or for Contractor and submitted by Contractor to illustrate some portion of the Work.
43. *Site* – Lands or areas indicated in the Contract Documents as being furnished by Owner upon which the Work is to be performed, including rights-of-way and easements for access thereto, and such other lands furnished by Owner which are designated for the use of Contractor.
44. *Specifications* – That part of the Contract Documents consisting of written requirements for materials, equipment, systems, standards and workmanship as applied to the Work, and certain administrative requirements and procedural matters applicable thereto.
45. *Subcontractor* – An individual or entity having a direct contract with Contractor or with any other Subcontractor for the performance of a part of the Work at the Site.
46. *Substantial Completion* – The time at which the Work (or a specified part thereof) has progressed to the point where, in the opinion of Engineer, the Work (or a specified part thereof) is sufficiently complete, in accordance with the Contract Documents, so that the Work (or a specified part thereof) can be utilized for the purposes for which it is intended. **The warranty period will not start, nor will retainage be released until the final**

punch list items have been accepted and approved by the Owner and the Engineer. The terms "substantially complete" and "substantially completed" as applied to all or part of the Work refer to Substantial Completion thereof.

47. *Successful Bidder* – The Bidder submitting a responsive Bid to whom Owner makes an award.
48. *Supplementary Conditions* – That part of the Contract Documents which amends or supplements these General Conditions.
49. *Supplier* – A manufacturer, fabricator, supplier, distributor, materialman, or vendor having a direct contract with Contractor or with any Subcontractor to furnish materials or equipment to be incorporated in the Work by Contractor or any Subcontractor.
50. *Underground Facilities* – All underground pipelines, conduits, ducts, cables, wires, manholes, vaults, tanks, tunnels, or other such facilities or attachments, and any encasements containing such facilities, including those that convey electricity, gases, steam, liquid petroleum products, telephone or other communications, cable television, water, wastewater, storm water, other liquids or chemicals, or traffic or other control systems.
51. *Unit Price Work* – Work to be paid for on the basis of unit prices.
52. *Work* – The entire construction or the various separately identifiable parts thereof required to be provided under the Contract Documents. Work includes and is the result of performing or providing all labor, services, and documentation necessary to produce such construction, and furnishing, installing, and incorporating all materials and equipment into such construction, all as required by the Contract Documents.
53. *Work Change Directive* – A written statement to Contractor issued on or after the Effective Date of the Agreement and signed by Owner and Agency upon recommendation of the Engineer ordering an addition, deletion, or revision in the Work, or responding to differing or unforeseen subsurface or physical conditions under which the Work is to be performed or to emergencies. A Work Change Directive will not change the Contract Price or the Contract Times but is evidence that the parties expect that the change ordered or documented by a Work Change Directive will be incorporated in a subsequently issued Change Order following negotiations by the parties as to its effect, if any, on the Contract Price or Contract Times.

1.02 *Terminology*

- A. The following words or terms are not defined but, when used in the Bidding Requirements or Contract Documents, have the following meaning.
- B. *Intent of Certain Terms or Adjectives*
 1. The Contract Documents include the terms "as allowed," "as approved," "as ordered," "as directed" or terms of like effect or import to authorize an exercise of professional judgment by Engineer. In addition, the adjectives "reasonable," "suitable," "acceptable," "proper," "satisfactory," or adjectives of like effect or import are used to describe an action or determination of Engineer as to the Work. It is intended that such exercise of professional judgment, action or determination will be solely to evaluate, in general, the Work for compliance with the requirements of and information in the Contract Documents and conformance with the design concept of the completed Project as a functioning whole as shown or indicated in the Contract Documents (unless there is a specific statement indicating otherwise). The use of any such term or adjective is not intended to and shall not be effective to assign to Engineer any duty or authority to supervise or direct the performance of the Work or any duty or authority to undertake responsibility contrary to the provisions of Paragraph 9.09 or any other provision of the Contract Documents.

C. *Day*

1. The word "day" means a calendar day of 24 hours measured from midnight to the next midnight.

D. *Defective*

1. The word "defective," when modifying the word "Work," refers to Work that is unsatisfactory, faulty, or deficient in that it:
 - a. does not conform to the Contract Documents, or
 - b. does not meet the requirements of any applicable inspection, reference standard, test, or approval referred to in the Contract Documents, or
 - c. has been damaged prior to Engineer's recommendation of final payment (unless responsibility for the protection thereof has been assumed by Owner at Substantial Completion in accordance with Paragraph 14.04 or 14.05).

E. *Furnish, Install, Perform, Provide*

1. The word "furnish," when used in connection with services, materials, or equipment, shall mean to supply and deliver said services, materials, or equipment to the Site (or some other specified location) ready for use or installation and in usable or operable condition.
 2. The word "install," when used in connection with services, materials, or equipment, shall mean to put into use or place in final position said services, materials, or equipment complete and ready for intended use.
 3. The words "perform" or "provide," when used in connection with services, materials, or equipment, shall mean to furnish and install said services, materials, or equipment complete and ready for intended use.
 4. When "furnish," "install," "perform," or "provide" is not used in connection with services, materials, or equipment in a context clearly requiring an obligation of Contractor, "provide" is implied.
- F. Unless stated otherwise in the Contract Documents, words or phrases which have a well-known technical or construction industry or trade meaning are used in the Contract Documents in accordance with such recognized meaning.

ARTICLE 2 – PRELIMINARY MATTERS

2.01 *Delivery of Bonds and Evidence of Insurance*

- A. When Contractor delivers the executed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner such bonds as Contractor may be required to furnish.
- B. *Evidence of Insurance:* Before any Work at the Site is started, Contractor and Owner shall each deliver to the other, with copies to each additional insured identified in the Supplementary Conditions, certificates of insurance (and other evidence of insurance which either of them or any additional insured may reasonably request) which Contractor and Owner respectively are required to purchase and maintain in accordance with Article 5.

2.02 *Copies of Documents*

- A. Owner shall furnish to Contractor up to ten printed or hard copies of the Drawings and Project Manual. Additional copies will be furnished upon request at the cost of reproduction.

2.03 *Commencement of Contract Times; Notice to Proceed*

- A. The Contract Times will commence to run on the thirtieth day after the Effective Date of the Agreement or, if a Notice to Proceed is given, on the day indicated in the Notice to Proceed. A Notice to Proceed may be given at any time within 30 days after the Effective Date of the Agreement.

2.04 *Starting the Work*

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

2.05 *Before Starting Construction*

- A. *Preliminary Schedules:* Within 10 days after the Effective Date of the Agreement (unless otherwise specified in the General Requirements), Contractor shall submit to Engineer for timely review:
 - 1. a preliminary Progress Schedule;
 - 2. a preliminary Schedule of Submittals; and
 - 3. a preliminary Schedule of Values for all of the Work which includes quantities and prices of items which when added together equal the Contract Price and subdivides the Work into component parts in sufficient detail to serve as the basis for progress payments during performance of the Work. Such prices will include an appropriate amount of overhead and profit applicable to each item of Work.

2.06 *Preconstruction Conference*

- A. Before any Work at the Site is started, a conference attended by Owner, Contractor, Engineer, Agency, and others as appropriate will be held to establish a working understanding among the parties as to the Work and to discuss the schedules referred to in Paragraph 2.05.A, procedures for handling Shop Drawings and other submittals, processing Applications for Payment, and maintaining required records.

2.07 *Initial Acceptance of Schedules*

- A. At least 10 days before submission of the first Application for Payment a conference attended by Contractor, Engineer, and others as appropriate will be held to review for acceptability to Engineer as provided below the schedules submitted in accordance with Paragraph 2.05.A. Contractor shall have an additional 10 days to make corrections and adjustments and to complete and resubmit the schedules. No progress payment shall be made to Contractor until acceptable schedules are submitted to Engineer.
 - 1. The Progress Schedule will be acceptable to Engineer if it provides an orderly progression of the Work to completion within the Contract Times. Such acceptance will not impose on Engineer responsibility for the Progress Schedule, for sequencing, scheduling, or progress of the Work nor interfere with or relieve Contractor from Contractor's full responsibility therefor.
 - 2. Contractor's Schedule of Submittals will be acceptable to Engineer if it provides a workable arrangement for reviewing and processing the required submittals.
 - 3. Contractor's Schedule of Values will be acceptable to Engineer as to form and substance if it provides a reasonable allocation of the Contract Price to component parts of the Work.

ARTICLE 3 – CONTRACT DOCUMENTS: INTENT, AMENDING, REUSE

3.01 *Intent*

- A. The Contract Documents are complementary; what is required by one is as binding as if required by all.
- B. It is the intent of the Contract Documents to describe a functionally complete Project (or part thereof) to be constructed in accordance with the Contract Documents. Any labor, documentation, services, materials, or equipment that may reasonably be inferred from the Contract Documents or from prevailing custom or trade usage as being required to produce the intended result will be provided whether or not specifically called for at no additional cost to Owner.
- C. Clarifications and interpretations of the Contract Documents shall be issued by Engineer as provided in Article 9.

3.02 *Reference Standards*

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

- 1. Reference to standards, specifications, manuals, or codes of any technical society, organization, or association, or to Laws or Regulations, whether such reference be specific or by implication, shall mean the standard, specification, manual, code, or Laws or Regulations in effect at the time of opening of Bids (or on the Effective Date of the Agreement if there were no Bids), except as may be otherwise specifically stated in the Contract Documents.
- 2. No provision of any such standard, specification, manual or code, or any instruction of a Supplier shall be effective to change the duties or responsibilities of Owner, Contractor, or Engineer, or any of their subcontractors, consultants, agents, or employees from those set forth in the Contract Documents. No such provision or instruction shall be effective to assign to Owner, or Engineer, or any of their Related Entities, any duty or authority to supervise or direct the performance of the Work or any duty or authority to undertake responsibility inconsistent with the provisions of the Contract Documents.

3.03 *Reporting and Resolving Discrepancies*

A. Reporting Discrepancies

- 1. *Contractor's Review of Contract Documents Before Starting Work:* Before undertaking each part of the Work, Contractor shall carefully study and compare the Contract Documents and check and verify pertinent figures therein and all applicable field measurements. Contractor shall promptly report in writing to Engineer any conflict, error, ambiguity, or discrepancy which Contractor may discover and shall obtain a written interpretation or clarification from Engineer before proceeding with any Work affected thereby.
- 2. *Contractor's Review of Contract Documents During Performance of Work:* If, during the performance of the Work, Contractor discovers any conflict, error, ambiguity, or discrepancy within the Contract Documents or between the Contract Documents and any provision of any Law or Regulation applicable to the performance of the Work or of any standard, specification, manual or code, or of any instruction of any Supplier, Contractor shall promptly report it to Engineer in writing. Contractor shall not proceed with the Work affected thereby (except in an emergency as required by Paragraph 6.16.A) until an amendment or supplement to the Contract Documents has been issued by one of the methods indicated in Paragraph 3.04.
- 3. Contractor shall not be liable to Owner or Engineer for failure to report any conflict, error, ambiguity, or discrepancy in the Contract Documents unless Contractor knew or reasonably should have known thereof.

B. Resolving Discrepancies

1. Except as may be otherwise specifically stated in the Contract Documents, the provisions of the Contract Documents shall take precedence in resolving any conflict, error, ambiguity, or discrepancy between the provisions of the Contract Documents and:
 - a. the provisions of any standard, specification, manual, code, or instruction (whether or not specifically incorporated by reference in the Contract Documents); or
 - b. the provisions of any Laws or Regulations applicable to the performance of the Work (unless such an interpretation of the provisions of the Contract Documents would result in violation of such Law or Regulation).

3.04 *Amending and Supplementing Contract Documents*

- A. The Contract Documents may be amended to provide for additions, deletions, and revisions in the Work or to modify the terms and conditions thereof by either a Change Order or a Work Change Directive.
- B. The requirements of the Contract Documents may be supplemented, and minor variations and deviations in the Work may be authorized, by one or more of the following ways:
 1. A Field Order;
 2. Engineer's approval of a Shop Drawing or Sample; (Subject to the provisions of Paragraph 6.17.D.3) or
 3. Engineer's written interpretation or clarification.

3.05 *Reuse of Documents*

- A. Contractor and any Subcontractor or Supplier shall not:
 1. have or acquire any title to or ownership rights in any of the Drawings, Specifications, or other documents (or copies of any thereof) prepared by or bearing the seal of Engineer or Engineer's consultants, including electronic media editions; or
 2. reuse any of such Drawings, Specifications, other documents, or copies thereof on extensions of the Project or any other project without written consent of Owner and Engineer and specific written verification or adaptation by Engineer.
- B. The prohibition of this Paragraph 3.05 will survive final payment, or termination of the Contract. Nothing herein shall preclude Contractor from retaining copies of the Contract Documents for record purposes.

3.06 *Electronic Data*

- A. Copies of data furnished by Owner or Engineer to Contractor or Contractor to Owner or Engineer that may be relied upon are limited to the printed copies (also known as hard copies). Files in electronic media format of text, data, graphics, or other types are furnished only for the convenience of the receiving party. Any conclusion or information obtained or derived from such electronic files will be at the user's sole risk. If there is a discrepancy between the electronic files and the hard copies, the hard copies govern.
- B. Because data stored in electronic media format can deteriorate or be modified inadvertently or otherwise without authorization of the data's creator, the party receiving electronic files agrees that it will perform acceptance tests or procedures within 60 days, after which the receiving party shall be deemed to have accepted the data thus transferred. Any errors detected within the 60-day acceptance period will be corrected by the transferring party.

- C. When transferring documents in electronic media format, the transferring party makes no representations as to long term compatibility, usability, or readability of documents resulting from the use of software application packages, operating systems, or computer hardware differing from those used by the data's creator.

ARTICLE 4 – AVAILABILITY OF LANDS; SUBSURFACE AND PHYSICAL CONDITIONS; HAZARDOUS ENVIRONMENTAL CONDITIONS; REFERENCE POINTS

4.01 *Availability of Lands*

- A. Owner shall furnish the Site. Owner shall notify Contractor of any encumbrances or restrictions not of general application but specifically related to use of the Site with which Contractor must comply in performing the Work. Owner will obtain in a timely manner and pay for easements for permanent structures or permanent changes in existing facilities. If Contractor and Owner are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Contract Times, or both, as a result of any delay in Owner's furnishing the Site or a part thereof, Contractor may make a Claim therefor as provided in Paragraph 10.05.
- B. Upon reasonable written request, Owner shall furnish Contractor with a current statement of record legal title and legal description of the lands upon which the Work is to be performed and Owner's interest therein as necessary for giving notice of or filing a mechanic's or construction lien against such lands in accordance with applicable Laws and Regulations.
- C. Contractor shall provide for all additional lands and access thereto that may be required for temporary construction facilities or storage of materials and equipment.

4.02 *Subsurface and Physical Conditions*

- A. *Reports and Drawings:* The Supplementary Conditions identify:
 - 1. those reports of explorations and tests of subsurface conditions at or contiguous to the Site that Engineer has used in preparing the Contract Documents; and
 - 2. those drawings of physical conditions in or relating to existing surface or subsurface structures at or contiguous to the Site (except Underground Facilities) that Engineer has used in preparing the Contract Documents.
- B. *Limited Reliance by Contractor on Technical Data Authorized:* Contractor may rely upon the general accuracy of the "technical data" contained in such reports and drawings, but such reports and drawings are not Contract Documents. Such "technical data" is identified in the Supplementary Conditions. Except for such reliance on such "technical data," Contractor may not rely upon or make any claim against Owner or Engineer, or any of their Related Entities with respect to:
 - 1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor, and safety precautions and programs incident thereto; or
 - 2. other data, interpretations, opinions, and information contained in such reports or shown or indicated in such drawings; or
 - 3. any Contractor interpretation of or conclusion drawn from any "technical data" or any such other data, interpretations, opinions, or information.

4.03 *Differing Subsurface or Physical Conditions*

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

1. is of such a nature as to establish that any "technical data" on which Contractor is entitled to rely as provided in Paragraph 4.02 is materially inaccurate; or
2. is of such a nature as to require a change in the Contract Documents; or
3. differs materially from that shown or indicated in the Contract Documents; or
4. is of an unusual nature, and differs materially from conditions ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract Documents;

then Contractor shall, promptly after becoming aware thereof and before further disturbing the subsurface or physical conditions or performing any Work in connection therewith (except in an emergency as required by Paragraph 6.16.A), notify Owner and Engineer in writing about such condition. Contractor shall not further disturb such condition or perform any Work in connection therewith (except as aforesaid) until receipt of written order to do so.

B. *Engineer's Review:* After receipt of written notice as required by Paragraph 4.03.A, Engineer will promptly review the pertinent condition, determine the necessity of Owner's obtaining additional exploration or tests with respect thereto, and advise Owner in writing (with a copy to Contractor) of Engineer's findings and conclusions.

C. *Possible Price and Times Adjustments*

1. The Contract Price or the Contract Times, or both, will be equitably adjusted to the extent that the existence of such differing subsurface or physical condition causes an increase or decrease in Contractor's cost of, or time required for, performance of the Work; subject, however, to the following:
 - a. such condition must meet any one or more of the categories described in Paragraph 4.03.A; and
 - b. with respect to Work that is paid for on a Unit Price Basis, any adjustment in Contract Price will be subject to the provisions of Paragraphs 9.07 and 11.03.
2. Contractor shall not be entitled to any adjustment in the Contract Price or Contract Times if:
 - a. Contractor knew of the existence of such conditions at the time Contractor made a final commitment to Owner with respect to Contract Price and Contract Times by the submission of a Bid or becoming bound under a negotiated contract; or
 - b. the existence of such condition could reasonably have been discovered or revealed as a result of any examination, investigation, exploration, test, or study of the Site and contiguous areas required by the Bidding Requirements or Contract Documents to be conducted by or for Contractor prior to Contractor's making such final commitment; or
 - c. Contractor failed to give the written notice as required by Paragraph 4.03.A.
3. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Contract Times, or both, a Claim may be made therefor as provided in Paragraph 10.05. However, Owner and Engineer, and any of their Related Entities shall not be liable to Contractor for any claims, costs, losses, or damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) sustained by Contractor on or in connection with any other project or anticipated project.

4.04 *Underground Facilities*

A. *Shown or Indicated:* The information and data shown or indicated in the Contract Documents with respect to existing Underground Facilities at or contiguous to the Site is based on information and data furnished to Owner or Engineer by the owners of such Underground Facilities, including Owner, or by others. Unless it is otherwise expressly provided in the Supplementary Conditions:

1. Owner and Engineer shall not be responsible for the accuracy or completeness of any such information or data; and
2. the cost of all of the following will be included in the Contract Price, and Contractor shall have full responsibility for:
 - a. reviewing and checking all such information and data,
 - b. locating all Underground Facilities shown or indicated in the Contract Documents,
 - c. coordination of the Work with the owners of such Underground Facilities, including Owner, during construction, and
 - d. the safety and protection of all such Underground Facilities and repairing any damage thereto resulting from the Work.

B. *Not Shown or Indicated*

1. If an Underground Facility is uncovered or revealed at or contiguous to the Site which was not shown or indicated, or not shown or indicated with reasonable accuracy in the Contract Documents, Contractor shall, promptly after becoming aware thereof and before further disturbing conditions affected thereby or performing any Work in connection therewith (except in an emergency as required by Paragraph 6.16.A), identify the owner of such Underground Facility and give written notice to that owner and to Owner and Engineer. Engineer will promptly review the Underground Facility and determine the extent, if any, to which a change is required in the Contract Documents to reflect and document the consequences of the existence or location of the Underground Facility. During such time, Contractor shall be responsible for the safety and protection of such Underground Facility.
2. If Engineer concludes that a change in the Contract Documents is required, a Work Change Directive or a Change Order will be issued to reflect and document such consequences. An equitable adjustment shall be made in the Contract Price or Contract Times, or both, to the extent that they are attributable to the existence or location of any Underground Facility that was not shown or indicated or not shown or indicated with reasonable accuracy in the Contract Documents and that Contractor did not know of and could not reasonably have been expected to be aware of or to have anticipated. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any such adjustment in Contract Price or Contract Times, Owner or Contractor may make a Claim therefor as provided in Paragraph 10.05.

4.05 *Reference Points*

A. Owner shall provide engineering surveys to establish reference points for construction which in Engineer's judgment are necessary to enable Contractor to proceed with the Work. Contractor shall be responsible for laying out the Work, shall protect and preserve the established reference points and property monuments, and shall make no changes or relocations without the prior written approval of Owner. Contractor shall report to Engineer whenever any reference point or property monument is lost or destroyed or requires relocation because of necessary changes in grades or locations, and shall be responsible for the accurate replacement or relocation of such reference points or property monuments by professionally qualified personnel.

4.06 *Hazardous Environmental Condition at Site*

- A. *Reports and Drawings:* Reference is made to the Supplementary Conditions for the identification of those reports and drawings relating to a Hazardous Environmental Condition identified at the Site, if any, that have been utilized by the Engineer in the preparation of the Contract Documents.
- B. *Limited Reliance by Contractor on Technical Data Authorized:* Contractor may rely upon the general accuracy of the "technical data" contained in such reports and drawings, but such reports and drawings are not Contract Documents. Such "technical data" is identified in the Supplementary Conditions. Except for such reliance on such "technical data," Contractor may not rely upon or make any claim against Owner or Engineer, or any of their Related Entities with respect to:
1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences and procedures of construction to be employed by Contractor and safety precautions and programs incident thereto; or
 2. other data, interpretations, opinions and information contained in such reports or shown or indicated in such drawings; or
 3. any Contractor interpretation of or conclusion drawn from any "technical data" or any such other data, interpretations, opinions or information.
- C. Contractor shall not be responsible for any Hazardous Environmental Condition uncovered or revealed at the Site which was not shown or indicated in Drawings or Specifications or identified in the Contract Documents to be within the scope of the Work. Contractor shall be responsible for a Hazardous Environmental Condition created with any materials brought to the Site by Contractor, Subcontractors, Suppliers, or anyone else for whom Contractor is responsible.
- D. If Contractor encounters a Hazardous Environmental Condition or if Contractor or anyone for whom Contractor is responsible creates a Hazardous Environmental Condition, Contractor shall immediately: (i) secure or otherwise isolate such condition; (ii) stop all Work in connection with such condition and in any area affected thereby (except in an emergency as required by Paragraph 6.16.A); and (iii) notify Owner and Engineer (and promptly thereafter confirm such notice in writing). Owner shall promptly consult with Engineer concerning the necessity for Owner to retain a qualified expert to evaluate such condition or take corrective action, if any.
- E. Contractor shall not be required to resume Work in connection with such condition or in any affected area until after Owner has obtained any required permits related thereto and delivered to Contractor written notice: (i) specifying that such condition and any affected area is or has been rendered safe for the resumption of Work; or (ii) specifying any special conditions under which such Work may be resumed safely. If Owner and Contractor cannot agree as to entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times, or both, as a result of such Work stoppage or such special conditions under which Work is agreed to be resumed by Contractor, either party may make a Claim therefor as provided in Paragraph 10.05.
- F. If after receipt of such written notice Contractor does not agree to resume such Work based on a reasonable belief it is unsafe, or does not agree to resume such Work under such special conditions, then Owner may order the portion of the Work that is in the area affected by such condition to be deleted from the Work. If Owner and Contractor cannot agree as to entitlement to or on the amount or extent, if any, of an adjustment in Contract Price or Contract Times as a result of deleting such portion of the Work, then either party may make a Claim therefor as provided in Paragraph 10.05. Owner may have such deleted portion of the Work performed by Owner's own forces or others in accordance with Article 7.
- G. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, Subcontractors, and Engineer, and the officers, directors, partners, employees, agents, consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration

or other dispute resolution costs) arising out of or relating to a Hazardous Environmental Condition, provided that such Hazardous Environmental Condition: (i) was not shown or indicated in the Drawings or Specifications or identified in the Contract Documents to be included within the scope of the Work, and (ii) was not created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 4.06.G shall obligate Owner to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.

- H. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, partners, employees, agents, consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to a Hazardous Environmental Condition created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 4.06. H shall obligate Contractor to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.
- I. The provisions of Paragraphs 4.02, 4.03, and 4.04 do not apply to a Hazardous Environmental Condition uncovered or revealed at the Site.

ARTICLE 5 – BONDS AND INSURANCE

5.01 *Performance, Payment, and Other Bonds*

- A. Contractor shall furnish performance and payment bonds, each in an amount at least equal to the Contract Price as security for the faithful performance and payment of all of Contractor's obligations under the Contract Documents. These bonds shall remain in effect until one year after the date when final payment becomes due or until completion of the correction period specified in Paragraph 13.07, whichever is later, except as provided otherwise by Laws or Regulations or by the Contract Documents. Contractor shall also furnish such other bonds as are required by the Contract Documents.
- B. All bonds shall be in the form prescribed by the Contract Documents except as provided otherwise by Laws or Regulations, and shall be executed by such sureties as are named in the current list of "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" as published in Circular 570 (amended) by the Financial Management Service, Surety Bond Branch, U.S. Department of the Treasury. All bonds signed by an agent must be accompanied by a certified copy of the agent's authority to act.
- C. If the surety on any bond furnished by Contractor is declared bankrupt or becomes insolvent or its right to do business is terminated in any state where any part of the Project is located or it ceases to meet the requirements of Paragraph 5.01.B, Contractor shall promptly notify Owner and Engineer and shall, within 20 days after the event giving rise to such notification, provide another bond and surety, both of which shall comply with the requirements of Paragraphs 5.01.B and 5.02.

5.02 *Licensed Sureties and Insurers*

- A. All bonds and insurance required by the Contract Documents to be purchased and maintained by Owner or Contractor shall be obtained from surety or insurance companies that are duly licensed or authorized in the jurisdiction in which the Project is located to issue bonds or insurance policies for the limits and coverages so required. Such surety and insurance companies shall also meet such additional requirements and qualifications as may be provided in the Supplementary Conditions.

5.03 *Certificates of Insurance*

- A. Contractor shall deliver to Owner, with copies to each additional insured identified in the Supplementary Conditions, certificates of insurance (and other evidence of insurance requested by Owner or any other additional insured) which Contractor is required to purchase and maintain.
- B. Owner shall deliver to Contractor, with copies to each additional insured identified in the Supplementary Conditions, certificates of insurance (and other evidence of insurance requested by Contractor or any other additional insured) which Owner is required to purchase and maintain.

5.04 *Contractor's Liability Insurance*

- A. Contractor shall purchase and maintain such liability and other insurance as is appropriate for the Work being performed and as will provide protection from claims set forth below which may arise out of or result from Contractor's performance of the Work and Contractor's other obligations under the Contract Documents, whether it is to be performed by Contractor, any Subcontractor or Supplier, or by anyone directly or indirectly employed by any of them to perform any of the Work, or by anyone for whose acts any of them may be liable:
 - 1. claims under workers' compensation, disability benefits, and other similar employee benefit acts;
 - 2. claims for damages because of bodily injury, occupational sickness or disease, or death of Contractor's employees;
 - 3. claims for damages because of bodily injury, sickness or disease, or death of any person other than Contractor's employees;
 - 4. claims for damages insured by reasonably available personal injury liability coverage which are sustained:
 - a. by any person as a result of an offense directly or indirectly related to the employment of such person by Contractor, or
 - b. by any other person for any other reason;
 - 5. claims for damages, other than to the Work itself, because of injury to or destruction of tangible property wherever located, including loss of use resulting therefrom; and
 - 6. claims for damages because of bodily injury or death of any person or property damage arising out of the ownership, maintenance or use of any motor vehicle.
- B. The policies of insurance required by this Paragraph 5.04 shall:
 - 1. with respect to insurance required by Paragraphs 5.04.A.3 through 5.04.A.6 inclusive, include as additional insureds (subject to any customary exclusion regarding professional liability) Owner and Engineer, and any other individuals or entities identified in the Supplementary Conditions, all of whom shall be listed as additional insureds, and include coverage for the respective officers, directors, partners, employees, agents, consultants and subcontractors of each and any of all such additional insureds, and the insurance afforded to these additional insureds shall provide primary coverage for all claims covered thereby;
 - 2. include at least the specific coverages and be written for not less than the limits of liability provided in the Supplementary Conditions or required by Laws or Regulations, whichever is greater;
 - 3. include completed operations insurance;

4. include contractual liability insurance covering Contractor's indemnity obligations under Paragraphs 6.11 and 6.20;
5. contain a provision or endorsement that the coverage afforded will not be canceled, materially changed or renewal refused until at least 30 days prior written notice has been given to Owner and Contractor and to each other additional insured identified in the Supplementary Conditions to whom a certificate of insurance has been issued (and the certificates of insurance furnished by the Contractor pursuant to Paragraph 5.03 will so provide);
6. remain in effect at least until final payment and at all times thereafter when Contractor may be correcting, removing, or replacing defective Work in accordance with Paragraph 13.07; and
7. with respect to completed operations insurance, and any insurance coverage written on a claims-made basis, remain in effect for at least two years after final payment.
 - a. Contractor shall furnish Owner and each other additional insured identified in the Supplementary Conditions, to whom a certificate of insurance has been issued, evidence satisfactory to Owner and any such additional insured of continuation of such insurance at final payment and one year thereafter.

5.05 *Owner's Liability Insurance*

- A. In addition to the insurance required to be provided by Contractor under Paragraph 5.04, Owner, at Owner's option, may purchase and maintain at Owner's expense Owner's own liability insurance as will protect Owner against claims which may arise from operations under the Contract Documents.

5.06 *Property Insurance*

- A. Unless otherwise provided in the Supplementary Conditions, Contractor shall purchase and maintain property insurance upon the Work at the Site in the amount of the full replacement cost thereof (Contractor shall be responsible for any deductible or self-insured retention.). This insurance shall:
 1. include the interests of Owner, Contractor, Subcontractors, and Engineer, and any other individuals or entities identified in the Supplementary Conditions, and the officers, directors, partners, employees, agents, consultants and subcontractors of any of them, each of whom is deemed to have an insurable interest and shall be listed as an insured or additional insured;
 2. be written on a Builder's Risk "all-risk" or open peril or special causes of loss policy form that shall at least include insurance for physical loss or damage to the Work, temporary buildings, falsework, and materials and equipment in transit, and shall insure against at least the following perils or causes of loss: fire, lightning, extended coverage, theft, vandalism and malicious mischief, earthquake, collapse, debris removal, demolition occasioned by enforcement of Laws and Regulations, water damage (other than caused by flood), and such other perils or causes of loss as may be specifically required by the Supplementary Conditions;
 3. include expenses incurred in the repair or replacement of any insured property (including but not limited to fees and charges of engineers and architects);
 4. cover materials and equipment stored at the Site or at another location that was agreed to in writing by Owner prior to being incorporated in the Work, provided that such materials and equipment have been included in an Application for Payment recommended by Engineer;
 5. allow for partial utilization of the Work by Owner;
 6. include testing and startup; and

7. be maintained in effect until final payment is made unless otherwise agreed to in writing by Owner, Contractor, and Engineer with 30 days written notice to each other additional insured to whom a certificate of insurance has been issued.
- B. Contractor shall purchase and maintain such boiler and machinery insurance or additional property insurance as may be required by the Supplementary Conditions or Laws and Regulations which will include the interests of Owner, Contractor, Subcontractors, and Engineer, and any other individuals or entities identified in the Supplementary Conditions, and the officers, directors, partners, employees, agents, consultants and subcontractors of each and any of them, each of whom is deemed to have an insurable interest and shall be listed as an insured or additional insured.
 - C. All the policies of insurance (and the certificates or other evidence thereof) required to be purchased and maintained in accordance with Paragraph 5.06 will contain a provision or endorsement that the coverage afforded will not be canceled or materially changed or renewal refused until at least 30 days prior written notice has been given to Owner and Contractor and to each other additional insured to whom a certificate of insurance has been issued and will contain waiver provisions in accordance with Paragraph 5.07.
 - D. Owner shall not be responsible for purchasing and maintaining any property insurance specified in this Paragraph 5.06 to protect the interests of Contractor, Subcontractors, or others in the Work to the extent of any deductible amounts that are identified in the Supplementary Conditions. The risk of loss within such identified deductible amount will be borne by Contractor, Subcontractors, or others suffering any such loss, and if any of them wishes property insurance coverage within the limits of such amounts, each may purchase and maintain it at the purchaser's own expense.

5.07 *Waiver of Rights*

- A. Owner and Contractor intend that all policies purchased in accordance with Paragraph 5.06 will protect Owner, Contractor, Subcontractors, and Engineer, and all other individuals or entities identified in the Supplementary Conditions to be listed as insureds or additional insureds (and the officers, directors, partners, employees, agents, consultants and subcontractors of each and any of them) in such policies and will provide primary coverage for all losses and damages caused by the perils or causes of loss covered thereby. All such policies shall contain provisions to the effect that in the event of payment of any loss or damage the insurers will have no rights of recovery against any of the insureds or additional insureds thereunder. Owner and Contractor waive all rights against each other and their respective officers, directors, partners, employees, agents, consultants and subcontractors of each and any of them for all losses and damages caused by, arising out of or resulting from any of the perils or causes of loss covered by such policies and any other property insurance applicable to the Work; and, in addition, waive all such rights against Subcontractors, and Engineer, and all other individuals or entities identified in the Supplementary Conditions to be listed as insured or additional insured (and the officers, directors, partners, employees, agents, consultants and subcontractors of each and any of them) under such policies for losses and damages so caused. None of the above waivers shall extend to the rights that any party making such waiver may have to the proceeds of insurance held by Contractor as trustee or otherwise payable under any policy so issued.
- B. Owner waives all rights against Contractor, Subcontractors, and Engineer, and the officers, directors, partners, employees, agents, consultants and subcontractors of each and any of them for:
 1. loss due to business interruption, loss of use, or other consequential loss extending beyond direct physical loss or damage to Owner's property or the Work caused by, arising out of, or resulting from fire or other perils whether or not insured by Owner; and
 2. loss or damage to the completed Project or part thereof caused by, arising out of, or resulting from fire or other insured peril or cause of loss covered by any property insurance maintained on the completed Project or part thereof by Owner during partial utilization pursuant to Paragraph 14.05, after Substantial Completion pursuant to Paragraph 14.04, or after final payment pursuant to Paragraph 14.07.

- C. Any insurance policy maintained by Owner covering any loss, damage or consequential loss referred to in Paragraph 5.07.B shall contain provisions to the effect that in the event of payment of any such loss, damage, or consequential loss, the insurers will have no rights of recovery against Contractor, Subcontractors, or Engineer, and the officers, directors, partners, employees, agents, consultants and subcontractors of each and any of them.

5.08 *Receipt and Application of Insurance Proceeds*

- A. Any insured loss under the policies of insurance required by Paragraph 5.06 will be adjusted with Contractor and made payable to Contractor as fiduciary for the insureds, as their interests may appear, subject to the requirements of any applicable mortgage clause and of Paragraph 5.08.B. Contractor shall deposit in a separate account any money so received and shall distribute it in accordance with such agreement as the parties in interest may reach. If no other special agreement is reached, the damaged Work shall be repaired or replaced, the moneys so received applied on account thereof.
- B. Contractor as fiduciary shall have power to adjust and settle any loss with the insurers unless one of the parties in interest shall object in writing within 15 days after the occurrence of loss to Contractor's exercise of this power. If such objection be made, Contractor as fiduciary shall make settlement with the insurers in accordance with such agreement as the parties in interest may reach. If no such agreement among the parties in interest is reached, Contractor as fiduciary shall adjust and settle the loss with the insurers and, if required in writing by any party in interest, Contractor as fiduciary shall give bond for the proper performance of such duties.

5.09 *Acceptance of Bonds and Insurance; Option to Replace*

- A. If either Owner or Contractor has any objection to the coverage afforded by or other provisions of the bonds or insurance required to be purchased and maintained by the other party in accordance with Article 5 on the basis of non-conformance with the Contract Documents, the objecting party shall so notify the other party in writing within 10 days after receipt of the certificates (or other evidence requested) required by Paragraph 2.01.B. Owner and Contractor shall each provide to the other such additional information in respect of insurance provided as the other may reasonably request. If either party does not purchase or maintain all of the bonds and insurance required of such party by the Contract Documents, such party shall notify the other party in writing of such failure to purchase prior to the start of the Work, or of such failure to maintain prior to any change in the required coverage. Without prejudice to any other right or remedy, the other party may elect to obtain equivalent bonds or insurance to protect such other party's interests at the expense of the party who was required to provide such coverage, and a Change Order shall be issued to adjust the Contract Price accordingly.

5.10 *Partial Utilization, Acknowledgment of Property Insurer*

- A. If Owner finds it necessary to occupy or use a portion or portions of the Work prior to Substantial Completion of all the Work as provided in Paragraph 14.05, no such use or occupancy shall commence before the insurers providing the property insurance pursuant to Paragraph 5.06 have acknowledged notice thereof and in writing effected any changes in coverage necessitated thereby. The insurers providing the property insurance shall consent by endorsement on the policy or policies, but the property insurance shall not be canceled or permitted to lapse on account of any such partial use or occupancy.

ARTICLE 6 – CONTRACTOR'S RESPONSIBILITIES

6.01 *Supervision and Superintendence*

- A. Contractor shall supervise, inspect, and direct the Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform the Work in accordance with the Contract Documents. Contractor shall be solely responsible for the means, methods, techniques, sequences, and procedures of construction. Contractor shall not be responsible for the negligence of Owner or Engineer in the design or specification of a specific means, method, technique, sequence, or procedure of construction which is shown or indicated in and expressly required by the Contract Documents.

- B. At all times during the progress of the Work, Contractor shall assign a competent resident superintendent who shall not be replaced without written notice to Owner and Engineer except under extraordinary circumstances. The superintendent will be Contractor's representative at the Site and shall have authority to act on behalf of Contractor. All communications given to or received from the superintendent shall be binding on Contractor.

6.02 *Labor; Working Hours*

- A. Contractor shall provide competent, suitably qualified personnel to survey and lay out the Work and perform construction as required by the Contract Documents. Contractor shall at all times maintain good discipline and order at the Site.
- B. Except as otherwise required for the safety or protection of persons or the Work or property at the Site or adjacent thereto, and except as otherwise stated in the Contract Documents, all Work at the Site shall be performed during regular working hours. Contractor will not permit the performance of Work on a Saturday, Sunday, or any legal holiday without Owner's written consent (which will not be unreasonably withheld) given after prior written notice to Engineer.

6.03 *Services, Materials, and Equipment*

- A. Unless otherwise specified in the Contract Documents, Contractor shall provide and assume full responsibility for all services, materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, temporary facilities, and all other facilities and incidentals necessary for the performance, testing, start-up, and completion of the Work.
- B. All materials and equipment incorporated into the Work shall be as specified or, if not specified, shall be of good quality and new, except as otherwise provided in the Contract Documents. All special warranties and guarantees required by the Specifications shall expressly run to the benefit of Owner. If required by Engineer, Contractor shall furnish satisfactory evidence (including reports of required tests) as to the source, kind, and quality of materials and equipment.
- C. All materials and equipment shall be stored, applied, installed, connected, erected, protected, used, cleaned, and conditioned in accordance with instructions of the applicable Supplier, except as otherwise may be provided in the Contract Documents.

6.04 *Progress Schedule*

- A. Contractor shall adhere to the Progress Schedule established in accordance with Paragraph 2.07 as it may be adjusted from time to time as provided below.
 - 1. Contractor shall submit to Engineer for acceptance (to the extent indicated in Paragraph 2.07) proposed adjustments in the Progress Schedule that will not result in changing the Contract Times. Such adjustments will comply with any provisions of the General Requirements applicable thereto.
 - 2. Proposed adjustments in the Progress Schedule that will change the Contract Times shall be submitted in accordance with the requirements of Article 12. Adjustments in Contract Times may only be made by a Change Order.

6.05 *Substitutes and "Or-Equals"*

- A. Whenever an item of material or equipment is specified or described in the Contract Documents by using the name of a proprietary item or the name of a particular Supplier, the specification or description is intended to establish the type, function, appearance, and quality required. Unless the specification or description contains or is followed by words reading that no like, equivalent, or "or-equal" item or no substitution is permitted, other items of material or

equipment or material or equipment of other Suppliers may be submitted to Engineer for review under the circumstances described below.

1. *“Or-Equal” Items:* If in Engineer’s sole discretion an item of material or equipment proposed by Contractor is functionally equal to that named and sufficiently similar so that no change in related Work will be required, it may be considered by Engineer as an “or-equal” item, in which case review and approval of the proposed item may, in Engineer’s sole discretion, be accomplished without compliance with some or all of the requirements for approval of proposed substitute items. For the purposes of this Paragraph 6.05.A.1, a proposed item of material or equipment will be considered functionally equal to an item so named if:
 - a. in the exercise of reasonable judgment Engineer determines that:
 - 1) it is at least equal in materials of construction, quality, durability, appearance, strength, and design characteristics;
 - 2) it will reliably perform at least equally well the function and achieve the results imposed by the design concept of the completed Project as a functioning whole;
 - 3) it has a proven record of performance and availability of responsive service; and
 - b. Contractor certifies that, if approved and incorporated into the Work:
 - 1) there will be no increase in cost to the Owner or increase in Contract Times, and
 - 2) it will conform substantially to the detailed requirements of the item named in the Contract Documents.
2. *Substitute Items*
 - a. If in Engineer’s sole discretion an item of material or equipment proposed by Contractor does not qualify as an “or-equal” item under Paragraph 6.05.A.1, it will be considered a proposed substitute item.
 - b. Contractor shall submit sufficient information as provided below to allow Engineer to determine that the item of material or equipment proposed is essentially equivalent to that named and an acceptable substitute therefor. Requests for review of proposed substitute items of material or equipment will not be accepted by Engineer from anyone other than Contractor.
 - c. The procedure requirements for review by Engineer will be as set forth in Paragraph 6.05.A.2.d, as supplemented in the General Requirements and as Engineer may decide is appropriate under the circumstances.
 - d. Contractor shall make written application to Engineer for review of a proposed substitute item of material or equipment that Contractor seeks to furnish or use. The application:
 - 1) shall certify that the proposed substitute item will:
 - a) will perform adequately the functions and achieve the results called for by the general design,
 - b) be similar in substance to that specified, and
 - c) be suited to the same use as that specified;
 - 2) will state:

- a) the extent, if any, to which the use of the proposed substitute item will prejudice Contractor's achievement of Substantial Completion on time;
 - b) whether or not use of the proposed substitute item in the Work will require a change in any of the Contract Documents (or in the provisions of any other direct contract with Owner for other work on the Project) to adapt the design to the proposed substitute item; and
 - c) whether or not incorporation or use of the proposed substitute item in connection with the Work is subject to payment of any license fee or royalty;
- 3) will identify:
- a) all variations of the proposed substitute item from that specified, and
 - b) available engineering, sales, maintenance, repair, and replacement services;
- 4) and shall contain an itemized estimate of all costs or credits that will result directly or indirectly from use of such substitute item, including costs of redesign and claims of other contractors affected by any resulting change.
- B. *Substitute Construction Methods or Procedures:* If a specific means, method, technique, sequence, or procedure of construction is expressly required by the Contract Documents, Contractor may furnish or utilize a substitute means, method, technique, sequence, or procedure of construction approved by Engineer. Contractor shall submit sufficient information to allow Engineer, in Engineer's sole discretion, to determine that the substitute proposed is equivalent to that expressly called for by the Contract Documents. The requirements for review by Engineer will be similar to those provided in Paragraph 6.05.A.2.
- C. *Engineer's Evaluation:* Engineer will be allowed a reasonable time within which to evaluate each proposal or submittal made pursuant to Paragraphs 6.05.A and 6.05.B. Engineer may require Contractor to furnish additional data about the proposed substitute item. Engineer will be the sole judge of acceptability. No "or equal" or substitute will be ordered, installed or utilized until Engineer's review is complete, which will be evidenced by either a Change Order for a substitute or an approved Shop Drawing for an "or equal." Engineer will advise Contractor in writing of any negative determination.
- D. *Special Guarantee:* Owner may require Contractor to furnish at Contractor's expense a special performance guarantee or other surety with respect to any substitute.
- E. *Engineer's Cost Reimbursement:* Engineer will record Engineer's costs in evaluating a substitute proposed or submitted by Contractor pursuant to Paragraphs 6.05.A.2 and 6.05.B. Whether or not Engineer approves a substitute item so proposed or submitted by Contractor, Contractor shall reimburse Owner for the charges of Engineer for evaluating each such proposed substitute. Contractor shall also reimburse Owner for the charges of Engineer for making changes in the Contract Documents (or in the provisions of any other direct contract with Owner) resulting from the acceptance of each proposed substitute.
- F. *Contractor's Expense:* Contractor shall provide all data in support of any proposed substitute or "or-equal" at Contractor's expense.

6.06 *Concerning Subcontractors, Suppliers, and Others*

- A. Contractor shall not employ any Subcontractor, Supplier, or other individual or entity (including those acceptable to Owner as indicated in Paragraph 6.06.B), whether initially or as a replacement, against whom Owner may have reasonable objection. Contractor shall not be required to employ any Subcontractor, Supplier, or other individual or entity to furnish or perform any of the Work against whom Contractor has reasonable objection.

- B. If the Supplementary Conditions require the identity of certain Subcontractors, Suppliers, or other individuals or entities to be submitted to Owner in advance for acceptance by Owner by a specified date prior to the Effective Date of the Agreement, and if Contractor has submitted a list thereof in accordance with the Supplementary Conditions, Owner's acceptance (either in writing or by failing to make written objection thereto by the date indicated for acceptance or objection in the Bidding Documents or the Contract Documents) of any such Subcontractor, Supplier, or other individual or entity so identified may be revoked on the basis of reasonable objection after due investigation. Contractor shall submit an acceptable replacement for the rejected Subcontractor, Supplier, or other individual or entity, and the Contract Price will be adjusted by the difference in the cost occasioned by such replacement, and an appropriate Change Order will be issued. No acceptance by Owner of any such Subcontractor, Supplier, or other individual or entity, whether initially or as a replacement, shall constitute a waiver of any right of Owner or Engineer to reject defective Work.
- C. Contractor shall be fully responsible to Owner and Engineer for all acts and omissions of the Subcontractors, Suppliers, and other individuals or entities performing or furnishing any of the Work just as Contractor is responsible for Contractor's own acts and omissions. Nothing in the Contract Documents:
 - 1. shall create for the benefit of any such Subcontractor, Supplier, or other individual or entity any contractual relationship between Owner or Engineer and any such Subcontractor, Supplier or other individual or entity, nor
 - 2. shall anything in the Contract Documents create any obligation on the part of Owner or Engineer to pay or to see to the payment of any moneys due any such Subcontractor, Supplier, or other individual or entity except as may otherwise be required by Laws and Regulations.
- D. Contractor shall be solely responsible for scheduling and coordinating the Work of Subcontractors, Suppliers, and other individuals or entities performing or furnishing any of the Work under a direct or indirect contract with Contractor.
- E. Contractor shall require all Subcontractors, Suppliers, and such other individuals or entities performing or furnishing any of the Work to communicate with Engineer through Contractor.
- F. The divisions and sections of the Specifications and the identifications of any Drawings shall not control Contractor in dividing the Work among Subcontractors or Suppliers or delineating the Work to be performed by any specific trade.
- G. All Work performed for Contractor by a Subcontractor or Supplier will be pursuant to an appropriate agreement between Contractor and the Subcontractor or Supplier which specifically binds the Subcontractor or Supplier to the applicable terms and conditions of the Contract Documents for the benefit of Owner and Engineer. Whenever any such agreement is with a Subcontractor or Supplier who is listed as an additional insured on the property insurance provided in Paragraph 5.06, the agreement between the Contractor and the Subcontractor or Supplier will contain provisions whereby the Subcontractor or Supplier waives all rights against Owner, Contractor, and Engineer, and all other individuals or entities identified in the Supplementary Conditions to be listed as insureds or additional insureds (and the officers, directors, partners, employees, agents, consultants and subcontractors of each and any of them) for all losses and damages caused by, arising out of, relating to, or resulting from any of the perils or causes of loss covered by such policies and any other property insurance applicable to the Work. If the insurers on any such policies require separate waiver forms to be signed by any Subcontractor or Supplier, Contractor will obtain the same.

6.07 *Patent Fees and Royalties*

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

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

6.08 *Permits*

- A. Unless otherwise provided in the Supplementary Conditions, Contractor shall obtain and pay for all construction permits and licenses. Owner shall assist Contractor, when necessary, in obtaining such permits and licenses. Contractor shall pay all governmental charges and inspection fees necessary for the prosecution of the Work which are applicable at the time of opening of Bids, or, if there are no Bids, on the Effective Date of the Agreement. Owner shall pay all charges of utility owners for connections for providing permanent service to the Work.

6.09 *Laws and Regulations*

- A. Contractor shall give all notices required by and shall comply with all Laws and Regulations applicable to the performance of the Work. Except where otherwise expressly required by applicable Laws and Regulations, neither Owner nor Engineer shall be responsible for monitoring Contractor's compliance with any Laws or Regulations.
- B. If Contractor performs any Work knowing or having reason to know that it is contrary to Laws or Regulations, Contractor shall bear all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such Work. However, it shall not be Contractor's primary responsibility to make certain that the Specifications and Drawings are in accordance with Laws and Regulations, but this shall not relieve Contractor of Contractor's obligations under Paragraph 3.03.
- C. Changes in Laws or Regulations not known at the time of opening of Bids (or, on the Effective Date of the Agreement if there were no Bids) having an effect on the cost or time of performance of the Work shall be the subject of an adjustment in Contract Price or Contract Times. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any such adjustment, a Claim may be made therefor as provided in Paragraph 10.05.

6.10 *Taxes*

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

6.11 *Use of Site and Other Areas*

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

1. Contractor shall confine construction equipment, the storage of materials and equipment, and the operations of workers to the Site and other areas permitted by Laws and Regulations, and shall not unreasonably encumber the Site and other areas with construction equipment or other materials or equipment. Contractor shall assume full responsibility for any damage to any such land or area, or to the owner or occupant thereof, or of any adjacent land or areas resulting from the performance of the Work.
2. Should any claim be made by any such owner or occupant because of the performance of the Work, Contractor shall promptly settle with such other party by negotiation or otherwise resolve the claim by arbitration or other dispute resolution proceeding or at law.

3. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any claim or action, legal or equitable, brought by any such owner or occupant against Owner, Engineer, or any other party indemnified hereunder to the extent caused by or based upon Contractor's performance of the Work.
- B. *Removal of Debris During Performance of the Work:* During the progress of the Work Contractor shall keep the Site and other areas free from accumulations of waste materials, rubbish, and other debris. Removal and disposal of such waste materials, rubbish, and other debris shall conform to applicable Laws and Regulations.
 - C. *Cleaning:* Prior to Substantial Completion of the Work, Contractor shall clean the Site and the Work and make it ready for utilization by Owner. At the completion of the Work Contractor shall remove from the Site all tools, appliances, construction equipment and machinery, and surplus materials and shall restore to original condition all property not designated for alteration by the Contract Documents.
 - D. *Loading Structures:* Contractor shall not load nor permit any part of any structure to be loaded in any manner that will endanger the structure, nor shall Contractor subject any part of the Work or adjacent property to stresses or pressures that will endanger it.

6.12 *Record Documents*

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

6.13 *Safety and Protection*

- A. Contractor shall be solely responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Work. Contractor shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury or loss to:
 1. all persons on the Site or who may be affected by the Work;
 2. all the Work and materials and equipment to be incorporated therein, whether in storage on or off the Site; and
 3. other property at the Site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, utilities, and Underground Facilities not designated for removal, relocation, or replacement in the course of construction.
- B. Contractor shall comply with all applicable Laws and Regulations relating to the safety of persons or property, or to the protection of persons or property from damage, injury, or loss; and shall erect and maintain all necessary safeguards for such safety and protection. Contractor shall notify owners of adjacent property and of Underground Facilities and other utility owners when prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation, and replacement of their property.
- C. All damage, injury, or loss to any property referred to in Paragraph 6.13.A.2 or 6.13.A.3 caused, directly or indirectly, in whole or in part, by Contractor, any Subcontractor, Supplier, or any other individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, shall be remedied by Contractor (except damage or loss attributable to the fault of Drawings or

Specifications or to the acts or omissions of Owner or Engineer or , or anyone employed by any of them, or anyone for whose acts any of them may be liable, and not attributable, directly or indirectly, in whole or in part, to the fault or negligence of Contractor or any Subcontractor, Supplier, or other individual or entity directly or indirectly employed by any of them).

- D. Contractor's duties and responsibilities for safety and for protection of the Work shall continue until such time as all the Work is completed and Engineer has issued a notice to Owner and Contractor in accordance with Paragraph 14.07.B that the Work is acceptable (except as otherwise expressly provided in connection with Substantial Completion).

6.14 *Safety Representative*

- A. Contractor shall designate a qualified and experienced safety representative at the Site whose duties and responsibilities shall be the prevention of accidents and the maintaining and supervising of safety precautions and programs.

6.15 *Hazard Communication Programs*

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

6.16 *Emergencies*

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

6.17 *Shop Drawings and Samples*

- A. Contractor shall submit Shop Drawings and Samples to Engineer for review and approval in accordance with the acceptable Schedule of Submittals (as required by Paragraph 2.07). Each submittal will be identified as Engineer may require.

1. *Shop Drawings*

- a. Submit number of copies specified in the General Requirements.
- b. Data shown on the Shop Drawings will be complete with respect to quantities, dimensions, specified performance and design criteria, materials, and similar data to show Engineer the services, materials, and equipment Contractor proposes to provide and to enable Engineer to review the information for the limited purposes required by Paragraph 6.17.D.

2. *Samples*

- a. Submit number of Samples specified in the Specifications.
- b. Clearly identify each Sample as to material, Supplier, pertinent data such as catalog numbers, the use for which intended and other data as Engineer may require to enable Engineer to review the submittal for the limited purposes required by Paragraph 6.17.D.

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

C. *Submittal Procedures*

1. Before submitting each Shop Drawing or Sample, Contractor shall have determined and verified:
 - a. all field measurements, quantities, dimensions, specified performance and design criteria, installation requirements, materials, catalog numbers, and similar information with respect thereto;
 - b. the suitability of all materials with respect to intended use, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work;
 - c. all information relative to Contractor's responsibilities for means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incident thereto; and
 - d. shall also have reviewed and coordinated each Shop Drawing or Sample with other Shop Drawings and Samples and with the requirements of the Work and the Contract Documents.
2. Each submittal shall bear a stamp or specific written certification that Contractor has satisfied Contractor's obligations under the Contract Documents with respect to Contractor's review and approval of that submittal.
3. With each submittal, Contractor shall give Engineer specific written notice of any variations, that the Shop Drawing or Sample may have from the requirements of the Contract Documents. This notice shall be both a written communication separate from the Shop Drawings or Sample submittal; and, in addition, by a specific notation made on each Shop Drawing or Sample submitted to Engineer for review and approval of each such variation.

D. *Engineer's Review*

1. Engineer will provide timely review of Shop Drawings and Samples in accordance with the Schedule of Submittals acceptable to Engineer. Engineer's review and approval will be only to determine if the items covered by the submittals will, after installation or incorporation in the Work, conform to the information given in the Contract Documents and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents.
2. Engineer's review and approval will not extend to means, methods, techniques, sequences, or procedures of construction (except where a particular means, method, technique, sequence, or procedure of construction is specifically and expressly called for by the Contract Documents) or to safety precautions or programs incident thereto. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.
3. Engineer's review and approval shall not relieve Contractor from responsibility for any variation from the requirements of the Contract Documents unless Contractor has complied with the requirements of Paragraph 6.17.C.3 and Engineer has given written approval of each such variation by specific written notation thereof incorporated in or accompanying the Shop Drawing or Sample. Engineer's review and approval shall not relieve Contractor from responsibility for complying with the requirements of Paragraph 6.17.C.1.

E. *Resubmittal Procedures*

1. Contractor shall make corrections required by Engineer and shall return the required number of corrected copies of Shop Drawings and submit, as required, new Samples for review and approval. Contractor shall

direct specific attention in writing to revisions other than the corrections called for by Engineer on previous submittals.

6.18 *Continuing the Work*

- A. Contractor shall carry on the Work and adhere to the Progress Schedule during all disputes or disagreements with Owner. No Work shall be delayed or postponed pending resolution of any disputes or disagreements, except as permitted by Paragraph 15.04 or as Owner and Contractor may otherwise agree in writing.

6.19 *Contractor's General Warranty and Guarantee*

- A. Contractor warrants and guarantees to Owner that all Work will be in accordance with the Contract Documents and will not be defective. Engineer and its Related Entities shall be entitled to rely on representation of Contractor's warranty and guarantee.
- B. Contractor's warranty and guarantee hereunder excludes defects or damage caused by:
1. abuse, modification, or improper maintenance or operation by persons other than Contractor, Subcontractors, Suppliers, or any other individual or entity for whom Contractor is responsible; or
 2. normal wear and tear under normal usage.
- C. Contractor's obligation to perform and complete the Work in accordance with the Contract Documents shall be absolute. None of the following will constitute an acceptance of Work that is not in accordance with the Contract Documents or a release of Contractor's obligation to perform the Work in accordance with the Contract Documents:
1. observations by Engineer;
 2. recommendation by Engineer or payment by Owner of any progress or final payment;
 3. the issuance of a certificate of Substantial Completion by Engineer or any payment related thereto by Owner;
 4. use or occupancy of the Work or any part thereof by Owner;
 5. any review and approval of a Shop Drawing or Sample submittal or the issuance of a notice of acceptability by Engineer;
 6. any inspection, test, or approval by others; or
 7. any correction of defective Work by Owner.

6.20 *Indemnification*

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

- B. In any and all claims against Owner or Engineer or any of their respective consultants, agents, officers, directors, partners, or employees by any employee (or the survivor or personal representative of such employee) of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, the indemnification obligation under Paragraph 6.20.A shall not be limited in any way by any limitation on the amount or type of damages, compensation, or benefits payable by or for Contractor or any such Subcontractor, Supplier, or other individual or entity under workers' compensation acts, disability benefit acts, or other employee benefit acts.
- C. The indemnification obligations of Contractor under Paragraph 6.20.A shall not extend to the liability of Engineer and Engineer's officers, directors, partners, employees, agents, consultants and subcontractors arising out of:
 - 1. the preparation or approval of, or the failure to prepare or approve, maps, Drawings, opinions, reports, surveys, Change Orders, designs, or Specifications; or
 - 2. giving directions or instructions, or failing to give them, if that is the primary cause of the injury or damage.

6.21 *Delegation of Professional Design Services*

- A. Contractor will not be required to provide professional design services unless such services are specifically required by the Contract Documents for a portion of the Work or unless such services are required to carry out Contractor's responsibilities for construction means, methods, techniques, sequences and procedures. Contractor shall not be required to provide professional services in violation of applicable law.
- B. If professional design services or certifications by a design professional related to systems, materials or equipment are specifically required of Contractor by the Contract Documents, Owner and Engineer will specify all performance and design criteria that such services must satisfy. Contractor shall cause such services or certifications to be provided by a properly licensed professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings and other submittals prepared by such professional. Shop Drawings and other submittals related to the Work designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to Engineer.
- C. Owner and Engineer shall be entitled to rely upon the adequacy, accuracy and completeness of the services, certifications or approvals performed by such design professionals, provided Owner and Engineer have specified to Contractor all performance and design criteria that such services must satisfy.
- D. Pursuant to this Paragraph 6.21, Engineer's review and approval of design calculations and design drawings will be only for the limited purpose of checking for conformance with performance and design criteria given and the design concept expressed in the Contract Documents. Engineer's review and approval of Shop Drawings and other submittals (except design calculations and design drawings) will be only for the purpose stated in Paragraph 6.17.D.1.
- E. Contractor shall not be responsible for the adequacy of the performance or design criteria required by the Contract Documents.

ARTICLE 7 – OTHER WORK AT THE SITE

7.01 *Related Work at Site*

- A. Owner may perform other work related to the Project at the Site with Owner's employees, or via other direct contracts therefor, or have other work performed by utility owners. If such other work is not noted in the Contract Documents, then:
 - 1. written notice thereof will be given to Contractor prior to starting any such other work; and

2. if Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Contract Times that should be allowed as a result of such other work, a Claim may be made therefor as provided in Paragraph 10.05.
- B. Contractor shall afford each other contractor who is a party to such a direct contract, each utility owner and Owner, if Owner is performing other work with Owner's employees, proper and safe access to the Site, a reasonable opportunity for the introduction and storage of materials and equipment and the execution of such other work, and shall properly coordinate the Work with theirs. Contractor shall do all cutting, fitting, and patching of the Work that may be required to properly connect or otherwise make its several parts come together and properly integrate with such other work. Contractor shall not endanger any work of others by cutting, excavating, or otherwise altering their work and will only cut or alter their work with the written consent of Engineer and the others whose work will be affected. The duties and responsibilities of Contractor under this Paragraph are for the benefit of such utility owners and other contractors to the extent that there are comparable provisions for the benefit of Contractor in said direct contracts between Owner and such utility owners and other contractors.
- C. y part of Contractor's Work depends this Article 7, Contractor shall inspect such other work and promptly report to Engineer in writing any delays, defects, or deficiencies in such other work that render it unavailable or unsuitable for the proper execution and results of Contractor's Work. Contractor's failure to so report will constitute an acceptance of such other work as fit and proper for integration with Contractor's Work except for latent defects and deficiencies in such other work.

7.02 *Coordination*

- A. If Owner intends to contract with others for the performance of other work on the Project at the Site, the following will be set forth in Supplementary Conditions:
1. the individual or entity who will have authority and responsibility for coordination of the activities among the various contractors will be identified;
 2. the specific matters to be covered by such authority and responsibility will be itemized; and
 3. the extent of such authority and responsibilities will be provided.
- B. Unless otherwise provided in the Supplementary Conditions, Owner shall have sole authority and responsibility for such coordination.

7.03 *Legal Relationships*

- A. Paragraphs 7.01.A and 7.02 are not applicable for utilities not under the control of Owner.
- B. Each other direct contract of Owner under Paragraph 7.01.A shall provide that the other contractor is liable to Owner and Contractor for the reasonable direct delay and disruption costs incurred by Contractor as a result of the other contractor's actions or inactions.
- C. Contractor shall be liable to Owner and any other contractor for the reasonable direct delay and disruption costs incurred by such other contractor as a result of Contractor's action or inactions.

ARTICLE 8 – OWNER'S RESPONSIBILITIES

8.01 *Communications to Contractor*

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

8.02 *Replacement of Engineer*

- A. In case of termination of the employment of Engineer, Owner shall appoint an engineer to whom Contractor makes no reasonable objection, whose status under the Contract Documents shall be that of the former Engineer.

8.03 *Furnish Data*

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

8.04 *Pay When Due*

- A. Owner shall make payments to Contractor when they are due as provided in Paragraphs 14.02.C and 14.07.C.

8.05 *Lands and Easements; Reports and Tests*

- A. Owner's duties in respect of providing lands and easements and providing engineering surveys to establish reference points are set forth in Paragraphs 4.01 and 4.05. Paragraph 4.02 refers to Owner's identifying and making available to Contractor copies of reports of explorations and tests of subsurface conditions and drawings of physical conditions in or relating to existing surface or subsurface structures at or contiguous to the Site that have been utilized by Engineer in preparing the Contract Documents.

8.06 *Insurance*

- A. Owner's responsibilities, if any, in respect to purchasing and maintaining liability and property insurance are set forth in Article 5.

8.07 *Change Orders*

- A. Owner is obligated to execute Change Orders as indicated in Paragraph 10.03.

8.08 *Inspections, Tests, and Approvals*

- A. Owner's responsibility in respect to certain inspections, tests, and approvals is set forth in Paragraph 13.03.B.

8.09 *Limitations on Owner's Responsibilities*

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

8.10 *Undisclosed Hazardous Environmental Condition*

- A. Owner's responsibility in respect to an undisclosed Hazardous Environmental Condition is set forth in Paragraph 4.06.

8.11 *Evidence of Financial Arrangements*

- A. If and to the extent Owner has agreed to furnish Contractor reasonable evidence that financial arrangements have been made to satisfy Owner's obligations under the Contract Documents, Owner's responsibility in respect thereof will be as set forth in the Supplementary Conditions.

ARTICLE 9 – ENGINEER’S STATUS DURING CONSTRUCTION

9.01 *Owner’s Representative*

- A. Engineer will be Owner’s representative during the construction period. The duties and responsibilities and the limitations of authority of Engineer as Owner’s representative during construction are set forth in the Contract Documents and will not be changed without written consent of Owner and Engineer.

9.02 *Visits to Site*

- A. Engineer will make visits to the Site at intervals appropriate to the various stages of construction as Engineer deems necessary in order to observe as an experienced and qualified design professional the progress that has been made and the quality of the various aspects of Contractor’s executed Work. Based on information obtained during such visits and observations, Engineer, for the benefit of Owner, will determine, in general, if the Work is proceeding in accordance with the Contract Documents. Engineer will not be required to make exhaustive or continuous inspections on the Site to check the quality or quantity of the Work. Engineer’s efforts will be directed toward providing for Owner a greater degree of confidence that the completed Work will conform generally to the Contract Documents. On the basis of such visits and observations, Engineer will keep Owner informed of the progress of the Work and will endeavor to guard Owner against defective Work.
- B. Engineer’s visits and observations are subject to all the limitations on Engineer’s authority and responsibility set forth in Paragraph 9.09. Particularly, but without limitation, during or as a result of Engineer’s visits or observations of Contractor’s Work Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor’s means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work.

9.03 *Project Representative*

- A. If Owner and Engineer agree, Engineer will furnish a Resident Project Representative to assist Engineer in providing more extensive observation of the Work. The authority and responsibilities of any such Resident Project Representative and assistants will be as provided in the Supplementary Conditions, and limitations on the responsibilities thereof will be as provided in Paragraph 9.09. If Owner designates another representative or agent to represent Owner at the Site who is not Engineer’s consultant, agent or employee, the responsibilities and authority and limitations thereon of such other individual or entity will be as provided in the Supplementary Conditions.

9.04 *Authorized Variations in Work*

- A. Engineer may authorize minor variations in the Work from the requirements of the Contract Documents which do not involve an adjustment in the Contract Price or the Contract Times and are compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. These may be accomplished by a Field Order and will be binding on Owner and also on Contractor, who shall perform the Work involved promptly. If Owner or Contractor believes that a Field Order justifies an adjustment in the Contract Price or Contract Times, or both, and the parties are unable to agree on entitlement to or on the amount or extent, if any, of any such adjustment, a Claim may be made therefor as provided in Paragraph 10.05.

9.05 *Rejecting Defective Work*

- A. Engineer will have authority to reject Work which Engineer believes to be defective, or that Engineer believes will not produce a completed Project that conforms to the Contract Documents or that will prejudice the integrity of the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. Engineer will also have authority to require special inspection or testing of the Work as provided in Paragraph 13.04, whether or not the Work is fabricated, installed, or completed.

9.06 *Shop Drawings, Change Orders and Payments*

- A. In connection with Engineer's authority, and limitations thereof, as to Shop Drawings and Samples, see Paragraph 6.17.
- B. In connection with Engineer's authority, and limitations thereof, as to design calculations and design drawings submitted in response to a delegation of professional design services, if any, see Paragraph 6.21.
- C. In connection with Engineer's authority as to Change Orders, see Articles 10, 11, and 12.
- D. In connection with Engineer's authority as to Applications for Payment, see Article 14.

9.07 *Determinations for Unit Price Work*

- A. Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor. Engineer will review with Contractor the Engineer's preliminary determinations on such matters before rendering a written decision thereon (by recommendation of an Application for Payment or otherwise). Engineer's written decision thereon will be final and binding (except as modified by Engineer to reflect changed factual conditions or more accurate data) upon Owner and Contractor, subject to the provisions of Paragraph 10.05.

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

- A. Engineer will be the initial interpreter of the requirements of the Contract Documents and judge of the acceptability of the Work thereunder. All matters in question and other matters between Owner and Contractor arising prior to the date final payment is due relating to the acceptability of the Work, and the interpretation of the requirements of the Contract Documents pertaining to the performance of the Work, will be referred initially to Engineer in writing within 30 days of the event giving rise to the question.
- B. Engineer will, with reasonable promptness, render a written decision on the issue referred. If Owner or Contractor believe that any such decision entitles them to an adjustment in the Contract Price or Contract Times or both, a Claim may be made under Paragraph 10.05. The date of Engineer's decision shall be the date of the event giving rise to the issues referenced for the purposes of Paragraph 10.05.B.
- C. Engineer's written decision on the issue referred will be final and binding on Owner and Contractor, subject to the provisions of Paragraph 10.05.
- D. When functioning as interpreter and judge under this Paragraph 9.08, Engineer will not show partiality to Owner or Contractor and will not be liable in connection with any interpretation or decision rendered in good faith in such capacity.

9.09 *Limitations on Engineer's Authority and Responsibilities*

- A. Neither Engineer's authority or responsibility under this Article 9 or under any other provision of the Contract Documents nor any decision made by Engineer in good faith either to exercise or not exercise such authority or responsibility or the undertaking, exercise, or performance of any authority or responsibility by Engineer shall create, impose, or give rise to any duty in contract, tort, or otherwise owed by Engineer to Contractor, any Subcontractor, any Supplier, any other individual or entity, or to any surety for or employee or agent of any of them.
- B. Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Engineer will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.

- C. Engineer will not be responsible for the acts or omissions of Contractor or of any Subcontractor, any Supplier, or of any other individual or entity performing any of the Work.
- D. Engineer's review of the final Application for Payment and accompanying documentation and all maintenance and operating instructions, schedules, guarantees, bonds, certificates of inspection, tests and approvals, and other documentation required to be delivered by Paragraph 14.07.A will only be to determine generally that their content complies with the requirements of, and in the case of certificates of inspections, tests, and approvals that the results certified indicate compliance with the Contract Documents.
- E. The limitations upon authority and responsibility set forth in this Paragraph 9.09 shall also apply to the Resident Project Representative, if any, and assistants, if any.

ARTICLE 10 – CHANGES IN THE WORK; CLAIMS

10.01 *Authorized Changes in the Work*

- A. Without invalidating the Contract and without notice to any surety, Owner may, subject to written approval by Agency at any time or from time to time, order additions, deletions, or revisions in the Work by a Change Order, or a Work Change Directive. Upon receipt of any such document, Contractor shall promptly proceed with the Work involved which will be performed under the applicable conditions of the Contract Documents (except as otherwise specifically provided).
- B. If Owner and Contractor are unable to agree on entitlement to, or on the amount or extent, if any, of an adjustment in the Contract Price or Contract Times, or both, that should be allowed as a result of a Work Change Directive, a Claim may be made therefor as provided in Paragraph 10.05.

10.02 *Unauthorized Changes in the Work*

- A. Contractor shall not be entitled to an increase in the Contract Price or an extension of the Contract Times with respect to any work performed that is not required by the Contract Documents as amended, modified, or supplemented as provided in Paragraph 3.04, except in the case of an emergency as provided in Paragraph 6.16 or in the case of uncovering Work as provided in Paragraph 13.04.B.

10.03 *Execution of Change Orders*

- A. Owner and Contractor shall execute appropriate Change Orders recommended by Engineer covering:
 - 1. changes in the Work which are: (i) ordered by Owner pursuant to Paragraph 10.01.A, (ii) required because of acceptance of defective Work under Paragraph 13.08.A or Owner's correction of defective Work under Paragraph 13.09, or (iii) agreed to by the parties;
 - 2. changes in the Contract Price or Contract Times which are agreed to by the parties, including any undisputed sum or amount of time for Work actually performed in accordance with a Work Change Directive; and
 - 3. changes in the Contract Price or Contract Times which embody the substance of any written decision rendered by Engineer pursuant to Paragraph 10.05; provided that, in lieu of executing any such Change Order, an appeal may be taken from any such decision in accordance with the provisions of the Contract Documents and applicable Laws and Regulations, but during any such appeal, Contractor shall carry on the Work and adhere to the Progress Schedule as provided in Paragraph 6.18.A.

10.04 *Notification to Surety*

- A. If notice of any change affecting the general scope of the Work or the provisions of the Contract Documents (including, but not limited to, Contract Price or Contract Times) is required by the provisions of any bond to be

given to a surety, the giving of any such notice will be Contractor's responsibility. The amount of each applicable bond will be adjusted to reflect the effect of any such change.

10.05 *Claims*

- A. *Engineer's Decision Required:* All Claims, except those waived pursuant to Paragraph 14.09, shall be referred to the Engineer for decision. A decision by Engineer shall be required as a condition precedent to any exercise by Owner or Contractor of any rights or remedies either may otherwise have under the Contract Documents or by Laws and Regulations in respect of such Claims.
- B. *Notice:* Written notice stating the general nature of each Claim shall be delivered by the claimant to Engineer and the other party to the Contract promptly (but in no event later than 30 days) after the start of the event giving rise thereto. The responsibility to substantiate a Claim shall rest with the party making the Claim. Notice of the amount or extent of the Claim, with supporting data shall be delivered to the Engineer and the other party to the Contract within 60 days after the start of such event (unless Engineer allows additional time for claimant to submit additional or more accurate data in support of such Claim). A Claim for an adjustment in Contract Price shall be prepared in accordance with the provisions of Paragraph 12.01.B. A Claim for an adjustment in Contract Time shall be prepared in accordance with the provisions of Paragraph 12.02.B. Each Claim shall be accompanied by claimant's written statement that the adjustment claimed is the entire adjustment to which the claimant believes it is entitled as a result of said event. The opposing party shall submit any response to Engineer and the claimant within 30 days after receipt of the claimant's last submittal (unless Engineer allows additional time).
- C. *Engineer's Action:* Engineer will review each Claim and, within 30 days after receipt of the last submittal of the claimant or the last submittal of the opposing party, if any, take one of the following actions in writing:
1. deny the Claim in whole or in part,
 2. approve the Claim, or
 3. notify the parties that the Engineer is unable to resolve the Claim if, in the Engineer's sole discretion, it would be inappropriate for the Engineer to do so. For purposes of further resolution of the Claim, such notice shall be deemed a denial.
- D. In the event that Engineer does not take action on a Claim within said 30 days, the Claim shall be deemed denied.
- E. Engineer's written action under Paragraph 10.05.C or denial pursuant to Paragraphs 10.05.C.3 or 10.05.D will be final and binding upon Owner and Contractor, unless Owner or Contractor invoke the dispute resolution procedure set forth in Article 16 within 30 days of such action or denial.
- F. No Claim for an adjustment in Contract Price or Contract Times will be valid if not submitted in accordance with this Paragraph 10.05.

ARTICLE 11 – COST OF THE WORK; ALLOWANCES; UNIT PRICE WORK

11.01 *Cost of the Work*

- A. *Costs Included:* The term Cost of the Work means the sum of all costs, except those excluded in Paragraph 11.01.B, necessarily incurred and paid by Contractor in the proper performance of the Work. When the value of any Work covered by a Change Order or when a Claim for an adjustment in Contract Price is determined on the basis of Cost of the Work, the costs to be reimbursed to Contractor will be only those additional or incremental costs required because of the change in the Work or because of the event giving rise to the Claim. Except as otherwise may be agreed to in writing by Owner, such costs shall be in amounts no higher than those prevailing in the locality of the Project, shall include only the following items, and shall not include any of the costs itemized in Paragraph 11.01.B.

1. Payroll costs for employees in the direct employ of Contractor in the performance of the Work under schedules of job classifications agreed upon by Owner and Contractor. Such employees shall include, without limitation, superintendents, foremen, and other personnel employed full time at the Site. Payroll costs for employees not employed full time on the Work shall be apportioned on the basis of their time spent on the Work. Payroll costs shall include, but not be limited to, salaries and wages plus the cost of fringe benefits, which shall include social security contributions, unemployment, excise, and payroll taxes, workers' compensation, health and retirement benefits, bonuses, sick leave, vacation and holiday pay applicable thereto. The expenses of performing Work outside of regular working hours, on Saturday, Sunday, or legal holidays, shall be included in the above to the extent authorized by Owner.
2. Cost of all materials and equipment furnished and incorporated in the Work, including costs of transportation and storage thereof, and Suppliers' field services required in connection therewith. All cash discounts shall accrue to Contractor unless Owner deposits funds with Contractor with which to make payments, in which case the cash discounts shall accrue to Owner. All trade discounts, rebates and refunds and returns from sale of surplus materials and equipment shall accrue to Owner, and Contractor shall make provisions so that they may be obtained.
3. Payments made by Contractor to Subcontractors for Work performed by Subcontractors. If required by Owner, Contractor shall obtain competitive bids from subcontractors acceptable to Owner and Contractor and shall deliver such bids to Owner, who will then determine, with the advice of Engineer, which bids, if any, will be acceptable. If any subcontract provides that the Subcontractor is to be paid on the basis of Cost of the Work plus a fee, the Subcontractor's Cost of the Work and fee shall be determined in the same manner as Contractor's Cost of the Work and fee as provided in this Paragraph 11.01.
4. Costs of special consultants (including but not limited to Engineers, architects, testing laboratories, surveyors, attorneys, and accountants) employed for services specifically related to the Work.
5. Supplemental costs including the following:
 - a. The proportion of necessary transportation, travel, and subsistence expenses of Contractor's employees incurred in discharge of duties connected with the Work.
 - b. Cost, including transportation and maintenance, of all materials, supplies, equipment, machinery, appliances, office, and temporary facilities at the Site, and hand tools not owned by the workers, which are consumed in the performance of the Work, and cost, less market value, of such items used but not consumed which remain the property of Contractor.
 - c. Rentals of all construction equipment and machinery, and the parts thereof whether rented from Contractor or others in accordance with rental agreements approved by Owner with the advice of Engineer, and the costs of transportation, loading, unloading, assembly, dismantling, and removal thereof. All such costs shall be in accordance with the terms of said rental agreements. The rental of any such equipment, machinery, or parts shall cease when the use thereof is no longer necessary for the Work.
 - d. Sales, consumer, use, and other similar taxes related to the Work, and for which Contractor is liable, imposed by Laws and Regulations.
 - e. Deposits lost for causes other than negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, and royalty payments and fees for permits and licenses.
 - f. Losses and damages (and related expenses) caused by damage to the Work, not compensated by insurance or otherwise, sustained by Contractor in connection with the performance of the Work (except losses and damages within the deductible amounts of property insurance established in accordance with Paragraph 5.06.D), provided such losses and damages have resulted from causes other than the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts

any of them may be liable. Such losses shall include settlements made with the written consent and approval of Owner. No such losses, damages, and expenses shall be included in the Cost of the Work for the purpose of determining Contractor's fee.

- g. The cost of utilities, fuel, and sanitary facilities at the Site.
- h. Minor expenses such as telegrams, long distance telephone calls, telephone service at the Site, expressages, and similar petty cash items in connection with the Work.
- i. The costs of premiums for all bonds and insurance Contractor is required by the Contract Documents to purchase and maintain.

B. *Costs Excluded:* The term Cost of the Work shall not include any of the following items:

- 1. Payroll costs and other compensation of Contractor's officers, executives, principals (of partnerships and sole proprietorships), general managers, safety managers, engineers, architects, estimators, attorneys, auditors, accountants, purchasing and contracting agents, expeditors, timekeepers, clerks, and other personnel employed by Contractor, whether at the Site or in Contractor's principal or branch office for general administration of the Work and not specifically included in the agreed upon schedule of job classifications referred to in Paragraph 11.01.A.1 or specifically covered by Paragraph 11.01.A.4, all of which are to be considered administrative costs covered by the Contractor's fee.
 - 2. Expenses of Contractor's principal and branch offices other than Contractor's office at the Site.
 - 3. Any part of Contractor's capital expenses, including interest on Contractor's capital employed for the Work and charges against Contractor for delinquent payments.
 - 4. Costs due to the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, including but not limited to, the correction of defective Work, disposal of materials or equipment wrongly supplied, and making good any damage to property.
 - 5. Other overhead or general expense costs of any kind and the costs of any item not specifically and expressly included in Paragraphs 11.01.A and 11.01.B.
- C. *Contractor's Fee:* When all the Work is performed on the basis of cost-plus, Contractor's fee shall be determined as set forth in the Agreement. When the value of any Work covered by a Change Order or when a Claim for an adjustment in Contract Price is determined on the basis of Cost of the Work, Contractor's fee shall be determined as set forth in Paragraph 12.01.C.
- D. *Documentation:* Whenever the Cost of the Work for any purpose is to be determined pursuant to Paragraphs 11.01.A and 11.01.B, Contractor will establish and maintain records thereof in accordance with generally accepted accounting practices and submit in a form acceptable to Engineer an itemized cost breakdown together with supporting data.

11.02 Allowances

- A. It is understood that Contractor has included in the Contract Price all allowances so named in the Contract Documents and shall cause the Work so covered to be performed for such sums and by such persons or entities as may be acceptable to Owner and Engineer.
- B. Cash Allowances
 - 1. Contractor agrees that:

- a. the cash allowances include the cost to Contractor (less any applicable trade discounts) of materials and equipment required by the allowances to be delivered at the Site, and all applicable taxes; and
- b. Contractor's costs for unloading and handling on the Site, labor, installation, overhead, profit, and other expenses contemplated for the cash allowances have been included in the Contract Price and not in the allowances, and no demand for additional payment on account of any of the foregoing will be valid.

C. *Contingency Allowance*

1. Contractor agrees that a contingency allowance, if any, is for the sole use of Owner to cover unanticipated costs.
- D. Prior to final payment, an appropriate Change Order will be issued as recommended by Engineer to reflect actual amounts due Contractor on account of Work covered by allowances, and the Contract Price shall be correspondingly adjusted.

11.03 *Unit Price Work*

- A. Where the Contract Documents provide that all or part of the Work is to be Unit Price Work, initially the Contract Price will be deemed to include for all Unit Price Work an amount equal to the sum of the unit price for each separately identified item of Unit Price Work times the estimated quantity of each item as indicated in the Agreement.
- B. The estimated quantities of items of Unit Price Work are not guaranteed and are solely for the purpose of comparison of Bids and determining an initial Contract Price. Determinations of the actual quantities and classifications of Unit Price Work performed by Contractor will be made by Engineer subject to the provisions of Paragraph 9.07.
- C. Each unit price will be deemed to include an amount considered by Contractor to be adequate to cover Contractor's overhead and profit for each separately identified item.
- D. Owner or Contractor may make a Claim for an adjustment in the Contract Price in accordance with Paragraph 10.05 if:
 1. the Bid price of a particular item of Unit Price Work amounts to more than 5 percent of the Contract Price and the variation in the quantity of that particular item of Unit Price Work performed by Contractor differs by more than 25 percent from the estimated quantity of such item indicated in the Agreement; and
 2. there is no corresponding adjustment with respect to any other item of Work; and
 3. Contractor believes that Contractor is entitled to an increase in Contract Price as a result of having incurred additional expense or Owner believes that Owner is entitled to a decrease in Contract Price and the parties are unable to agree as to the amount of any such increase or decrease.

ARTICLE 12 – CHANGE OF CONTRACT PRICE; CHANGE OF CONTRACT TIMES

12.01 *Change of Contract Price*

- A. The Contract Price may only be changed by a Change Order. Any Claim for an adjustment in the Contract Price shall be based on written notice submitted by the party making the Claim to the Engineer and the other party to the Contract in accordance with the provisions of Paragraph 10.05.
- B. The value of any Work covered by a Change Order or of any Claim for an adjustment in the Contract Price will be determined as follows:

1. where the Work involved is covered by unit prices contained in the Contract Documents, by application of such unit prices to the quantities of the items involved (subject to the provisions of Paragraph 11.03); or
2. where the Work involved is not covered by unit prices contained in the Contract Documents, by a mutually agreed lump sum (which may include an allowance for overhead and profit not necessarily in accordance with Paragraph 12.01.C.2); or
3. where the Work involved is not covered by unit prices contained in the Contract Documents and agreement to a lump sum is not reached under Paragraph 12.01.B.2, on the basis of the Cost of the Work (determined as provided in Paragraph 11.01) plus a Contractor's fee for overhead and profit (determined as provided in Paragraph 12.01.C).

C. Contractor's Fee: The Contractor's fee for overhead and profit shall be determined as follows:

1. a mutually acceptable fixed fee; or
2. if a fixed fee is not agreed upon, then a fee based on the following percentages of the various portions of the Cost of the Work:
 - a. for costs incurred under Paragraphs 11.01.A.1 and 11.01.A.2, the Contractor's fee shall be 15 percent;
 - b. for costs incurred under Paragraph 11.01.A.3, the Contractor's fee shall be five percent;
 - c. where one or more tiers of subcontracts are on the basis of Cost of the Work plus a fee and no fixed fee is agreed upon, the intent of Paragraph 12.01.C.2.a is that the Subcontractor who actually performs the Work, at whatever tier, will be paid a fee of 15 percent of the costs incurred by such Subcontractor under Paragraphs 11.01.A.1 and 11.01.A.2 and that any higher tier Subcontractor and Contractor will each be paid a fee of five percent of the amount paid to the next lower tier Subcontractor;
 - d. no fee shall be payable on the basis of costs itemized under Paragraphs 11.01.A.4, 11.01.A.5, and 11.01.B;
 - e. the amount of credit to be allowed by Contractor to Owner for any change which results in a net decrease in cost will be the amount of the actual net decrease in cost plus a deduction in Contractor's fee by an amount equal to five percent of such net decrease; and
 - f. when both additions and credits are involved in any one change, the adjustment in Contractor's fee shall be computed on the basis of the net change in accordance with Paragraphs 12.01.C.2.a through 12.01.C.2.e, inclusive.

12.02 *Change of Contract Times*

- A. The Contract Times may only be changed by a Change Order. Any Claim for an adjustment in the Contract Times shall be based on written notice submitted by the party making the Claim to the Engineer and the other party to the Contract in accordance with the provisions of Paragraph 10.05.
- B. Any adjustment of the Contract Times covered by a Change Order or any Claim for an adjustment in the Contract Times will be determined in accordance with the provisions of this Article 12.

12.03 *Delays*

- A. Where Contractor is prevented from completing any part of the Work within the Contract Times due to delay beyond the control of Contractor, the Contract Times will be extended in an amount equal to the time lost due to such delay if a Claim is made therefor as provided in Paragraph 12.02.A. Delays beyond the control of Contractor

shall include, but not be limited to, acts or neglect by Owner, acts or neglect of utility owners or other contractors performing other work as contemplated by Article 7, fires, floods, epidemics, abnormal weather conditions, or acts of God.

- B. If Owner, Engineer, or other contractors or utility owners performing other work for Owner as contemplated by Article 7, or anyone for whom Owner is responsible, delays, disrupts, or interferes with the performance or progress of the Work, then Contractor shall be entitled to an equitable adjustment in the Contract Price or the Contract Times, or both. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times.
- C. If Contractor is delayed in the performance or progress of the Work by fire, flood, epidemic, abnormal weather conditions, acts of God, acts or failures to act of utility owners not under the control of Owner, or other causes not the fault of and beyond control of Owner and Contractor, then Contractor shall be entitled to an equitable adjustment in Contract Times, if such adjustment is essential to Contractor's ability to complete the Work within the Contract Times. Such an adjustment shall be Contractor's sole and exclusive remedy for the delays described in this Paragraph 12.03.B.
 - I. delays caused by or within the control of Contractor; or
- D. Owner, Engineer and the Related Entities of each of them shall not be liable to Contractor for any claims, costs, losses, or damages (including but not limited to all fees and charges of Engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) sustained by Contractor on or in connection with any other project or anticipated project.
- E. Contractor shall not be entitled to an adjustment in Contract Price or Contract Times for delays within the control of Contractor. Delays attributable to and within the control of a Subcontractor or Supplier shall be deemed to be delays within the control of Contractor.

ARTICLE 13 – TESTS AND INSPECTIONS; CORRECTION, REMOVAL OR ACCEPTANCE OF DEFECTIVE WORK

13.01 Notice of Defects

- A. Prompt notice of all defective Work of which Owner or Engineer has actual knowledge will be given to Contractor. All defective Work may be rejected, corrected, or accepted as provided in this Article 13.

13.02 Access to Work

- A. Owner, Engineer, their consultants and other representatives and personnel of Owner, independent testing laboratories, and governmental agencies with jurisdictional interests will have access to the Site and the Work at reasonable times for their observation, inspecting, and testing. Contractor shall provide them proper and safe conditions for such access and advise them of Contractor's Site safety procedures and programs so that they may comply therewith as applicable.

13.03 Tests and Inspections

- A. Contractor shall give Engineer timely notice of readiness of the Work for all required inspections, tests, or approvals and shall cooperate with inspection and testing personnel to facilitate required inspections or tests.
- B. Owner shall employ and pay for the services of an independent testing laboratory to perform all inspections, tests, or approvals required by the Contract Documents except:
 - 1. for inspections, tests, or approvals covered by Paragraphs 13.03.C and 13.03.D below;

2. that costs incurred in connection with tests or inspections conducted pursuant to Paragraph 13.04.B shall be paid as provided in said Paragraph 13.04.C; and
 3. as otherwise specifically provided in the Contract Documents.
- C. If Laws or Regulations of any public body having jurisdiction require any Work (or part thereof) specifically to be inspected, tested, or approved by an employee or other representative of such public body, Contractor shall assume full responsibility for arranging and obtaining such inspections, tests, or approvals, pay all costs in connection therewith, and furnish Engineer the required certificates of inspection or approval.
 - D. Contractor shall be responsible for arranging and obtaining and shall pay all costs in connection with any inspections, tests, or approvals required for Owner's and Engineer's acceptance of materials or equipment to be incorporated in the Work; or acceptance of materials, mix designs, or equipment submitted for approval prior to Contractor's purchase thereof for incorporation in the Work. Such inspections, tests, or approvals shall be performed by organizations acceptable to Owner and Engineer.
 - E. If any Work (or the work of others) that is to be inspected, tested, or approved is covered by Contractor without written concurrence of Engineer, it must, if requested by Engineer, be uncovered for observation.
 - F. Uncovering Work as provided in Paragraph 13.03.E shall be at Contractor's expense unless Contractor has given Engineer timely notice of Contractor's intention to cover the same and Engineer has not acted with reasonable promptness in response to such notice.

13.04 *Uncovering Work*

- A. If any Work is covered contrary to the written request of Engineer, it must, if requested by Engineer, be uncovered for Engineer's observation and replaced at Contractor's expense.
- B. If Engineer considers it necessary or advisable that covered Work be observed by Engineer or inspected or tested by others, Contractor, at Engineer's request, shall uncover, expose, or otherwise make available for observation, inspection, or testing as Engineer may require, that portion of the Work in question, furnishing all necessary labor, material, and equipment.
- C. If it is found that the uncovered Work is defective, Contractor shall pay all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such uncovering, exposure, observation, inspection, and testing, and of satisfactory replacement or reconstruction (including but not limited to all costs of repair or replacement of work of others); and Owner shall be entitled to an appropriate decrease in the Contract Price. If the parties are unable to agree as to the amount thereof, Owner may make a Claim therefor as provided in Paragraph 10.05.
- D. If, the uncovered Work is not found to be defective, Contractor shall be allowed an increase in the Contract Price or an extension of the Contract Times, or both, directly attributable to such uncovering, exposure, observation, inspection, testing, replacement, and reconstruction. If the parties are unable to agree as to the amount or extent thereof, Contractor may make a Claim therefor as provided in Paragraph 10.05.

13.05 *Owner May Stop the Work*

- A. If the Work is defective, or Contractor fails to supply sufficient skilled workers or suitable materials or equipment, or fails to perform the Work in such a way that the completed Work will conform to the Contract Documents, Owner may order Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, this right of Owner to stop the Work shall not give rise to any duty on the part of Owner to exercise this right for the benefit of Contractor, any Subcontractor, any Supplier, any other individual or entity, or any surety for, or employee or agent of any of them.

13.06 *Correction or Removal of Defective Work*

- A. Promptly after receipt of notice, Contractor shall correct all defective Work, whether or not fabricated, installed, or completed, or, if the Work has been rejected by Engineer, remove it from the Project and replace it with Work that is not defective. Contractor shall pay all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such correction or removal (including but not limited to all costs of repair or replacement of work of others).
- B. When correcting defective Work under the terms of this Paragraph 13.06 or Paragraph 13.07, Contractor shall take no action that would void or otherwise impair Owner's special warranty and guarantee, if any, on said Work.

13.07 *Correction Period*

- A. If within one year after the date of Substantial Completion (or such longer period of time as may be prescribed by the terms of any applicable special guarantee required by the Contract Documents) or by any specific provision of the Contract Documents, any Work is found to be defective, or if the repair of any damages to the land or areas made available for Contractor's use by Owner or permitted by Laws and Regulations as contemplated in Paragraph 6.11.A is found to be defective, Contractor shall promptly, without cost to Owner and in accordance with Owner's written instructions:
 - 1. repair such defective land or areas; or
 - 2. correct such defective Work; or
 - 3. if the defective Work has been rejected by Owner, remove it from the Project and replace it with Work that is not defective, and
 - 4. satisfactorily correct or repair or remove and replace any damage to other Work, to the work of others or other land or areas resulting therefrom.
- B. If Contractor does not promptly comply with the terms of Owner's written instructions, or in an emergency where delay would cause serious risk of loss or damage, Owner may have the defective Work corrected or repaired or may have the rejected Work removed and replaced. All claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such correction or repair or such removal and replacement (including but not limited to all costs of repair or replacement of work of others) will be paid by Contractor.
- C. In special circumstances where a particular item of equipment is placed in continuous service before Substantial Completion of all the Work, the correction period for that item may start to run from an earlier date if so provided in the Specifications.
- D. Where defective Work (and damage to other Work resulting therefrom) has been corrected or removed and replaced under this Paragraph 13.07, the correction period hereunder with respect to such Work will be extended for an additional period of one year after such correction or removal and replacement has been satisfactorily completed.
- E. Contractor's obligations under this Paragraph 13.07 are in addition to any other obligation or warranty. The provisions of this Paragraph 13.07 shall not be construed as a substitute for or a waiver of the provisions of any applicable statute of limitation or repose.

13.08 *Acceptance of Defective Work*

- A. If, instead of requiring correction or removal and replacement of defective Work, Owner (and, prior to Engineer's recommendation of final payment, Engineer) prefers to accept it, Owner may do so. Contractor shall pay all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) attributable to Owner's evaluation of and determination to accept such defective Work (such costs to be approved by Engineer as to reasonableness) and the diminished value of the Work to the extent not otherwise paid by Contractor pursuant to this sentence. If any such acceptance occurs prior to Engineer's recommendation of final payment, a Change Order will be issued incorporating the necessary revisions in the Contract Documents with respect to the Work, and Owner shall be entitled to an appropriate decrease in the Contract Price, reflecting the diminished value of Work so accepted. If the parties are unable to agree as to the amount thereof, Owner may make a Claim therefor as provided in Paragraph 10.05. If the acceptance occurs after such recommendation, an appropriate amount will be paid by Contractor to Owner.

13.09 *Owner May Correct Defective Work*

- A. If Contractor fails within a reasonable time after written notice from Engineer to correct defective Work or to remove and replace rejected Work as required by Engineer in accordance with Paragraph 13.06.A, or if Contractor fails to perform the Work in accordance with the Contract Documents, or if Contractor fails to comply with any other provision of the Contract Documents, Owner may, after seven days written notice to Contractor, correct or remedy any such deficiency.
- B. In exercising the rights and remedies under this Paragraph 13.09, Owner shall proceed expeditiously. In connection with such corrective or remedial action, Owner may exclude Contractor from all or part of the Site, take possession of all or part of the Work and suspend Contractor's services related thereto, take possession of Contractor's tools, appliances, construction equipment and machinery at the Site, and incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere. Contractor shall allow Owner, Owner's representatives, agents and employees, Owner's other contractors, and Engineer and Engineer's consultants access to the Site to enable Owner to exercise the rights and remedies under this Paragraph.
- C. All claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) incurred or sustained by Owner in exercising the rights and remedies under this Paragraph 13.09 will be charged against Contractor, and a Change Order will be issued incorporating the necessary revisions in the Contract Documents with respect to the Work; and Owner shall be entitled to an appropriate decrease in the Contract Price. If the parties are unable to agree as to the amount of the adjustment, Owner may make a Claim therefor as provided in Paragraph 10.05. Such claims, costs, losses and damages will include but not be limited to all costs of repair, or replacement of work of others destroyed or damaged by correction, removal, or replacement of Contractor's defective Work.
- D. Contractor shall not be allowed an extension of the Contract Times because of any delay in the performance of the Work attributable to the exercise by Owner of Owner's rights and remedies under this Paragraph 13.09.

ARTICLE 14 – PAYMENTS TO CONTRACTOR AND COMPLETION

14.01 *Schedule of Values*

- A. The Schedule of Values established as provided in Paragraph 2.07.A will serve as the basis for progress payments and will be incorporated into a form of Application for Payment acceptable to Engineer. Progress payments on account of Unit Price Work will be based on the number of units completed.

14.02 *Progress Payments*

- A. *Applications for Payments*

1. At least 20 days before the date established in the Agreement for each progress payment (but not more often than once a month), Contractor shall submit to Engineer for review an Application for Payment filled out and signed by Contractor covering the Work completed as of the date of the Application and accompanied by such supporting documentation as is required by the Contract Documents. If payment is requested on the basis of materials and equipment not incorporated in the Work but delivered and suitably stored at the Site or at another location agreed to in writing, the Application for Payment shall also be accompanied by a bill of sale, invoice, or other documentation warranting that Owner has received the materials and equipment free and clear of all Liens and evidence that the materials and equipment are covered by appropriate property insurance or other arrangements to protect Owner's interest therein, all of which must be satisfactory to Owner.
2. Beginning with the second Application for Payment, each Application shall include an affidavit of Contractor stating that all previous progress payments received on account of the Work have been applied on account to discharge Contractor's legitimate obligations associated with prior Applications for Payment.
3. The amount of retainage with respect to progress payments will be as stipulated in the Agreement.

B. Review of Applications

1. Engineer will, within 10 days after receipt of each Application for Payment, either indicate in writing a recommendation of payment and present the Application to Owner or return the Application to Contractor indicating in writing Engineer's reasons for refusing to recommend payment. In the latter case, Contractor may make the necessary corrections and resubmit the Application.
2. Engineer's recommendation of any payment requested in an Application for Payment will constitute a representation by Engineer to Owner, based on Engineer's observations on the Site of the executed Work as an experienced and qualified design professional and on Engineer's review of the Application for Payment and the accompanying data and schedules, that to the best of Engineer's knowledge, information and belief:
 - a. the Work has progressed to the point indicated;
 - b. the quality of the Work is generally in accordance with the Contract Documents (subject to an evaluation of the Work as a functioning whole prior to or upon Substantial Completion, to the results of any subsequent tests called for in the Contract Documents, to a final determination of quantities and classifications for Unit Price Work under Paragraph 9.07, and to any other qualifications stated in the recommendation); and
 - c. the conditions precedent to Contractor's being entitled to such payment appear to have been fulfilled in so far as it is Engineer's responsibility to observe the Work.
3. By recommending any such payment Engineer will not thereby be deemed to have represented that:
 - a. inspections made to check the quality or the quantity of the Work as it has been performed have been exhaustive, extended to every aspect of the Work in progress, or involved detailed inspections of the Work beyond the responsibilities specifically assigned to Engineer in the Contract Documents; or
 - b. that there may not be other matters or issues between the parties that might entitle Contractor to be paid additionally by Owner or entitle Owner to withhold payment to Contractor.
4. Neither Engineer's review of Contractor's Work for the purposes of recommending payments nor Engineer's recommendation of any payment, including final payment, will impose responsibility on Engineer:
 - a. to supervise, direct, or control the Work, or

- b. for the means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or
 - c. for Contractor's failure to comply with Laws and Regulations applicable to Contractor's performance of the Work, or
 - d. to make any examination to ascertain how or for what purposes Contractor has used the moneys paid on account of the Contract Price, or
 - e. to determine that title to any of the Work, materials, or equipment has passed to Owner free and clear of any Liens.
5. Engineer may refuse to recommend the whole or any part of any payment if, in Engineer's opinion, it would be incorrect to make the representations to Owner stated in Paragraph 14.02.B.2. Engineer may also refuse to recommend any such payment or, because of subsequently discovered evidence or the results of subsequent inspections or tests, revise or revoke any such payment recommendation previously made, to such extent as may be necessary in Engineer's opinion to protect Owner from loss because:
- a. the Work is defective, or completed Work has been damaged, requiring correction or replacement;
 - b. the Contract Price has been reduced by Change Orders;
 - c. Owner has been required to correct defective Work or complete Work in accordance with Paragraph 13.09; or
 - d. Engineer has actual knowledge of the occurrence of any of the events enumerated in Paragraph 15.02.A.

C. Payment Becomes Due

1. Ten days after presentation of the Application for Payment to Owner with Engineer's recommendation, the amount recommended will (subject to the provisions of Paragraph 14.02.D) become due, and when due will be paid by Owner to Contractor.

D. Reduction in Payment

1. Owner may refuse to make payment of the full amount recommended by Engineer because:
- a. claims have been made against Owner on account of Contractor's performance or furnishing of the Work;
 - b. Liens have been filed in connection with the Work, except where Contractor has delivered a specific bond satisfactory to Owner to secure the satisfaction and discharge of such Liens;
 - c. the Contractor's performance or furnishing of the Work is inconsistent with funding Agency requirements;
 - d. there are other items entitling Owner to a set-off against the amount recommended; or
 - e. Owner has actual knowledge of the occurrence of any of the events enumerated in Paragraphs 14.02.B.5.a through 14.02.B.5.c or Paragraph 15.02.A.
2. If Owner refuses to make payment of the full amount recommended by Engineer, Owner will give Contractor immediate written notice (with a copy to Engineer) stating the reasons for such action and promptly pay Contractor any amount remaining after deduction of the amount so withheld. Owner shall promptly pay Contractor the amount so withheld, or any adjustment thereto agreed to by Owner and Contractor, when Contractor corrects to Owner's satisfaction the reasons for such action.

3. If it is subsequently determined that Owner's refusal of payment was not justified, the amount wrongfully withheld shall be treated as an amount due as determined by Paragraph 14.02.C.1.

14.03 *Contractor's Warranty of Title*

- A. Contractor warrants and guarantees that title to all Work, materials, and equipment covered by any Application for Payment, whether incorporated in the Project or not, will pass to Owner no later than the time of payment free and clear of all Liens.

14.04 *Substantial Completion*

- A. When Contractor considers the entire Work ready for its intended use Contractor shall notify Owner and Engineer in writing that the entire Work is substantially complete (except for items specifically listed by Contractor as incomplete) and request that Engineer issue a certificate of Substantial Completion.
- B. Promptly after Contractor's notification, Owner, Agency, Contractor, and Engineer shall make a prefinal inspection of the Work to determine the status of completion. If Engineer does not consider the Work substantially complete, Engineer will notify Contractor in writing giving the reasons therefor.
- C. If Engineer considers the Work substantially complete, Engineer will deliver to Owner a tentative certificate of Substantial Completion which shall fix the date of Substantial Completion. There shall be attached to the certificate a tentative list of items to be completed or corrected before final payment. Owner shall have seven days after receipt of the tentative certificate during which to make written objection to Engineer as to any provisions of the certificate or attached list. If, after considering such objections, Engineer concludes that the Work is not substantially complete, Engineer will within 14 days after submission of the tentative certificate to Owner notify Contractor in writing, stating the reasons therefor. If, after consideration of Owner's objections, Engineer considers the Work substantially complete, Engineer will within said 14 days execute and deliver to Owner and Contractor a definitive certificate of Substantial Completion (with a revised tentative list of items to be completed or corrected) reflecting such changes from the tentative certificate as Engineer believes justified after consideration of any objections from Owner.
- D. At the time of delivery of the tentative certificate of Substantial Completion, Engineer will deliver to Owner and Contractor a written recommendation as to division of responsibilities pending final payment between Owner and Contractor with respect to security, operation, safety, and protection of the Work, maintenance, heat, utilities, insurance, and warranties and guarantees. Unless Owner and Contractor agree otherwise in writing and so inform Engineer in writing prior to Engineer's issuing the definitive certificate of Substantial Completion, Engineer's aforesaid recommendation will be binding on Owner and Contractor until final payment.
- E. Owner shall have the right to exclude Contractor from the Site after the date of Substantial Completion subject to allowing Contractor reasonable access to complete or correct items on the tentative list.

14.05 *Partial Utilization*

- A. Prior to Substantial Completion of all the Work, Owner may use or occupy any substantially completed part of the Work which has specifically been identified in the Contract Documents, or which Owner, Engineer, and Contractor agree constitutes a separately functioning and usable part of the Work that can be used by Owner for its intended purpose without significant interference with Contractor's performance of the remainder of the Work, subject to the following conditions.
 1. Owner at any time may request Contractor in writing to permit Owner to use or occupy any such part of the Work which Owner believes to be ready for its intended use and substantially complete. If and when Contractor agrees that such part of the Work is substantially complete, Contractor will certify to Owner and Engineer that such part of the Work is substantially complete and request Engineer to issue a certificate of Substantial Completion for that part of the Work.

2. Contractor at any time may notify Owner and Engineer in writing that Contractor considers any such part of the Work ready for its intended use and substantially complete and request Engineer to issue a certificate of Substantial Completion for that part of the Work.
3. Within a reasonable time after either such request, Owner, Contractor, and Engineer shall make an inspection of that part of the Work to determine its status of completion. If Engineer does not consider that part of the Work to be substantially complete, Engineer will notify Owner and Contractor in writing giving the reasons therefor. If Engineer considers that part of the Work to be substantially complete, the provisions of Paragraph 14.04 will apply with respect to certification of Substantial Completion of that part of the Work and the division of responsibility in respect thereof and access thereto.
4. No use or occupancy or separate operation of part of the Work may occur prior to compliance with the requirements of Paragraph 5.10 regarding property insurance.

14.06 *Final Inspection*

- A. Upon written notice from Contractor that the entire Work or an agreed portion thereof is complete, Engineer will promptly make a final inspection with Owner, Agency, and Contractor and will notify Contractor in writing of all particulars in which this inspection reveals that the Work is incomplete or defective. Contractor shall immediately take such measures as are necessary to complete such Work or remedy such deficiencies.

14.07 *Final Payment*

A. *Application for Payment*

1. After Contractor has, in the opinion of Engineer, satisfactorily completed all corrections identified during the final inspection and has delivered, in accordance with the Contract Documents, all maintenance and operating instructions, schedules, guarantees, bonds, certificates or other evidence of insurance certificates of inspection, marked-up record documents (as provided in Paragraph 6.12), and other documents, Contractor may make application for final payment following the procedure for progress payments.
2. The final Application for Payment shall be accompanied (except as previously delivered) by:
 - a. all documentation called for in the Contract Documents, including but not limited to the evidence of insurance required by Paragraph 5.04.B.7;
 - b. consent of the surety, if any, to final payment;
 - c. a list of all Claims against Owner that Contractor believes are unsettled; and
 - d. complete and legally effective releases or waivers (satisfactory to Owner) of all Lien rights arising out of or Liens filed in connection with the Work.
3. In lieu of the releases or waivers of Liens specified in Paragraph 14.07.A.2 and as approved by Owner, Contractor may furnish receipts or releases in full and an affidavit of Contractor that: (i) the releases and receipts include all labor, services, material, and equipment for which a Lien could be filed; and (ii) all payrolls, material and equipment bills, and other indebtedness connected with the Work for which Owner or Owner's property might in any way be responsible have been paid or otherwise satisfied. If any Subcontractor or Supplier fails to furnish such a release or receipt in full, Contractor may furnish a bond or other collateral satisfactory to Owner to indemnify Owner against any Lien.

B. *Engineer's Review of Application and Acceptance*

1. If, on the basis of Engineer's observation of the Work during construction and final inspection, and Engineer's review of the final Application for Payment and accompanying documentation as required by the Contract Documents, Engineer is satisfied that the Work has been completed and Contractor's other obligations under the Contract Documents have been fulfilled, Engineer will, within ten days after receipt of the final Application for Payment, indicate in writing Engineer's recommendation of payment and present the Application for Payment to Owner for payment. At the same time Engineer will also give written notice to Owner and Contractor that the Work is acceptable subject to the provisions of Paragraph 14.09. Otherwise, Engineer will return the Application for Payment to Contractor, indicating in writing the reasons for refusing to recommend final payment, in which case Contractor shall make the necessary corrections and resubmit the Application for Payment.

C. Payment Becomes Due

1. Thirty days after the presentation to Owner of the Application for Payment and accompanying documentation, the amount recommended by Engineer, less any sum Owner is entitled to set off against Engineer's recommendation, including but not limited to liquidated damages, will become due and will be paid by Owner to Contractor.

14.08 *Final Completion Delayed*

- A. If, through no fault of Contractor, final completion of the Work is significantly delayed, and if Engineer so confirms, Owner shall, upon receipt of Contractor's final Application for Payment (for Work fully completed and accepted) and recommendation of Engineer, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed and accepted. If the remaining balance to be held by Owner for Work not fully completed or corrected is less than the retainage stipulated in the Agreement, and if bonds have been furnished as required in Paragraph 5.01, the written consent of the surety to the payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by Contractor to Engineer with the Application for such payment. Such payment shall be made under the terms and conditions governing final payment, except that it shall not constitute a waiver of Claims. The remaining balance of any sum included in the final Application for Payment but held by OWNER for Work not fully completed and accepted will become due when the Work is fully completed and accepted.

14.09 *Waiver of Claims*

- A. The making and acceptance of final payment will constitute:
 1. a waiver of all Claims by Owner against Contractor, except Claims arising from unsettled Liens, from defective Work appearing after final inspection pursuant to Paragraph 14.06, from failure to comply with the Contract Documents or the terms of any special guarantees specified therein, or from Contractor's continuing obligations under the Contract Documents; and
 2. a waiver of all Claims by Contractor against Owner other than those previously made in accordance with the requirements herein and expressly acknowledged by Owner in writing as still unsettled.

ARTICLE 15 – SUSPENSION OF WORK AND TERMINATION

15.01 *Owner May Suspend Work*

- A. At any time and without cause, Owner may suspend the Work or any portion thereof for a period of not more than 90 consecutive days by notice in writing to Contractor and Engineer which will fix the date on which Work will be resumed. Contractor shall resume the Work on the date so fixed. Contractor shall be granted an adjustment in the Contract Price or an extension of the Contract Times, or both, directly attributable to any such suspension if Contractor makes a Claim therefor as provided in Paragraph 10.05.

15.02 *Owner May Terminate for Cause*

- A. The occurrence of any one or more of the following events will justify termination for cause:
1. Contractor's persistent failure to perform the Work in accordance with the Contract Documents (including, but not limited to, failure to supply sufficient skilled workers or suitable materials or equipment or failure to adhere to the Progress Schedule established under Paragraph 2.07 as adjusted from time to time pursuant to Paragraph 6.04);
 2. Contractor's disregard of Laws or Regulations of any public body having jurisdiction;
 3. Contractor's disregard of the authority of Engineer; or
 4. Contractor's violation in any substantial way of any provisions of the Contract Documents.
- B. If one or more of the events identified in Paragraph 15.02.A occur, Owner may, after giving Contractor (and surety) seven days written notice of its intent to terminate the services of Contractor:
1. exclude Contractor from the Site, and take possession of the Work and of all Contractor's tools, appliances, construction equipment, and machinery at the Site, and use the same to the full extent they could be used by Contractor (without liability to Contractor for trespass or conversion),
 2. incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere, and
 3. complete the Work as Owner may deem expedient.
- C. If Owner proceeds as provided in Paragraph 15.02.B, Contractor shall not be entitled to receive any further payment until the Work is completed. If the unpaid balance of the Contract Price exceeds all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) sustained by Owner arising out of or relating to completing the Work, such excess will be paid to Contractor. If such claims, costs, losses, and damages exceed such unpaid balance, Contractor shall pay the difference to Owner. Such claims, costs, losses, and damages incurred by Owner will be reviewed by Engineer as to their reasonableness and, when so approved by Engineer, incorporated in a Change Order. When exercising any rights or remedies under this Paragraph Owner shall not be required to obtain the lowest price for the Work performed.
- D. Notwithstanding Paragraphs 15.02.B and 15.02.C, Contractor's services will not be terminated if Contractor begins within seven days of receipt of notice of intent to terminate to correct its failure to perform and proceeds diligently to cure such failure within no more than 30 days of receipt of said notice.
- E. Where Contractor's services have been so terminated by Owner, the termination will not affect any rights or remedies of Owner against Contractor then existing or which may thereafter accrue. Any retention or payment of moneys due Contractor by Owner will not release Contractor from liability.
- F. If and to the extent that Contractor has provided a performance bond under the provisions of Paragraph 5.01.A, the termination procedures of that bond shall supersede the provisions of Paragraphs 15.02.B, and 15.02.C.

15.03 *Owner May Terminate For Convenience*

- A. Upon seven days written notice to Contractor and Engineer, Owner may, without cause and without prejudice to any other right or remedy of Owner, terminate the Contract. In such case, Contractor shall be paid for (without duplication of any items):

1. completed and acceptable Work executed in accordance with the Contract Documents prior to the effective date of termination, including fair and reasonable sums for overhead and profit on such Work;
 2. expenses sustained prior to the effective date of termination in performing services and furnishing labor, materials, or equipment as required by the Contract Documents in connection with uncompleted Work, plus fair and reasonable sums for overhead and profit on such expenses;
 3. all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) incurred in settlement of terminated contracts with Subcontractors, Suppliers, and others; and
 4. reasonable expenses directly attributable to termination.
- B. Contractor shall not be paid on account of loss of anticipated profits or revenue or other economic loss arising out of or resulting from such termination.

15.04 *Contractor May Stop Work or Terminate*

- A. If, through no act or fault of Contractor, (i) the Work is suspended for more than 90 consecutive days by Owner or under an order of court or other public authority, or (ii) Engineer fails to act on any Application for Payment within 30 days after it is submitted, or (iii) Owner fails for 30 days to pay Contractor any sum finally determined to be due, then Contractor may, upon seven days written notice to Owner and Engineer, and provided Owner or Engineer do not remedy such suspension or failure within that time, terminate the Contract and recover from Owner payment on the same terms as provided in Paragraph 15.03.
- B. In lieu of terminating the Contract and without prejudice to any other right or remedy, if Engineer has failed to act on an Application for Payment within 30 days after it is submitted, or Owner has failed for 30 days to pay Contractor any sum finally determined to be due, Contractor may, seven days after written notice to Owner and Engineer, stop the Work until payment is made of all such amounts due Contractor, including interest thereon. The provisions of this Paragraph 15.04 are not intended to preclude Contractor from making a Claim under Paragraph 10.05 for an adjustment in Contract Price or Contract Times or otherwise for expenses or damage directly attributable to Contractor's stopping the Work as permitted by this Paragraph.

ARTICLE 16 – DISPUTE RESOLUTION

16.01 *Methods and Procedures*

- A. Owner and Contractor may mutually request mediation of any Claim submitted to Engineer for a decision under Paragraph 10.05 before such decision becomes final and binding. The mediation will be governed by the Construction Industry Mediation Rules of the American Arbitration Association in effect as of the Effective Date of the Agreement. The request for mediation shall be submitted in writing to the American Arbitration Association. Timely submission of the request shall stay the effect of Paragraph 10.05.E.
- B. Owner and Contractor shall participate in the mediation process in good faith. The process shall be concluded within 60 days of filing of the request. The date of termination of the mediation shall be determined by application of the mediation rules referenced above.
- C. If the claim is not resolved by mediation, Engineer's action under Paragraph 10.05.C or a denial pursuant to Paragraphs 10.05.C.3 or 10.05.D shall become final and binding 30 days after termination of the mediation unless, within that time period, Owner or Contractor:
1. elects in writing to invoke any dispute resolution process provided for in the Supplementary Conditions, or
 2. agrees with the other party to submit the Claim to another dispute resolution process, or

3. gives written notice to the other party of their intent to submit the Claim to a court of competent jurisdiction.

ARTICLE 17 – MISCELLANEOUS

17.01 *Giving Notice*

- A. Whenever any provision of the Contract Documents requires the giving of written notice, it will be deemed to have been validly given if:
 1. delivered in person to the individual or to a member of the firm or to an officer of the corporation for whom it is intended, or
 2. delivered at or sent by registered or certified mail, postage prepaid, to the last business address known to the giver of the notice.

17.02 *Computation of Times*

- A. When any period of time is referred to in the Contract Documents by days, it will be computed to exclude the first and include the last day of such period. If the last day of any such period falls on a Saturday or Sunday or on a day made a legal holiday by the law of the applicable jurisdiction, such day will be omitted from the computation.

17.03 *Cumulative Remedies*

- A. The duties and obligations imposed by these General Conditions and the rights and remedies available hereunder to the parties hereto are in addition to, and are not to be construed in any way as a limitation of, any rights and remedies available to any or all of them which are otherwise imposed or available by Laws or Regulations, by special warranty or guarantee, or by other provisions of the Contract Documents. The provisions of this Paragraph will be as effective as if repeated specifically in the Contract Documents in connection with each particular duty, obligation, right, and remedy to which they apply.

17.04 *Survival of Obligations*

- A. All representations, indemnifications, warranties, and guarantees made in, required by, or given in accordance with the Contract Documents, as well as all continuing obligations indicated in the Contract Documents, will survive final payment, completion, and acceptance of the Work or termination or completion of the Contract or termination of the services of Contractor.

17.05 *Controlling Law*

- A. This Contract is to be governed by the law of the state in which the Project is located.

17.06 *Headings*

- A. Article and paragraph headings are inserted for convenience only and do not constitute parts of these General Conditions.

ARTICLE 18 – FEDERAL REQUIREMENTS

18.01 *Agency Not a Party*

- A. This Contract is expected to be funded in part with funds provided by Agency. Neither Agency, nor any of its departments, entities, or employees is a party to this Contract.

18.02 *Contract Approval*

- A. Owner and Contractor will furnish Owner's attorney such evidence as required so that Owner's attorney can complete and execute the following "Certificate of Owner's Attorney" (Exhibit GC-A) before Owner submits the executed Contract Documents to Agency for approval.
- B. Concurrence by Agency in the award of the Contract is required before the Contract is effective.

18.03 *Conflict of Interest*

- A. Contractor may not knowingly contract with a supplier or manufacturer if the individual or entity who prepared the plans and specifications has a corporate or financial affiliation with the supplier or manufacturer.
- B. Owner's officers, employees, or agents shall not engage in the award or administration of this Contract if a conflict of interest, real or apparent, would be involved. Such a conflict would arise when: (i) the employee, officer or agent; (ii) any member of their immediate family; (iii) their partner or (iv) an organization that employs, or is about to employ, any of the above, has a financial interest in Contractor. Owner's officers, employees, or agents shall neither solicit nor accept gratuities, favors or anything of monetary value from Contractor or subcontractors.

18.04 *Gratuities*

- A. If Owner finds after a notice and hearing that Contractor, or any of Contractor's agents or representatives, offered or gave gratuities (in the form of entertainment, gifts, or otherwise) to any official, employee, or agent of Owner or Agency in an attempt to secure this Contract or favorable treatment in awarding, amending, or making any determinations related to the performance of this Contract, Owner may, by written notice to Contractor, terminate this Contract. Owner may also pursue other rights and remedies that the law or this Contract provides. However, the existence of the facts on which Owner bases such findings shall be an issue and may be reviewed in proceedings under the dispute resolution provisions of this Contract.
- B. In the event this Contract is terminated as provided in paragraph 18.04.A, Owner may pursue the same remedies against Contractor as it could pursue in the event of a breach of this Contract by Contractor. As a penalty, in addition to any other damages to which it may be entitled by law, Owner may pursue exemplary damages in an amount (as determined by Owner) which shall not be less than three nor more than ten times the costs Contractor incurs in providing any such gratuities to any such officer or employee.

18.05 *Audit and Access to Records*

- A. For all negotiated contracts and negotiated modifications (except those of \$10,000 or less), Owner, Agency, the Comptroller General, or any of their duly authorized representatives, shall have access to any books, documents, papers, and records of the Contractor, which are pertinent to the Contract, for the purpose of making audits, examinations, excerpts and transcriptions. Contractor shall maintain all required records for three years after final payment is made and all other pending matters are closed.

18.06 *Small, Minority and Women's Businesses*

- A. If Contractor intends to let any subcontracts for a portion of the work, Contractor shall take affirmative steps to assure that small, minority and women's businesses are used when possible as sources of supplies, equipment, construction, and services. Affirmative steps shall consist of: (1) including qualified small, minority and women's businesses on solicitation lists; (2) assuring that small, minority and women's businesses are solicited whenever they are potential sources; (3) dividing total requirements when economically feasible, into small tasks or quantities to permit maximum participation of small, minority, and women's businesses; (4) establishing delivery schedules, where the requirements of the work permit, which will encourage participation by small, minority and women's businesses; (5) using the services and assistance of the Small Business Administration and the Minority Business Development Agency of the U.S. Department of Commerce; (6) requiring each party to a subcontract to take the

affirmative steps of this section; and (7) Contractor is encouraged to procure goods and services from labor surplus area firms.

18.07 *Anti-Kickback*

- A. Contractor shall comply with the Copeland Anti-Kickback Act (18 USC 874 and 40 USC 276c) as supplemented by Department of Labor regulations (29 CFR Part 3, "Contractors and Subcontractors on Public Buildings or Public Works Financed in Whole or in Part by Loans or Grants of the United States"). The Act provides that Contractor or subcontractor shall be prohibited from inducing, by any means, any person employed in the construction, completion, or repair of public facilities, to give up any part of the compensation to which they are otherwise entitled. Owner shall report all suspected or reported violations to Agency.

18.08 *Clean Air and Pollution Control Acts*

- A. If this Contract exceeds \$100,000, Contractor shall comply with all applicable standards, orders or regulations issued pursuant to the Clean Air Act (42 USC 7401 *et seq.*) and the Federal Water Pollution Control Act as amended (33 USC 1251 *et seq.*). Contractor will report violations to the Agency and the Regional Office of the EPA.

18.09 *State Energy Policy*

- A. Contractor shall comply with the Energy Policy and Conservation Act (P.L. 94-163). Mandatory standards and policies relating to energy efficiency, contained in any applicable State Energy Conservation Plan, shall be utilized.

18.10 *Equal Opportunity Requirements*

- A. If this Contract exceeds \$10,000, Contractor shall comply with Executive Order 11246, "Equal Employment Opportunity," as amended by Executive Order 11375, "Amending Executive Order 11246 Relating to Equal Employment Opportunity," and as supplemented by regulations at 41 CFR part 60, "Office of Federal Contract Compliance Programs, Equal Employment Opportunity, Department of Labor."
- B. Contractor's compliance with Executive Order 11246 shall be based on its implementation of the Equal Opportunity Clause; specific affirmative active obligations required by the Standard Federal Equal Employment Opportunity Construction Contract Specifications, as set forth in 41 CFR Part 60-4 and its efforts to meet the goals established for the geographical area where the Contract is to be performed. The hours of minority and female employment and training must be substantially uniform throughout the length of the Contract, and in each trade, and Contractor shall make a good faith effort to employ minorities and women evenly on each of its projects. The transfer of minority or female employees or trainees from Contractor to Contractor or from project to project for the sole purpose of meeting Contractor's goals shall be a violation of the Contract, the Executive Order, and the regulations in 41 CFR Part 60-4. Compliance with the goals will be measured against the total work hours performed.
- C. Contractor shall provide written notification to the Director of the Office of Federal Contract Compliance Programs within 10 working days of award of any construction subcontract in excess of \$10,000 at any tier for construction work under the Contract resulting from this solicitation. The notification shall list the name, address, and telephone number of the subcontractor; employer identification number; estimated dollar amount of subcontract; estimated starting and completion dates of the subcontract; and the geographical area in which the Contract is to be performed.

18.11 *Restrictions on Lobbying*

- A. Contractor and each subcontractor shall comply with Restrictions on Lobbying (Public Law 101-121, Section 319) as supplemented by applicable Agency regulations. This Law applies to the recipients of contracts and subcontracts that exceed \$100,000 at any tier under a Federal loan that exceeds \$150,000 or a Federal grant that exceeds

\$100,000. If applicable, Contractor must complete a certification form on lobbying activities related to a specific Federal loan or grant that is a funding source for this Contract. Each tier certifies to the tier above that it will not and has not used Federal appropriated funds to pay any person or organization for influencing or attempting to influence an officer or employee of any agency, a member of Congress, or an employee of a member of Congress in connection with obtaining any Federal contract, grant, or any other award covered by 31 USC 1352. Each tier shall disclose any lobbying with non-Federal funds that takes place in connection with obtaining any Federal award. Certifications and disclosures are forwarded from tier to tier up to the Owner. Necessary certification and disclosure forms shall be provided by Owner.

18.12 *Environmental Requirements*

- A. When constructing a project involving trenching and/or other related earth excavations, Contractor shall comply with the following environmental constraints:
1. Wetlands – When disposing of excess, spoil, or other construction materials on public or private property, Contractor shall not fill in or otherwise convert wetlands.
 2. Floodplains – When disposing of excess, spoil, or other construction materials on public or private property, Contractor shall not fill in or otherwise convert 100 year floodplain areas delineated on the latest Federal Emergency Management Agency Floodplain Maps, or other appropriate maps, i.e., alluvial soils on NRCS Soil Survey Maps.
 3. Historic Preservation – Any excavation by Contractor that uncovers an historical or archaeological artifact shall be immediately reported to Owner and a representative of Agency. Construction shall be temporarily halted pending the notification process and further directions issued by Agency after consultation with the State Historic Preservation Officer (SHPO).
 4. Endangered Species – Contractor shall comply with the Endangered Species Act, which provides for the protection of endangered and/or threatened species and critical habitat. Should any evidence of the presence of endangered and/or threatened species or their critical habitat be brought to the attention of Contractor, Contractor will immediately report this evidence to Owner and a representative of Agency. Construction shall be temporarily halted pending the notification process and further directions issued by Agency after consultation with the U.S. Fish and Wildlife Service.

EXHIBIT GC-A

Certificate of Owner's Attorney

I, the undersigned, _____, the duly authorized and acting legal representative of _____, do hereby certify as follows:

I have examined the attached Contract(s) and performance and payment bond(s) and the manner of execution thereof, and I am of the opinion that each of the aforesaid agreements is adequate and has been duly executed by the proper parties thereto acting through their duly authorized representatives; that said representatives have full power and authority to execute said agreements on behalf of the respective parties named thereon; and that the foregoing agreements constitute valid and legally binding obligations upon the parties executing the same in accordance with the terms, conditions, and provisions thereof.

Date: _____

SUPPLEMENTAL GENERAL CONDITIONS



Section 00800

Supplementary Conditions

These Supplementary Conditions amend or supplement the Standard General Conditions of the Construction Contract Funding Agency Edition (No. C-710, 2002 Edition) and other provisions of the Contract Documents as indicated below. All provisions that are not so amended or supplemented remain in full force and effect.

The terms used in these Supplementary Conditions will have the meanings indicated in the General Conditions. Additional terms used in these Supplementary Conditions have the meanings stated below, which are applicable to both the singular and plural thereof.

TABLE OF CONTENTS

		Page
SC-1.01.A.2	Project Financing	1
SC-1.01.A.4	Application for Payment	1
SC-1.01.A.10	Change Order	1
SC-1.01.A.15	Contract Times	1
SC-2.03.A	Commencement of Contract Times; Notice to Proceed	2
SC-4.02	Subsurface and Physical Conditions	2
SC-4.06	Hazardous Environmental Condition at Site	2
SC-5.03	Certificates of Insurance	2
SC-5.04	Contractor's Liability Insurance	2
SC-6.06	Concerning Subcontractors, Suppliers, and Others	3
SC-9.03	Project Representative	3
SC-14.02.A.3	Applications for Payment	3
SC-14.02.C.1	Payment Becomes Due	3
SC-18.08	Clean Air and Pollution Control Acts	3

SC-1.01.A.2. Add the following language to the end of Paragraph 1.01.A.2:

The Project is financed in whole or in part by the USDA Rural Development.

SC-1.01.A.4. Add the following language to the end of Paragraph 1.01.A.4:

The Application for Payment form to be used on this Project is Form RD 1924-18. The Agency must approve all Applications for Payment before payment is made.

SC-1.01.A.10. Add the following language to the end of Paragraph 1.01.A.10:

The Change Order form to be used on this Project is Form RD 1927-7. Agency approval is required before Change Orders are effective.

SC-1.01.A.15. Delete in it's entirety and replace with the following:

Contract Times: The number of days or date stated in the Agreement to achieve substantial completion. Final completion date will be determined by Contractor, Owner and Engineer, after substantial completion, based on remaining work, weather and market conditions.

SC-2.03.A. Delete Paragraph 2.03.A in its entirety and insert the following in its place:

- A. The Contract Times will commence to run on the day indicated in the Notice to Proceed. A Notice to Proceed may be given at any time within 10 days after the Effective Date of the Agreement.

SC-4.02. Delete Paragraphs 4.02.A and 4.02.B in their entirety and insert the following:

- A. No reports or explorations or tests of subsurface conditions at or contiguous to the Site are known to the Owner or Engineer.

SC-4.06. Delete Paragraphs 4.06.A and 4.06.B in their entirety and insert the following:

- A. No reports or explorations or tests of subsurface conditions at or contiguous to the Site are known to the Owner or Engineer.
- B. Not used.

SC-5.03. Add the following new paragraph immediately after Paragraph 5.03.B:

- C. Failure of the Owner to demand such certificates or other evidence of full compliance with these insurance requirements or failure of the Owner to identify a deficiency from evidence provided shall not be construed as a waiver of Contractor's obligation to maintain such insurance.

SC-5.04. Add the following new paragraph immediately after Paragraph 5.04.B:

- C. The limits of liability for insurance required by Paragraph 5.04 of the General Conditions shall provide coverage for not less than the following amounts or greater where required by Laws and Regulations:

- 1. Workers' Compensation, and related coverages under Paragraphs 5.04.A.1 and A.2 of the General Conditions:

- a. State: Statutory
- b. Applicable Federal (e.g., Longshoremen's) Statutory
- c. Employer's Liability \$ 500,000

- 2. Contractor's General Liability under Paragraphs 5.04.A.3 through A.6 of the General Conditions which shall include completed operations and product liability coverages and eliminate the exclusion with respect to property under the care, custody, and control of the Contractor:

- a. General Aggregate \$ 2,000,000
- b. Products - Completed Operations Aggregate \$ 1,000,000
- c. Personal and Advertising Injury \$ 1,000,000
- d. Each Occurrence (Bodily Injury and Property Damage) \$ 1,000,000
- e. Property Damage liability insurance will provide Explosion, Collapse, and Underground coverages where applicable.
- f. Excess or Umbrella Liability
 - 1) General Aggregate \$ 5,000,000
 - 2) Each Occurrence \$ 5,000,000

- 3. Automobile Liability under Paragraph 5.04.A.6 of the General Conditions:

- a. Bodily Injury:
 - Each Person \$ 1,000,000
 - Each Accident \$ 1,000,000
 - b. Property Damage:
 - Each Accident \$ 1,000,000
 - c. Combined Single Limit of \$ 1,000,000
4. The Contractual Liability coverage required by paragraph 5.04.B.4 of the General Conditions shall provide coverage for not less than the following amounts:
- a. Bodily Injury:
 - Each Person \$ 2,000,000
 - Each Accident \$ 2,000,000
 - b. Property Damage:
 - Each Accident \$ 2,000,000
 - Annual Aggregate \$ 2,000,000

SC-6.06 Add a new paragraph immediately after Paragraph 6.06.G:

- H. The Contractor shall not award work valued at more than fifty (50%) percent of the Contract Price to Subcontractor(s), without prior written approval of the Owner.

SC-9.03.A. Add the following language at the end of paragraph 9.03.A:

The Engineer will provide Resident Project Representative services for this project. The Duties, Responsibilities, and Limitations of Authority of the Resident Project Representative will be as stated in Exhibit D of the Agreement Between Owner and Engineer, E-510, 2002 Edition, as amended and executed for this specific Project.

SC-14.02.A.3 Add the following language at the end of paragraph 14.02.A.3:

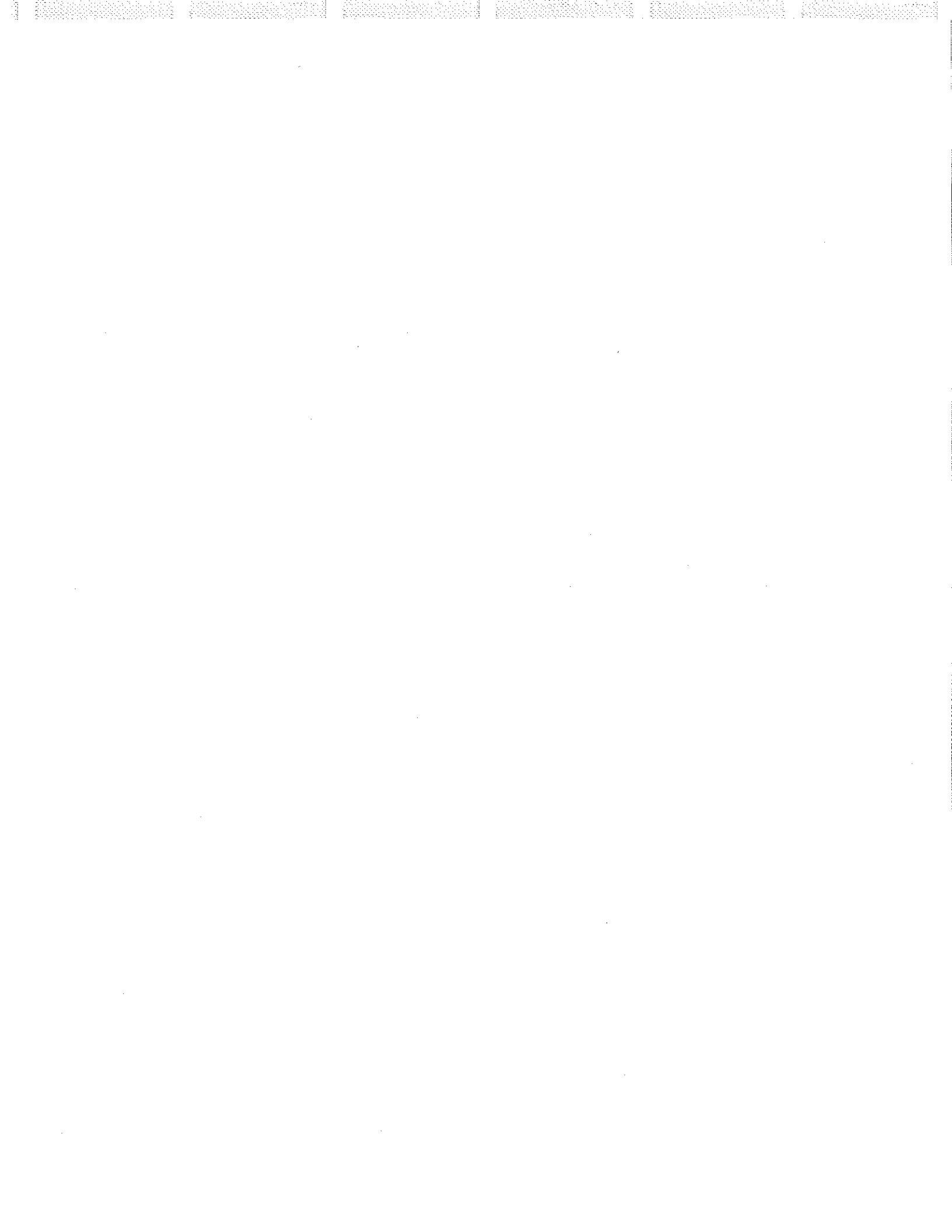
No payments will be made that would deplete the retainage prior to substantial completion, nor place in escrow any funds that are required for retainage, or invest the retainage for benefit.

SC-14.02.C.1. Delete Paragraph 14.02.C.1 in its entirety and insert the following in its place:

- 1. The Application for Payment with Engineer's recommendations will be presented to the Owner and Agency for consideration. If both the Owner and Agency find the Application for Payment acceptable, the recommended amount less any reduction under the provisions of Paragraph 14.02.D will become due ten days after the Application for Payment is presented to the Owner, and the Owner will make payment to the Contractor.

SC-18.08 Delete paragraph 18.08.A in its entirety and insert the following in its place:

- A. If this Contract exceeds \$100,000, the Contractor shall comply with all applicable standards, orders, or requirements issued under Section 306 of the Clean Air Act (42 USC §1857(h)), Section 508 of the Clean Water Act (33 USC §1368), Executive Order 11738, and Environmental Protection Agency regulations (40 CFR Part 15).



KENVIRONS, INC.
FRANKFORT, KENTUCKY

Project No.
2012141

Change Order No.

CONTRACT CHANGE ORDER

Contract For
Apple Orchard Road Transmission Main

County
Laurel

Owner
East Laurel Water District

To _____
(Contractor)

You are hereby requested to comply with the following changes from the contract plans and specifications:

Description of Changes (Supplemental Plans and Specifications Attached)	DECREASE Contract Price	INCREASE Contract Price
TOTALS	\$ _____	\$ _____
NET CHANGE IN CONTRACT PRICE	\$ _____	\$ _____

JUSTIFICATION:

The amount of the Contract will be (Decreased) (Increased) by the sum of: _____
Dollars (\$) _____.

The Contract Total including this and previous Change Orders will be: _____
Dollars (\$) _____.

The Contract Period provided for completion will be (Increased) (Decreased) (Unchanged): _____

This document will become a supplement to the contract and all provisions will apply hereto.

Requested _____ (Owner) _____ (Date)

Recommended _____ (Owner's Architect/Engineer) _____ (Date)

Accepted _____ (Contractor) _____ (Date)

Approved _____ (Name and Title) _____ (Date)



Form RD 1924-18
(Rev. 6-97)

UNITED STATES DEPARTMENT OF AGRICULTURE
RURAL DEVELOPMENT
FARM SERVICE AGENCY

PARTIAL PAYMENT ESTIMATE

CONTRACT NO. _____
PARTIAL PAYMENT ESTIMATE NO. _____
PAGE _____

OWNER: _____ CONTRACTOR: _____ PERIOD OF ESTIMATE
FROM _____ TO _____

CONTRACT CHANGE ORDER SUMMARY

ESTIMATE

No.	Agency Approval Date	Amount			
		Additions	Deductions		
				1. Original Contract	_____
				2. Change Orders	_____ \$0.00
				3. Revised Contract (1 + 2)	_____ \$0.00
				4. Work Completed*	_____
				5. Stored Materials*	_____
				6. Subtotal (4 + 5)	_____ \$0.00
				7. Retainage*	_____
				8. Previous Payments	_____
				9. Amount Due (6-7-8)	_____ \$0.00
TOTALS		\$0.00	\$0.00	* Detailed breakdown attached	
NET CHANGE		\$0.00	\$0.00		

CONTRACT TIME

Original (days) _____
Revised _____
Remaining _____

On Schedule Yes No

Starting Date _____
Projected Completion _____

CONTRACTOR'S CERTIFICATION:

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

Contractor _____
By _____
Date _____

APPROVED BY OWNER:

Owner _____
By _____
Date _____

ARCHITECT OR ENGINEER'S CERTIFICATION:

The undersigned certifies that the work has been carefully inspected and to the best of their knowledge and belief, the quantities shown in this estimate are correct and the work has been performed in accordance with the contract documents.

Architect or Engineer _____
By _____
Date _____

ACCEPTED BY AGENCY:

The review and acceptance of this estimate does not attest to the correctness of the quantities shown or that the work has been performed in accordance with the contract documents.

By _____
Title _____
Date _____

According to the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number. The valid OMB control number for this information collection is 0575-0042. The time required to complete this information collection is estimated to average 30 minutes per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed and completing and reviewing the collection of information.

TYPICAL UNIT PRICE BREAKDOWN *

ITEM	DESCRIPTION	CONTRACT (revised)			THIS PERIOD		TOTAL TO DATE		% COMPLETE
		QUANTITY	UNIT PRICE	AMOUNT	QUANTITY	AMOUNT	QUANTITY	AMOUNT	
				\$0.00		\$0.00		\$0.00	0
				\$0.00		\$0.00		\$0.00	0
				\$0.00		\$0.00		\$0.00	0
				\$0.00		\$0.00		\$0.00	0
				\$0.00		\$0.00		\$0.00	0
				\$0.00		\$0.00		\$0.00	0
				\$0.00		\$0.00		\$0.00	0
				\$0.00		\$0.00		\$0.00	0
				\$0.00		\$0.00		\$0.00	0
				\$0.00		\$0.00		\$0.00	0
				\$0.00		\$0.00		\$0.00	0
TOTALS				\$0.00		\$0.00		\$0.00	0

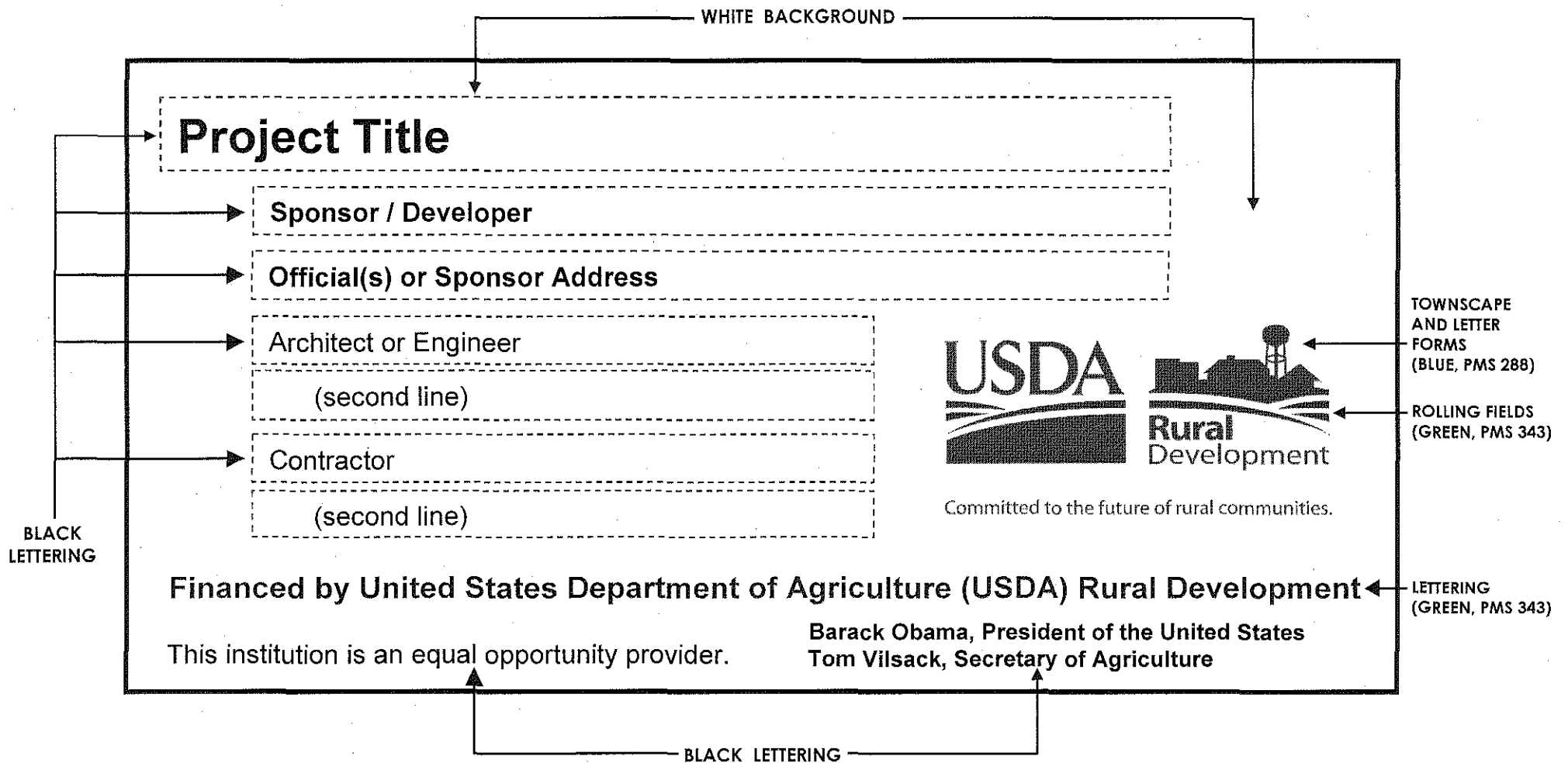
TYPICAL LUMP SUM PRICE BREAKDOWN *

TYPICAL STORED MATERIALS AND RETAINAGE BREAKDOWN *

ITEM	DESCRIPTION	SCHEDULED VALUE	WORK COMPLETED		% COMPLETE	MATERIALS STORED AT END OF THIS PAYMENT PERIOD			
			THIS PERIOD	TO DATE		DESCRIPTION	QUANTITY	UNIT VALUE	AMOUNT
					0				\$0.00
					0				\$0.00
					0				\$0.00
					0				\$0.00
					0	RETAINAGE			
					0		THIS ESTIMATE	PERCENT	RETAINED
					0			%	
					0	WORK COMPLETED:			
					0	STORED MATERIALS:			
					0	OTHER (explain)			
TOTALS		\$0.00	\$0.00	\$0.00	0	TOTAL			\$0.00

* As a minimum, detailed breakdowns should contain this information.

TEMPORARY CONSTRUCTION SIGN FOR RURAL DEVELOPMENT PROJECTS



SIGN DIMENSIONS: 1200 mm x 2400 mm x 19 mm (approx. 4' x 8' x 3/4")
PLYWOOD PANEL (APA RATED A-B GRADE-EXTERIOR)



WAGE DETERMINATION





Steven L. Beshear
Governor

KENTUCKY LABOR CABINET
DEPARTMENT OF WORKPLACE STANDARDS
DIVISION OF EMPLOYMENT STANDARDS,
APPRENTICESHIP & MEDIATION
1047 US Hwy 127 S - Suite 4
Frankfort, Kentucky 40601
Phone: (502) 564-3534
Fax (502) 696-1897
www.labor.ky.gov

Larry Roberts
Secretary

Anthony Russell
Commissioner

February 25, 2015

Eddie Brown
Kenvirons Inc.
452 Versailles Rd.
Frankfort KY 40601

Re: East Laurel Water District, Apple Orchard Road Transmission Main

Advertising Date as Shown on Notification: February 27, 2015

Dear Eddie Brown:

This office is in receipt of your written notification on the above project as required by KRS 337.510 (1).

I am enclosing a copy of the current prevailing wage determination number CR 1-021, dated October 8, 2014 for LAUREL County. This schedule of wages shall be attached to and made a part of the specifications for the work, printed on the bidding blanks, and made a part of the contract for the construction of the public works between the public authority and the successful bidder or bidders.

The determination number assigned to this project is based upon the advertising date contained in your notification. There may be modifications to this wage determination prior to the advertising date indicated. In addition, if the contract is not awarded within 90 days of this advertising date or if the advertising date is modified, a different set of prevailing rates of wages may be applicable. It will be the responsibility of the public authority to contact this office and verify the correct schedule of the prevailing rates of wages for use on the project. Your project number is as follows: 063-H-01177-14-1, Heavy/Highway

Sincerely,

Anthony Russell
Commissioner





**KENTUCKY LABOR CABINET
PREVAILING WAGE DETERMINATION
CURRENT REVISION
LOCALITY NO. 021**

BATH, ESTILL, JACKSON, LAUREL, MENIFEE & POWELL COUNTIES

Determination No. CR 1-021

Date of Determination: October 8, 2014

Project No. 063-H-01177-14-1

_____ Bldg ___x___ HH

This schedule of the prevailing rate of wages for Locality No. 021, which includes Bath, Estill, Jackson, Laurel, Meniffee and Powell Counties, has been determined in accordance with the provisions of KRS 337.505 to 337.550. This determination shall be referred to as Prevailing Wage Determination No. CR 1-021.

Apprentices shall be permitted to work as such subject to Administrative Regulations 803 KAR 1:010. Copies of these regulations will be furnished upon request to any interested person.

Overtime is to be computed at not less than one and one-half (1 1/2) times the indicated BASE RATE for all hours worked in excess of eight (8) per day, or in excess of forty (40) per week. However, KRS 337.540 permits an employee and employer to agree, in writing, that the employee will be compensated at a straight time base rate for hours worked in excess of eight (8) hours in any one workday, but not more than ten (10) hours worked in any one workday, if such written agreement is prior to the over eight (8) hours in a workday actually being worked, or where provided for in a collective bargaining agreement. The fringe benefit rate is to be paid for each hour worked at a straight time rate for all hours worked. Fringe benefit amounts are applicable for all hours worked except when otherwise noted. Welders will receive rate for craft in which welding is incidental.

No laborer, workman or mechanic shall be paid at a rate less than that of the General Laborer except those classified as bona fide apprentices registered with the Kentucky State Apprenticeship Supervisor unless otherwise specified in this schedule of wage rates.

NOTE: The type of construction shall be determined by applying the following definitions.

BUILDING CONSTRUCTION


Building construction is the construction of sheltered enclosures with walk-in access for the purpose of housing persons, machinery, equipment, or supplies. It includes all construction of such structures, the installation of utilities and the installation of equipment, both above and below grade level, as well as incidental grading, utilities and paving.

HIGHWAY CONSTRUCTION

Highway construction includes the construction, alteration or repair of roads, streets, highways, runways, taxiways, alleys, trails, paths, parking areas, and other similar projects not incidental to building or heavy construction. It includes all incidental construction in conjunction with the highway construction project.

HEAVY CONSTRUCTION

Heavy projects are those projects that are not properly classified as either "building" or "highway". For example, dredging projects, water and sewer line projects, dams, flood control projects, sewage treatment plants and facilities, and water treatment plants and facilities are considered heavy.



Anthony Russell, Commissioner
KENTUCKY LABOR CABINET

ASBESTOS / INSULATION WORKERS: (Mechanical only)		BASE RATE	\$31.84
		FRINGE BENEFITS	18.84
<hr/>			
BOILERMAKERS:		BASE RATE	\$23.95
		FRINGE BENEFITS	12.04
<hr/>			
BRICKLAYERS:		BASE RATE	\$20.43
		FRINGE BENEFITS	8.67
<hr/>			
CARPENTERS:		BASE RATE	\$21.98
Carpenters:	BUILDING	FRINGE BENEFITS	12.70
Piledrivermen:	BUILDING	BASE RATE	\$22.48
		FRINGE BENEFITS	12.70
Carpenters:	HEAVY & HIGHWAY	BASE RATE	\$26.90
		FRINGE BENEFITS	14.50
Piledrivermen:	HEAVY & HIGHWAY	BASE RATE	\$27.15
		FRINGE BENEFITS	14.50
Divers:	HEAVY & HIGHWAY	BASE RATE	\$40.73
		FRINGE BENEFITS	14.50
<hr/>			
CEMENT MASONS:		BASE RATE	\$10.70
<hr/>			
ELECTRICIANS:		BASE RATE	\$29.88
		FRINGE BENEFITS	14.78
LINEMAN:	HEAVY & HIGHWAY	BASE RATE	\$32.98
		FRINGE BENEFITS	11.60
EQUIPMENT OPERATOR:	HEAVY & HIGHWAY	BASE RATE	\$29.48
		FRINGE BENEFITS	10.90
GROUNDMAN:	HEAVY & HIGHWAY	BASE RATE	\$19.53
		FRINGE BENEFITS	8.91
<hr/>			
ELEVATOR CONSTRUCTORS:		BASE RATE	\$21.87
		FRINGE BENEFITS	8.01
<hr/>			
GLAZIERS:		BASE RATE	\$15.45
BATH, ESTILL & POWELL COUNTIES:		FRINGE BENEFITS	0.00
<hr/>			
GLAZIERS:		BASE RATE	\$7.39
JACKSON & LAUREL COUNTIES:		FRINGE BENEFITS	0.00

GLAZIERS: CONTINUED
MENIFEE COUNTY:

BASE RATE	\$9.05
FRINGE BENEFITS	0.00

IRONWORKERS BUILDING

BASE RATE	\$26.97
FRINGE BENEFITS	20.01

LABORERS / BUILDING:

BUILDING GROUP 1: General laborers, asbestos abatement laborer, toxic waste removal laborer, water boys, tool room checker, carpenter tenders, (civil engineer helpers, rodman, grade checkers, excluding all field work performed by Engineering Firms), concrete pouring and curing, concrete forms stripping and wrecking, hand digging and backfilling of ditches, clearing of right of ways and building sites, wood sheeting and shoring, signalman for concrete bucket and general cleaning, and environmental laborer - nuclear, radiation, toxic and hazardous waste - Level D:

BUILDING	BASE RATE	\$20.01
	FRINGE BENEFITS	10.09

BUILDING GROUP 2: All air tool operators, air track drills, asphalt rakers, tampers, batchers plant and scale man, chain saw, concrete saw, cutter/burner, electric hand grinder, all electric bush and chipping hammers, flagmen, forklift operators, form setter (street or highway), metal form setters, heaters, mesh handlers on walkways, streets and roadways outside building, gunnite laborers, hand spiker, introflax burning rod, joint makers, mason tenders, multi-trade tender, pipe layers, plaster tenders, powderman helpers, power driven Georgia buggies, power posthole diggers, railroad laborers, sandblaster laborers, scow man and deck hand, signal man, sweeper and cleaner machines, vibrator/tamper operators(operated by hand or remote control), walk behind trenching machines, mortar mixer machines, water pumpmen, and environmental laborers - nuclear, radiation, toxic and hazardous waste - Level C:

BUILDING	BASE RATE	\$20.41
	FRINGE BENEFITS	10.09

BUILDING GROUP 3: Asphalt pavers crewman, gunnite nozzleman and gunnite nozzle machine operator, sand blaster nozzleman, concrete or grout pumpman, plaster pumpman:

BUILDING	BASE RATE	\$20.61
	FRINGE BENEFITS	10.09

BUILDING GROUP 4: Powderman and blaster, and environmental laborer - nuclear, radiation, toxic and hazardous waste - Level B:

BUILDING	BASE RATE	\$20.71
	FRINGE BENEFITS	10.09

BUILDING GROUP 5: Caisson holes (6 ft. and over) pressure and free air including tools, and environmental laborer-nuclear, radiation, toxic and hazardous waste - Level A:

BUILDING	BASE RATE	\$21.21
	FRINGE BENEFITS	10.09

BUILDING GROUP 6: Tunnel man and tunnel sand miner, cofferdam (pressure and free air), sand hog or mucker (pressure or free air):

BUILDING	BASE RATE	\$21.51
	FRINGE BENEFITS	10.09

Building Projects: Employees handling chemically treated materials which are harmful to the skin add an additional \$.25 to base rate. Any employee working on high work putting the employee 50 feet above the ground or a solid floor shall receive an additional \$.50 per hour above the base rate. Any employee working on boilers, kilns, melting tanks, furnaces, or when refractory is done using live fire, drying fires, heatups or any hot work shall receive an additional 25% premium above the base rate.

LABORERS / HEAVY & HIGHWAY

GROUP 1: Aging and curing of concrete (any mode or method), asbestos abatement worker, asphalt plant laborers, asphalt laborers; batch truck dumpers; carpenter tenders, cement mason tenders, cleaning of machines, concrete laborers, demolition laborers, dredging laborers, drill helper, environmental laborer - nuclear, radiation, toxic and hazardous waste – Level D, flagmen, grade checkers, all hand digging and hand back filling, highway marker placers, landscaping laborers, mesh handlers and placers, puddler, railroad laborers, rip-rap and grouters, right of way laborers, sign, guard rail and fence installers (all types), signalmen, sound barrier installer, storm and sanitary sewer laborers, swampers, truck spotters and dumpers, wrecking of concrete forms, general cleanup:

HEAVY & HIGHWAY	BASE RATE	\$21.15
	FRINGE BENEFITS	11.41

GROUP 2: Batter board men (sanitary and storm sewer), brickmason tenders, mortar mixer operator, scaffold builders, burner and welder, bushammers, chain saw operator, concrete saw operators, deckhand scow man, dry cement handlers, environmental laborers – nuclear, radiation, toxic and hazardous waste – Level C, forklift operators for masonry, form setters, green concrete cutting, hand operated grouter and grinder machine operator, jack hammers, lead paint abatement, pavement breakers, paving joint machine, pipe layers – laser operators (non-metallic), plastic pipe fusion, power driven Georgia buggy and wheel barrow, power post hole diggers, precast manhole setters, walk-behind tampers, walk-behind trenchers, sand blasters, concrete chippers, surface grinders, vibrator operators, wagon drillers:

HEAVY & HIGHWAY	BASE RATE	\$21.40
	FRINGE BENEFITS	11.41

GROUP 3: Air track driller (all types), asphalt luteman and rakers, gunnite nozzleman, gunnite operators and mixers, grout pump operator, powderman and blaster, side rail setters, rail paved ditches, screw operators, tunnel laborers (free air), and water blasters:

HEAVY & HIGHWAY	BASE RATE	\$21.45
	FRINGE BENEFITS	11.41

GROUP 4: Caisson workers (free air), cement finishers, environmental laborer – nuclear, radiation, toxic and hazardous waste – Level A and B, miners and drillers (free air), tunnel blasters, and tunnel mockers (free air), directional and horizontal boring, air track drillers (all types), powder man and blasters, troxler and concrete tester if laborer is utilized:

HEAVY & HIGHWAY	BASE RATE	\$22.05
	FRINGE BENEFITS	11.41

MARBLE, TILE & TERRAZZO

SETTERS:

	BASE RATE	\$22.64
	FRINGE BENEFITS	6.10

FINISHERS:

	BASE RATE	\$15.42
	FRINGE BENEFITS	5.42

MILLWRIGHTS:

	BASE RATE	\$24.18
	FRINGE BENEFITS	15.67

OPERATING ENGINEERS / BUILDING:

BUILDING CLASS A-1: (NCCCO OR OECP CERTIFIED) Crane, dragline, hoist (1 drum when used for stack or chimney construction or repair), hoisting engineer (2 or more drums), orangepeel bucket, overhead crane, piledriver, truck crane, tower crane, hydraulic crane:

BUILDING	BASE RATE	\$31.31
	FRINGE BENEFITS	14.27

OPERATING ENGINEERS/BUILDING CONTINUED:

BUILDING CLASS A: Articulating Dump, Auto Patrol, Batch Plant, Bituminous Paver, Cableway, Carrydeck Crane, Central Compressor Plant, Clamshell, Concrete Mixer (21 cu. ft. or over), Concrete Pump, Crane, Crusher Plant, Derrick, Derrick Boat, Directional Boring Machine, Ditching and Trenching Machine, Dragline, Dredge Operator, Dredge Engineer, Elevating Grader and all types of Loaders, Forklift (regardless of lift height), GPS Systems (on equipment within the classification), Hoe-Type Machine, Hoist (1 drum when used for stack or chimney construction or repair), Hoisting Engine (2 or more drums), Laser or Remote Controlled Equipment (within the classification), Locomotive, Motor Scraper, Carry-all Scoop, Bulldozer, Heavy Duty Welder, Mechanic, Orangepeel Bucket, Piledriver, Power Blade, Motor Grader, Roller (bituminous), Scarifier, Shovel, Tractor Shovel, Truck Crane, Winch Truck, Push Dozer, Highlift, All Types of Boom Cats, Self Contained Core Drill, Hopto, Tow or Push Boat, A-Frame Winch Truck, Concrete Paver, Gradeall, Hoist, Hyster, Pumpcrete, Ross Carrier, Boom, Tail Boom, Rotary Drill, Hydro Hammer, Mucking Machine, Rock Spreader attached to equipment, Scoopmobile, KeCal Loader, Tower Cranes (French, German and other types), Hydrocrane, Backfiller, Gurries, Subgrader, Tunnel Mining Machines including Moles, Shields, or similar types of Tunnel Mining Equipment:

BUILDING	BASE RATE	\$30.46
	FRINGE BENEFITS	14.27

Operators on cranes with boom one-hundred fifty feet (150') and over including jib, shall receive seventy-five cents (\$.75) above base rate. All cranes with piling leads will receive \$.50 above base rate regardless of boom length

BUILDING CLASS B: All Air Compressors (over 900 cfm), Bituminous Mixer, Joint Sealing Machine, Concrete Mixer (under 21 cu. ft), Form Grader, Roller (rock), Tractor (50 HP and over), Bull Float, Finish Machine, Outboard Motor Boat, Flexplane, Fireman, Boom Type Tamping Machine, Truck Crane Oiler, Greaser on Grease Facilities servicing , Heavy Equipment, Switchman or Brakeman, Mechanic Helper, Whirley Oiler, Self-Propelled Compactor, Tractair and Road Widening Trencher and Farm Tractor with Attachments (except backhoe, highlift and endloader), Elevator (regardless of ownership when used for hoisting any building materials), Hoisting Engineer (1 drum or buck hoist), Firebrick (masonry excluded), Well Points, Grout Pump, Throttle-Valve Man, Tugger, Electric Vibrator Compactor, and Caisson Drill Helper:

BUILDING	BASE RATE	\$25.92
	FRINGE BENEFITS	14.27

BUILDING CLASS C: Bituminous Distributor, Cement Gun, Conveyor, Mud Jack, Paving Joint Machine, Roller (earth), Tamping Machine, Tractors (under 50 HP), Vibrator, Oiler, Concrete Saw, Burlap and Curing Machine, Hydro-Seeder, Power Form handling Equipment, Deckhand Steersman, Hydraulic Driver and Drill Helper:

BUILDING	BASE RATE	\$24.60
	FRINGE BENEFITS	14.27

All Building Operators assigned to work below ground level are to be paid ten percent (10%) above base wagherate. This does not apply to open cut work

OPERATING ENGINEERS / HEAVY HIGHWAY:

HEAVY HIGHWAY CLASS A-1: (NCCCO OR OECP CERTIFIED) Cableway, carry deck crane, cherry picker, clamshell, crane, derrick, derrick boat, dragline, hoist engine (2 or more drums), hydraulic boom truck, hydrocrane, orangepeel bucket, overhead crane, piledriver, rough terrain crane, tower cranes (French, German and other types), truck crane:

HEAVY & HIGHWAY	BASE RATE	\$29.95
	FRINGE BENEFITS	14.15

OPERATING ENGINEERS / HEAVY HIGHWAY: CONTINUED

HEAVY HIGHWAY CLASS A: A-Frame Winch Truck, Auto Patrol, Backfiller, Batcher Plant, Bituminous Paver, Bituminous Transfer Machine, All types of Boom Cats, Bulldozer, Cableway, Carry-All Scoop, Carry Deck Crane, Central Compressor Plant Operator, Clamshell, Concrete Mixer (21 cu. ft. or over), Concrete Paver, Truck-Mounted Concrete Pump, Core Drills, Crane, Crusher Plant, Derrick, Derrick Boat, Ditching and Trenching Machine, Dragline, Dredge Operator, Dredge Engineer, Earth Movers, Elevating Grader and all types of Loaders, Grade-All, Gurries, Heavy Equipment Robotics Operator/Mechanic, Highlift, Hoe-Type Machine, Hoist (two or more drums), Hoisting Engine (two or more drums), Horizontal Directional Drill Operator, Hydraulic Boom Truck, Hydrocrane, Hyster, KeCal Loader, Letourneau, Locomotive, Mechanic, Mechanically Operated Laser Screed, Mechanic Welder, Mucking Machine, Motor Scraper, Orangepeel Bucket, Piledriver, Power Blade, Pumpcrete, Push Dozer, Rock Spreader attached to Equipment, All Rotary Drills, Roller (bituminous), Scarifier, Scoopmobile, Shovel, Side Boom, Subgrader, Tailboom, Telescoping Type Forklift, Tow or Push Boat, Tower Cranes (French, German and other types), Tractor Shovel, Truck Crane, Tunnel Mining Machines including Moles, Shields, or Similar types of Tunnel Mining Equipment:

HEAVY & HIGHWAY	BASE RATE	\$28.85
	FRINGE BENEFITS	14.15

Operators on cranes with booms one hundred fifty feet (150') and over including jib shall receive \$.50 above base rate.

HEAVY HIGHWAY CLASS B: All Air Compressors (over 900 cu. ft. per min.), Bituminous Mixer, Boom Type Tamping Machine, Bull Float, Concrete Mixer (under 21 cu. ft.), Electric Vibrator Compactor/Self-Propelled Compactor, Elevator (one drum or buck hoist), Elevator (regardless of ownership when used to hoist building material), Finish Machine, Firemen, Flex-Plane, Forklift (regardless of lift height), Form Grader, Hoist (one drum), Joint Sealing Machine, Mechanic Helper, Outboard Motor Boat, Power Sweeper (riding type), Roller (rock), Ross Carrier, Skid Mounted or Trailer Mounted Concrete Pumps, Switchman or Brakeman, Throttle Valve Man, Tractair and Road Widening Trencher, Tractor (50 HP and over), Truck Crane Oiler, Tugger, Welding Machine, Well Points, and Whirley Oiler:

HEAVY & HIGHWAY	BASE RATE	\$26.24
	FRINGE BENEFITS	14.15

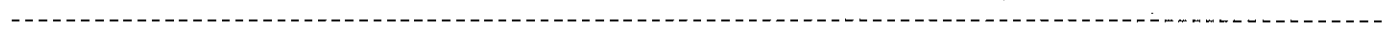
HEAVY HIGHWAY CLASS B2: Greaser on Grease Facilities servicing Heavy Equipment, all off road material handling equipment, including articulating dump trucks:

HEAVY & HIGHWAY	BASE RATE	\$26.65
	FRINGE BENEFITS	14.15

HEAVY HIGHWAY CLASS C: Bituminous Distributor, Burlap and Curing Machine, Caisson Drill and Core Drill Helper (track or skid mounted), Cement Gun, Concrete Saw, Conveyor, Deckhand Oiler, Grout Pump, Hydraulic Post Driver, Hydro Seeder, Mud Jack, Oiler, Paving Joint Machine, Power Form Handling Equipment, Pump, Roller (earth), Steermen, Tamping Machine, Tractors (under 50 H.P.) and Vibrator:

HEAVY & HIGHWAY	BASE RATE	\$25.95
	FRINGE BENEFITS	14.15

All Heavy Highway operators assigned to work below ground level are to be paid ten percent (10%) above base wage rate. This does not apply to open cut work.



PAINTERS:

Drywall Finisher:	BASE RATE	\$8.19
	FRINGE BENEFITS	0.00
Painters:	BASE RATE	\$9.46
	FRINGE BENEFITS	0.00

PLASTERERS:

BATH, ESTILL, MENIFEE & POWELL COUNTIES:	BASE RATE	\$8.25
	FRINGE BENEFITS	0.00

PLASTERERS:

JACKSON & LAUREL COUNTIES:	BASE RATE	\$13.30
	FRINGE BENEFITS	0.00

PLUMBERS & PIPEFITTERS:

BASE RATE	\$31.00
FRINGE BENEFITS	15.31

ROOFERS: (Excluding metal roofs)

BASE RATE	\$15.90
FRINGE BENEFITS	2.25

SHEETMETAL WORKERS: (Including metal roofs)

BASE RATE	\$12.25
FRINGE BENEFITS	.62

SPRINKLER FITTERS:

BASE RATE	\$29.00
FRINGE BENEFITS	16.75

TRUCK DRIVERS: BUILDING

BASE RATE	\$9.50
FRINGE BENEFITS	.72

TRUCK DRIVERS: HEAVY & HIGHWAY

BASE RATE	\$17.35
FRINGE BENEFITS	5.80

END OF DOCUMENT
CR 1-021
OCTOBER 8, 2014



TECHNICAL SPECIFICATIONS



SECTION 01001

SPECIAL CONDITIONS

1.0 DESCRIPTION OF THE WORK AND DESIGNATION OF OWNER

These Specifications and accompanying Drawings describe the work to be done and the materials to be furnished for the construction of the project entitled: Apple Orchard Road Transmission Main.

All references to the Owner in these Specifications, Contract Documents and plans shall mean the Southeastern Water Association.

2.0 AVAILABLE FUNDS

The attention of all Bidders is directed to the fact that funds will be made available for the award of the contract through Rural Development.

3.0 TIME OF COMPLETION

The time allowed for the completion of this contract is 210 calendar days. The time allowed for completion shall begin at midnight, local time, on the date which the Owner, or his authorized representative, the Engineer, shall instruct the Contractor in writing to start work, but no later than 10 days after Notice to Proceed.

Additional time will be allowed the Contractor to cover approved over-runs or additions to the contract in the same proportion that the said over-run or addition in net monetary value bears to the original amount; the total of said additional time to be computed to the nearest whole calendar day.

4.0 LIQUIDATED DAMAGES

It is understood that time is the essence of this contract and that the Owner will sustain damages, monetary and otherwise, in the event of delay in completion of the work hereby contracted.

Therefore, if the said Contractor shall neglect, fail or refuse to complete the work within the time herein specified, or any proper extension thereof granted by the Owner, then the Contractor does hereby agree, as a part of the consideration for the awarding of these contracts, to pay to the Owner the amount specified in the contract, not as a penalty but as liquidated damages for such breach of contract as hereinafter set forth, for each and every calendar day that the Contractor shall be in default after the time stipulated in the Contract for completing the work.

The said amount is fixed and agreed upon by and between the Contractor and the Owner because of the impracticability and extreme difficulty of fixing and ascertaining the actual damages the Owner would in such event sustain, and said amount is agreed to be the amount of damages which the Owner would sustain and said amount shall be retained from time to time by the Owner from current periodical estimates.

Liquidated damages are fixed at \$600 per calendar day of over-run beyond the date set for completion or authorized extension thereof.

5.0 INSURANCE

See Section 00800, Supplementary Conditions SC-5.04 for the minimum amounts of insurance coverage to be furnished under these contracts.

6.0 PERFORMANCE AND PAYMENT BOND

The Contractor shall furnish separate performance and payment bonds issued by an approved bonding company in an amount at least equal to one hundred percent (100%) of the contract price, as security for the faithful performance of this contract and for the payment of persons performing labor and furnishing materials in connection with this contract. These bonds shall be executed by a company authorized to do business in the State of Kentucky and shall be signed or countersigned by a Kentucky resident agent. Bonds shall remain in effect for one year after date of final acceptance of the work.

7.0 SITE DIMENSIONS

All Contractors furnishing materials and equipment for this contract shall obtain exact dimensions at the site. Scale or figure dimensions on the drawings and details show the correct size under ideal conditions and shall not, under any circumstances, be so construed as to relieve the Contractor from responsibility for taking measurements at the site and furnishing materials or equipment of the correct size.

8.0 DAMAGE TO EQUIPMENT STORED AND/OR IN PLACE PRIOR TO INITIAL OPERATION

Any equipment damaged or which has been subjected to possible damage by reason of inundation, improper storage and/or protection during the construction period of project, shall be handled only as follows:

- a) Be replaced with new equipment.
- b) With approval of the Engineer, be returned to the manufacturer of the equipment, or his authorized repair agency, for inspection and

repair provided, however, that such repair after inspection will place the equipment in new condition, and restore the manufacturer's guarantee the same as for new equipment.

9.0 SALVAGED MATERIALS AND EQUIPMENT

All materials and/or equipment to be removed from existing structures and not specifically specified to be re-used shall remain the property of the Owner. Such materials and/or equipment shall be stored on sites by the Contractor as directed by the Owner.

The use of second hand and/or salvaged materials will not be permitted, unless specifically provided for in the detailed specifications. Materials and equipment shall be new when turned over to the Owner.

10.0 TEMPORARY FACILITIES

- a) Build and maintain temporary offices and storage sheds as necessary for the work. Location of temporary buildings shall be subject to the approval of the Engineer.
- b) Provide temporary heat, light and power required by the work. Temporary telephone service shall be provided in the job office paid for by the General Contractor, except that the party placing a long distance call shall pay the toll charge.
- c) Each Contractor shall construct and maintain, in a sanitary condition, sanitary facilities for his employees and also employees of his subcontractors. At completion of the contract work, these sanitary facilities shall be properly disposed of as directed by the Engineer.
- d) Temporary construction for safety measures, hoists and scaffolds shall be erected in accordance with the General Conditions.
- e) Construction yard shall be located on job site. Provide security and safety protection.
- f) The obtaining of all utilities for construction, including power and water, shall be the responsibility of the Contractor, and he shall bear the cost of all utilities used for construction. Cost of all connections and facilities for use of utilities shall be borne by the Contractor.

11.0 PROPERTY PROTECTION

Care is to be exercised by the Contractor in all phases of construction to prevent damage and injury to the Owner's or other property.

In connection with work performed on "private property" (property other than that belonging to the Owner), the Contractor shall confine his equipment, the storage of materials, and the operation of his workmen to the limits indicated on the plans, or to lands and right-of-way provided for the project by the Owner, and shall take every precaution to avoid damage to the private property Owner's buildings, grounds and facilities.

Fences, hedges, shrubs, etc. within the construction limits shall be carefully removed, preserved, and replaced when the construction is completed. Where ditches or excavations cross lawns, the sod shall be removed carefully and replaced when the backfilling has been completed. If sod is damaged or not handled properly, it shall be replaced with new sod equal to existing sod at the Contractor's expense. Grassed areas, other than lawns, shall be graded, fertilized and seeded when construction is completed. When construction is completed the private property Owner's facilities and grounds shall be restored to as good or better condition than found as quickly as possible at the Contractor's expense. All disturbed areas shall be revegetated (permanently or temporarily) within 14 days.

12.0 CONFLICT WITH OR DAMAGE TO EXISTING UTILITIES AND FACILITIES

Insofar as location data is available to the Engineers, existing underground utilities (such as waterlines, sewer lines, gas lines, telephone conduits, etc.) are accurately located on the drawings. Due, however, to the approximate nature of much of this data, the location of any particular facility cannot be certified to be correct. In general, locations and elevations shown are approximate only.

Before proceeding with the work, the Contractor shall confer with all public or private companies, agencies, or departments that own and operate utilities in the vicinity of the construction work. The purpose of the conference is to verify the location of, and possible interference with, the existing utilities that are shown on the Plans, arrange for necessary suspension of service, and make arrangements to locate and avoid interference with all utilities that are not shown on the Plans.

13.0 CONTROL OF EROSION

The Contractor shall be responsible for control of siltation and erosion from the project work. Control shall include all necessary ditching, check dams, mulching, etc. to prevent deposition of materials in roadside ditches. The Owner shall incur no extra costs from such work.

The contractor shall obtain and pay for all grading, storm water, etc. permits, if any required to complete the work. The contractor shall maintain compliance with all conditions, limitations and stipulations of all permits. The contractor shall not commence work, except mobilization, until he has obtained all required permits for said work. The contractor shall supply the owner with copies of all permits within 24 hours of receipt. A KPDES Storm Water Discharge Permit will be required for this project. The contractor shall fill out, sign and submit the Notice of Intent (NOI) and the Notice of Termination (NOT). The notice to proceed will not be issued until the permit has been provided. The Kentucky Pollution Discharge Elimination System (KPDES) Form NOI-SWCA is included in these Specifications. The preferred electronic Notice of Intent (eNOI) for Stormwater Discharges Associated with Construction Activity (KPDES Form NOI-SWCA) under the KPDES General Permit is available on the Web.

For the eNOI, visit: <https://dep.gateway.ky.gov/eForms/default.aspx?FormID=7>.

14.0 MEASUREMENT AND PAYMENT

14.1 MEASUREMENT OF QUANTITIES

All Work completed under the Agreement will be measured by the Engineer according to United States standard measure.

14.1.1 Unless otherwise specified, measurement of concrete quantities will include only that volume within the neat lines as shown on the Plans or as altered by the Engineer to fit field conditions. The prismatic formula will be used in computing the volumes of structures, or portions of structures, having end sections of unequal areas.

14.1.2 All items which are measured by the linear foot, such as pipe, will be measured along the centerline distance of the installed item with no allowance for connections, fittings or laps at connections.

14.1.3 In computing volumes of excavation, borrow and embankments, the average end-area method will be used. For the purpose of ascertaining quantities, it is agreed that the planimeter shall be considered an instrument of precision adapted to the measurement of areas.

14.2 LUMP SUM

When a complete structure or structural unit (in effect, "lump sum" work) is specified as the unit of measurement, the unit will be construed to include all necessary fittings and accessories.

14.3 PLAN QUANTITIES

When the plan quantities for a specific portion of the Work are designated as the pay quantities in the Contract Documents, they shall be the final quantities for which payment for such specific portion of the Work will be made, unless the dimensions of said portions of the Work shown on the plans are revised by the Engineer. When revised dimensions result in an increase or decrease in the quantities of such Work, the final quantities for payment will be revised in the amount represented by the authorized changes in dimensions.

14.4 ACTUAL QUANTITIES

When actual quantities for a specific portion of the Work are designated as the pay quantities in the Contract Documents, they shall be the final quantities for which payment for such specific portion of the Work will be made. The actual quantities will be determined by the difference in field measurements and cross sections before and after construction.

14.5 SCOPE OF PAYMENT

The contract unit prices whether based on lump sum, plan quantities or actual quantities for the various bid items of the Contract Documents shall be considered full compensation for all labor, materials, supplies, equipment, tools, and all things of whatever nature required for the complete incorporation of the item into the Work the same as though the items were to read "in Plan" unless the Contract Documents provide otherwise.

14.6 PAYMENTS

Estimates for payment, partial payments and final payments shall be in accordance with and follow procedures set forth in the General Conditions and Supplementary Conditions.

15.0 **ACCESS ROADS**

The Contractor, Contractor's employees and all trucks delivering equipment, supplies or materials to the project shall use the access roads shown in the Plans for entering and leaving the project sites.

16.0 **TESTING LABORATORY SERVICES**

16.1 GENERAL

16.1.1 Work Included. From time to time during progress of the Work, the Owner may require that testing be performed to determine that materials provided for

the Work meet the specified requirements; such testing includes, but is not necessarily limited to:

- 1) Material Compaction
- 2) Cast-In-Place Concrete

16.1.2 Related Work Described Elsewhere. Requirements for testing may be described in various Sections of these Specifications; where no testing requirements are described, but the Owner decides that testing is required, the Owner may require testing to be performed under current pertinent standards for testing.

16.1.3 Selection of Testing Laboratory. The Owner will select a testing laboratory.

16.1.4 Codes and Standards. Testing, when required, will be in accordance with all pertinent codes and regulations and with selected standards of the American Society for Testing and Materials.

16.1.5 Product Handling. The Contractor shall promptly process and distribute all required copies of test reports for which he is responsible and related instructions to ensure all necessary retesting and/or replacement of materials with the least possible delay in progress of the Work.

16.2 PAYMENT FOR TESTING SERVICES

16.2.1 Initial Services. The Contractor will pay for all initial testing services required by the Owner.

16.2.2 Retesting. When initial tests indicate non-compliance with the Contract Documents, all subsequent retesting made necessary by the non-compliance shall be performed by a testing laboratory selected by the Contractor and approved by the Engineer and the costs thereof will be paid directly by the Contractor.

16.2.3 CONTRACTOR'S Convenience Testing. Inspection or testing performed exclusively for the CONTRACTOR'S convenience shall be the sole responsibility of the Contractor.

16.3 EXECUTION

16.3.1 Cooperation with Testing Laboratory. Representatives of the testing laboratory shall have access to the Work at all times. The Contractor shall provide facilities for such access in order that the laboratory may properly perform its functions.

16.3.2 SCHEDULES FOR TESTING

16.3.2.1 Establishing Schedule. By advance discussion with the testing laboratory selected by the Owner, the Contractor shall allow for the time required for the laboratory to perform its tests and to issue each of its findings. The Contractor shall allow for this time within the construction schedule.

16.3.2.2 Revising Schedule. When changes of construction schedule are necessary during construction, the Contractor shall coordinate all such changes of schedule with the testing laboratory as required.

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

16.3.3 Taking Specimens. All specimens and samples for testing, unless otherwise provided in these Contract Documents, will be taken by the testing laboratory; all sampling equipment and personnel will be provided by the testing laboratory; and all deliveries of specimens and samples to the testing laboratory will be performed by the testing laboratory.

17.0 **SUBMITTALS AND SUBSTITUTIONS**

17.1 GENERAL

17.1.1 Work Included. Wherever possible throughout the Contract Documents, the minimum acceptable quality of workmanship and materials has been defined either by manufacturer's name and catalog number or by reference to recognized industry standards. To insure that the specified products are furnished and installed in accordance with design intent, procedures have been established for advance submittal of design data and for its review and approval or rejection by the Engineer.

17.1.2 RELATED WORK DESCRIBED ELSEWHERE.

17.1.2.1 Contractual requirements for submittals are described in the General Conditions and Supplementary Conditions.

17.1.2.2 Individual submittals required are described in the pertinent sections of these Specifications.

17.2 SUBSTITUTIONS

17.2.1 ENGINEER'S Approval Required. The Agreement is based on the materials, equipment, and methods described in the Contract Documents. The Engineer will consider proposals for substitution of materials, equipment, and methods only when such proposals are accompanied by full and complete technical data and all other information required by the Engineer to evaluate the proposed substitution. Do not substitute materials, equipment, or methods unless such substitution has been specifically approved for this Work by the Engineer.

17.2.2 "Or Equal". Where the phrase "or equal" occurs in the Contract Documents, do not assume that material, equipment, or methods will be approved as equal by the Engineer unless the item has been specifically approved for this Work. The decision of the Engineer shall be final.

17.2.3 Availability of Specified Items. The Contractor shall verify prior to bidding that all specified items will be available in time for installation during orderly and timely progress of the Work. In the event the specified item or items will not be so available, the Contractor shall notify the Engineer prior to receipt of Bids.

17.3 IDENTIFICATION OF SUBMITTALS

The Contractor shall completely identify each submittal and resubmittal by showing at least the following information:

- 1) Name and address of submitter, plus name and telephone number of the individual who may be contacted for further information.
- 2) Name of project as it appears in these Specifications.
- 3) Drawing number and Specifications Section number to which the submittal applies.
- 4) Whether this is an original submittal or resubmittal.

17.4 COORDINATION OF SUBMITTALS

17.4.1 General. Prior to submittal for Engineer's review, the Contractor shall use all means necessary to fully coordinate all material, including the following procedures:

- 1) Determine and verify all field dimensions and conditions, materials, catalog numbers, and similar data.

- 2) Coordinate as required with all trades and with all public agencies involved.
- 3) Secure all necessary approvals from public agencies and others and signify by stamp, or other means, that they have been secured.
- 4) Clearly indicate all deviations from the Contract Documents.

17.4.2 Grouping of Submittals. Unless otherwise specifically permitted by the Engineer, the Contractor shall make all submittals in groups containing all associated items; the Engineer may reject partial submittals as not complying with the provisions of the Contract Documents.

17.5 TIMING OF SUBMITTALS

The Contractor shall make all submittals far enough in advance of schedule dates of installation to provide all required time for reviews, for securing necessary approvals, for possible revision and resubmittal, and for placing orders and securing delivery. In scheduling, allow at least five full working days for the Engineer's review following his receipt of the submittal.

18.0 **INSTALLATION REQUIREMENTS**

Manufactured articles, materials, and equipment shall be applied, installed, connected, erected, used, cleaned, and conditioned as directed by the respective manufacturers, unless otherwise specified.

19.0 **PROOF OF COMPLIANCE**

Whenever the Contract Documents require that a product be in accordance with Federal specification, ASTM designation, ANSI specification, or other association standard, the Contractor shall present an affidavit from the manufacturer certifying that the product complies therewith. Where requested or specified, the Contractor shall submit supporting test data to substantiate compliance.

20.0 **PROJECT RECORD DOCUMENTS**

20.1 As the Work progress, the Contractor shall keep a complete and accurate record of changes or deviations from the Contract Documents and the Shop Drawings, indicating the Work as actually installed. Changes shall be neatly and correctly shown on the respective portion of the affected document, using blackline prints of the Drawings affected, or the Specifications, with appropriate supplementary notes. This record set of Drawings, Shop Drawings, and Specifications shall be kept at the job site for inspection by the Engineer.

20.2 The records above shall be arranged in order, in accordance with the various sections of the Specifications, and properly indexed. Prior to application for final payment, and as a condition to its approval by the Engineer, deliver the record Drawings and Specifications, arranged in proper order, indexed, and endorsed as hereinbefore specified.

20.3 No review or receipt of such records by the Engineer or Owner shall be a waiver of any deviation from the Contract Documents or the Shop Drawings or in any way relieve the Contractor from his responsibility to perform the Work in accordance with the Contract Documents and the Shop Drawings to the extent they are in accordance with the Contract Documents.

21.0 PROJECT MEETINGS

The Contractor's Superintendent for the Work shall attend project meetings as required by either the Owner or Engineer.

22.0 VIDEO TAPE

The line Contractor, before proceeding with any work, shall make or have made a video of all areas where work is to be performed and a copy of this video cassette shall be furnished to the Engineer to review for completeness. This video shall be utilized as backup and reference for claims and cleanup.

23.0 DAILY REPORTS

The project inspector, as designated by the Owner and/or Engineer, will keep a daily record of materials installed. This daily report will be used by the Owner and the Engineer to determine the payments due to the Contractor. The Contractor shall sign the inspector's daily report each day. Should the contractor disagree with the inspector's report, the differences shall be resolved before the end of the next day, with the Contractor signing the daily report.

24.0 FINAL ADJUSTMENT OF QUANTITIES

Upon completion of the project, a final adjusting change order will be written to reconcile the differences between the bid quantities and the actual quantities installed. This final adjusting change order will be determined based on the inspector's daily reports.

25.0 DAVIS BACON AND RELATED ACTS

The Contractor must comply with the minimum rates for wages for laborers and mechanics as determined by the Secretary of Labor in accordance with the

provisions of the Davis Bacon and Related Acts. State Wage Rates apply to this project.

The Contractor shall submit certified payrolls and timesheets with all pay requests. Contractors will not be paid without providing payroll and timesheets.

SECTION 01002

SPECIAL CONSTRUCTION CONSIDERATIONS

1.0 CONSTRUCTION SEQUENCE

It shall be the sole responsibility of the Contractor to plan and implement construction sequences, to follow the Plans and Specifications and to protect any portions of the Work already completed.

2.0 CLEAN-UP

The work will not be considered as complete, and final payment will not be made, until all areas in connection with the Work have been cleared of all rubbish, equipment, excess materials and temporary structures.

3.0 SECURITY BY CONTRACTOR

In addition to the other provisions of the Contract Documents, the Contractor shall be responsible for providing security as he deems necessary for his work areas, storage areas, office areas, equipment, and any other item or area that he is using. The Owner will not be responsible for any damages due to insufficient site security.

4.0 BID SCHEDULE QUANTITIES

The material quantities shown in the bid schedule are not guaranteed and should not be used indiscriminately when ordering materials. The Contractor shall be responsible for ordering material quantities necessary for installation to the limits as shown on the drawings unless otherwise instructed. Any left-over quantities shall be the property of the Contractor unless other arrangements are made. The Owner shall not be responsible for re-stocking or other charges associated with left-over materials or increased costs associated with increases in price for materials needed to complete the project as shown on the drawings.

5.0 PERMITS

The contractor shall obtain and pay for all grading, storm water, etc. permits, if any, required to complete the work. The contractor shall maintain compliance with all conditions, limitations and stipulations of all permits. The contractor shall not commence work, except mobilization, until he has obtained all required permits for said work. The contractor shall supply the owner with copies of all permits within 24 hours of receipt. A KPDES Storm Water Discharge Permit will be required for this project. The contractor shall fill out, sign and submit the Notice of Intent (NOI) and the Notice of Termination (NOT).

6.0 GENERAL CERTIFICATION – NATIONWIDE #12 REQUIREMENTS

The contractor will be required to comply with the requirements of the General Certification – Nationwide Permit #12 contained in Appendix A to these Specifications.

SECTION 02001

EARTHWORK

1.0 SCOPE

This section covers the required topsoil removal, excavation, the removal and proper utilization or disposal of all excavated materials, necessary borrow, fill requirements, and the shaping and finishing of all excavation work to the required lines and grades.

2.0 TOPSOIL REMOVAL

All topsoil on areas to receive fill shall be stripped and stockpiled at an approved location.

3.0 CLEARING AND GRUBBING

Work shall consist of cutting and removing designated trees, stumps, brush, logs, removal of fences, or other loose and projecting material. Unless otherwise specified, it shall also include the grubbing of stumps, roots and other natural obstructions which, in the opinion of the Engineer, must be removed to prosecute properly the construction work and operate properly the facility upon the completion of construction.

No cleared or grubbed materials shall be used in backfills or embankment fills.

All stumps, roots and other objectionable material shall be grubbed up so that no roots larger than 3 inches in diameter remain less than 18' inches below the ground surface.

All holes and depressions left by grubbing operations shall be filled with suitable material and compacted to grade.

Disposal shall be by burning or other methods satisfactory to the Engineer; however, burning will be permitted only when the Contractor has obtained written permission from the local regulatory agency.

The Contractor shall also remove from the site and satisfactorily dispose of all miscellaneous rubbish including, but not limited to, masonry, scrap metal, rock, pavement, etc., that is under the fill or to be removed as shown on the Drawings, specified herein, or directed by the Engineer.

Existing improvements, adjacent property, utility and other facilities, and trees, plants and brush that are not to be removed shall be protected from injury or damage resulting from the Contractor's operations.

Trees and shrubs, designated to remain or that are beyond the clearing and grubbing limits, which are injured or damaged during construction operations shall be treated at the Contractor's expense by experienced tree surgery personnel.

3.1 EROSION CONTROL

Temporary measures shall be applied throughout the construction permit to control and to minimize siltation to adjacent properties and waterways. Such measures shall include, but not be limited to, the use of berms, baled straw silt barriers, gravel or crushed stone, mulch, slope drains and other methods. These temporary measures shall be applied to erodible material exposed by any activity associated with the construction of this project.

4.0 **STRUCTURAL EXCAVATION**

Structural excavation shall consist of and include the removal of all materials encountered or involved in the excavation and subgrade preparation for the placing of structures. The final depths and extent of structural excavation will be determined by the nature of the material encountered; however, after excavation to the limits as shown on the drawings, the ENGINEER shall inspect the work and determine if additional excavation is required.

5.0 **EXCAVATION CONSTRUCTION METHODS**

5.1 OPEN-CUT EXCAVATION - GENERAL

All open cut excavation shall be performed in accordance with this section to the lines, grades, and dimensions shown on the drawings or established by the ENGINEER.

All necessary precautions shall be taken to preserve the material below and beyond the lines of all excavation in the soundest possible condition. Any damage to the work due to the CONTRACTOR'S operations, including shattering of the material beyond the required excavation lines, shall be repaired at the expense of and by the CONTRACTOR. Any and all excess excavation for the convenience of the CONTRACTOR for any purpose or reason, except as may be ordered in writing by the ENGINEER and whether or not due to the fault of the CONTRACTOR, shall be at the expense of the CONTRACTOR. Where required to complete the work, all such excess excavation and overexcavation shall be refilled with materials furnished and placed at the expense of and by the CONTRACTOR. Slopes shattered or loosened by blasting shall be taken down at the expense of and by the CONTRACTOR.

All excavation for embankment and structure foundations shall be performed in the dry. No excavation shall be made in frozen materials without written approval.

The bottom and side slope of rock or shale upon or against which concrete or pervious blanket material is to be placed shall be excavated to the required dimensions as shown on the drawings or established by the ENGINEER. No material will be permitted to extend within the neat lines of the structure. If, at any point in rock or shale upon written orders from the ENGINEER, material is excavated beyond the limits required to receive the structure, the additional excavation shall be filled solidly with concrete. If material is excavated beyond the limits required to receive the structure without written orders from the ENGINEER, the additional excavation shall be brought back to grade with "Class A" concrete at the CONTRACTOR'S expense.

5.2 UTILIZATION OF EXCAVATED MATERIAL

All suitable material removed from the excavations shall be used insofar as practicable, in constructing the permanent works and at such other places as directed. The CONTRACTOR shall not waste materials removed from excavations and suitable for use in the construction of the permanent works, without a written application to do so and a written approval from the ENGINEER.

5.3 DISPOSAL OF SURPLUS AND/OR WASTE MATERIAL

All surplus excavated material and/or all waste materials shall be disposed of outside of the floodplain in an area provided by the CONTRACTOR and approved by the ENGINEER.

The surfaces thereof shall be left in a neat and sightly condition and sloped to provide positive drainage. Compaction of the waste materials shall be required.

5.4 BLASTING FOR EXCAVATION

A. General

Blasting may be done only to the depth, amount, and extent, and in such locations approved by the ENGINEER. Approval of the methods of blasting by the ENGINEER will not relieve the CONTRACTOR of his responsibility in blasting operation, and no payment will be made for any necessary extra excavation below or outside of the limit lines indicated on the drawings, or modifications thereof, due solely to injury caused by over-shooting, improper blasting, or carelessness on the part of the CONTRACTOR. All material thus removed shall be replaced by concrete when a concrete structure is to be placed upon or against such surface, or by compacted fill material when fill is to be placed thereon, at the expense

of the CONTRACTOR and in a manner satisfactory to the ENGINEER. Extra fill is to be of the same type as that to be placed directly above it.

B. Blasting Trench and/or Structure Excavation

The use of explosives or blasting material of any kind in trench excavation and/or the structure excavation shall be carried out by using not over one-half (1/2) pound of explosives (equivalent in strength to 40 percent dynamite) per cubic yard of material to be blasted and by shooting only a few holes simultaneously.

C. Use of Explosives

The transportation, handling, storage, and use of dynamite and other explosives shall be directed and supervised by a person of proven experience and ability in blasting operation. All blasting operations shall be in accordance with applicable local, state, and federal laws. Before any explosives are brought on the job, permission to do so shall be obtained from the ENGINEER. All blasts shall be fired electrically with an electric blasting machine. Where detonating cord is used as a detonating agent, the detonation cord shall be fired with an electric blasting cap. Delay electric detonators shall be used for all delayed blasts. Blasting machines used for firing shall be known to be in good condition and of sufficient capacity to fire all charges. Rubber-covered or other adequately insulated copper wires in good condition shall be used for firing lines and shall have solid cores of appropriate gage. Sufficient firing lines shall be provided to permit the blaster to be located at a safe distance from the blast. Single conductor lead lines shall be used. All operations involving the handling or use of explosives shall be discontinued during approach of a thunderstorm or while it is in progress. Blasting operations in the proximity of overhead power lines, communication lines, or other structures shall not be carried on until the operator and/or OWNER of such lines has been notified and precautionary measures deemed necessary have been taken. All holes loaded on a shift shall be fired on the same shift. The use of black powder is prohibited. Before any drilling operations in preparation for blasting are started, the CONTRACTOR shall furnish the ENGINEER a detailed plan of operations showing the method proposed for the prevention of damage. In order to assure adequate protection, such plan may be modified to meet the conditions that may develop.

5.5 SHEETING AND BRACING

Sheeting and bracing as may be required to safely support the sides of excavations while maintaining the required side slopes shall comply with the safety precautions as outlined in current and accepted safety manuals, such as "Associated General Contractors Manual of Accident Prevention in

Construction". Where sheeting and bracing are necessary to prevent caving of the walls of excavations and to safeguard the workmen, the excavations shall be dug to such widths that proper allowance is made for the space occupied by the sheeting and bracing. The CONTRACTOR shall perform the additional excavation required and furnish and put in place the necessary sheeting and bracing and shall remove the same as the excavation is filled, at his own expense.

5.6 REMOVAL OF WATER

The CONTRACTOR shall construct and maintain all necessary channels, flumes, and/or other temporary diversion and protective works; shall furnish all materials required therefore; and shall furnish, install, maintain and operate all well points, casings, pumps and other equipment for dewatering the various parts of the work and for maintaining the foundations, trenches and other parts of the work free from water as required for constructing each part of the work. After having served their purpose, all temporary protective works shall be removed, or leveled, to give a slightly appearance and so as not to interfere in any way with the operation, usefulness or stability of the permanent structures.

5.7 PROTECTION OF FINISHED STRUCTURE EXCAVATIONS

It shall be the CONTRACTOR'S responsibility to maintain finished excavated foundation surfaces for the works in good condition until such time as the structures are placed on or against the surfaces.

5.8 BORROW

Borrow excavation shall consist of and include the required excavation and proper utilization of approved materials obtained from designated areas when sufficient quantities of suitable materials are not available from other required excavation.

The control of excavation in any borrow area and the selection of materials therefrom shall at all times be as directed by the ENGINEER. On completion of excavation, all borrow pits shall be left in a neat and sightly condition. Unless otherwise approved by the ENGINEER, all borrow pits shall be so graded and dressed that water will readily drain therefrom, and away from all embankments, berms and structures. When shown on the drawings, terraces, or diversions shall be constructed to protect the slopes of the borrow areas from erosion and shall be considered a subsidiary of this specification.

6.0 STRUCTURE FOUNDATION FILL

After clearing and stripping operations have been completed, all structure locations shall be proofrolled with a loaded pan or heavy pneumatic tired vehicle to densify upper soils and to locate possible areas which will require

undercutting, removal and/or recompaction. This operation shall be conducted under the surveillance of the ENGINEER.

6.1 FILL MATERIAL APPROVAL

Before initiating filling operations, the CONTRACTOR shall receive approval of fill material by the ENGINEER. Several laboratory Proctor density tests shall be run on representative samples obtained from the proposed borrow material.

6.2 PLACEMENT OF FILLS

Where structures or other appurtenances are constructed on fill, the fill shall be placed in layers not over six (6") inches deep, as measured before compaction and be thoroughly compacted.

6.3 COMPACTION

Compaction may be obtained by use of a sheeps foot roller or pneumatic-tired roller. Water shall be applied as directed to obtain close adhesion between layers and all parts of the material. Fill shall be compacted to a minimum of 95% of the Standard Proctor maximum dry density (ASTM Specifications D- 698). A minimum of two (2) compaction tests per each two (2') feet of fill on a structure location shall be run by an experienced soils engineering technician.

In order to prevent damage to existing structures, heavy construction equipment shall not be allowed to operate within approximately 8 feet horizontally of the existing structure exterior wall.

7.0 BACKFILLING AROUND STRUCTURES

Only suitable material approved by the ENGINEER shall be used for backfilling around structures.

Backfilling around structures shall have material placed in layers of six (6") inch depth and compacted by pneumatic tools or other small equipment operated by hand. In no case shall the backfilling be allowed to obtain an elevation of one (1') foot above any other area. It shall be uniformly compacted throughout the structure depth. Any deviation shall be cause for the ENGINEER to require the material deposited to be removed and recompacted at the CONTRACTOR'S expense.

All backfilling shall be done in such a manner that the pipe or structure over or against which it is being placed will not be disturbed or injured. Any pipe or structure injured, damaged or moved from its proper line or grade during backfilling operations shall be removed or repaired to the satisfaction of the ENGINEER and then re-backfilled.

8.0 DAM EMBANKMENT (NOT APPLICABLE TO THIS PROJECT)

One foot of material shall be stripped from the top of the existing embankment. This material shall be stockpiled for use as final cover. The surface of the embankment shall then be moistened and/or worked with a harrow, scarifier, or other suitable equipment to provide a satisfactory bonding surface for the additional fill. The surface condition must be approved by the ENGINEER prior to any fill being placed.

No fill material used in raising the embankment shall be dumped in place, but shall be distributed by blading or dozing in a manner that will insure placement so that voids, pockets, and bridging are held to a minimum. The hauling and placement equipment shall be routed over the area such that all areas receive approximately the same compactive effort. The fill shall be compacted such that in-place density checks indicate a soil dry density of at least 90 percent of the maximum value as determined by the standard Proctor density test. The embankment shall be raised in approximately horizontal lifts extending the entire length and width of the embankment. The thickness of the lifts before compaction shall not be more than eight (8) inches.

The stockpiled topsoil shall be uniformly spread over the raised embankment to insure that the final surface is capable of being vegetated.

It is anticipated that sufficient material to reach the designated elevations and grades will be generated from the excavation necessary to construct the principal spillway and the cleaning of the emergency spillway. Should an insufficient supply of material be available from these two sources, the needed additional material will be obtained from the borrow area below the toe of the embankment designated on the Drawings. Borrow operations shall be conducted in accordance with 4.08 BORROW.

9.0 PRELOADING OF STRUCTURES

All tanks shall be preloaded with water prior to making final pipe connections. Elevations of structures shall be monitored until settlement has virtually ceased.

10.0 BACKFILLING TRENCHES

The backfill shall be in accordance with other applicable sections of these specifications.

11.0 FINISH GRADING

Finish grading shall be to the finished elevations and grades shown, and shall be made to blend into conformation with remaining natural ground surfaces. All finish graded surfaces shall be left smooth and free to drain. Areas to be sown in grasses shall be prepared according to Section 02003. Excess materials shall

be spread and compacted as directed. Grading within the construction area and around the outside of building and structure lines shall be performed in a manner which will prevent accumulation of water within the area. Where necessary, or where shown, finish grading shall be extended to insure that water will be directed to drainage ditches, and the site area left smooth and free from depressions holding water.

12.0 MAINTENANCE

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. The CONTRACTOR shall maintain trench backfill at the original ground surface by periodically adding specified backfill material as necessary or when directed by the ENGINEER. Such maintenance shall be continued until final acceptance of the project.

13.0 PAYMENT

Payment for all excavation and fill work shown on the Drawings and herein specified, that is required to complete the clearing, grubbing, site grading, roads, structural excavation, trench excavation, borrow excavation, backfill, sheeting, shoring, topsoil, crushed stone or gravel, drainage, pumping, embankment fills and any other excavation and fills required to complete the work as shown on the Drawings shall be included in the work to which it is subsidiary in the Bid Schedule and no measurement of the quantities will be made. The contours and elevations of the present ground are believed to be reasonably correct but are not guaranteed. The CONTRACTOR shall satisfy himself by actual examination of the site of work as to the existing elevations and contours and the amount of work required under this Section.

The cost of all initial soils inspections and testing shall be paid by the OWNER. If compaction tests do not meet required values, the cost of additional testing as required by the ENGINEER shall be paid by the CONTRACTOR.

SECTION 02002

ACCESS ROAD

1.0 GENERAL

This specification covers the earthwork and surfacing necessary to construct the access road in accordance with the Drawings and the direction of the Engineer. The access road will serve as the construction access road and as the water utility's service access road once the project is completed.

2.0 LOCATION

The layout of the access road will generally be as shown on the Drawings. The exact location and cross-section of the road will be as directed by the Engineer at the time of construction and will be such as to insure its stability and to keep the grade of the road to a minimum.

3.0 FILL

All roadway fill will be compacted as directed by the Engineer with the hauling/placement equipment to insure its stability.

4.0 DRAINAGE

Culvert pipes shall be installed in sizes shown on the drawings. Pipe shall be bituminous coated corrugated metal concrete pipe unless otherwise specified.

5.0 SURFACING

The access road to the pump station shall require a 6-inch compacted aggregate base course.

6.0 PAYMENT

Payment for all work on the access road shown on the Drawings and herein specified shall be included in the payment for Bid Item "90 GPM Booster Pump Station" as contained in the Bid Schedule and no measurement of the quantities will be made. The information given on the Drawings is believed to be reasonably correct but is not guaranteed. The Contractor shall satisfy himself by actual examination of the site of work as to the existing conditions and the amount of work required under this section.



SECTION 02003

SEEDING, MULCHING AND CLEANING UP

1.0 GENERAL

The Work covered by this Specification consists of furnishing all materials, equipment, and labor for preparing the seedbed, fertilizing, seeding and mulching the disturbed areas as directed by the ENGINEER. This Specification also covers cleaning up and repairing damage.

The ENGINEER shall direct all areas to receive seeding and mulching. All areas receiving seeding and mulching shall have lime and fertilizer applied.

2.0 MATERIALS

2.1 LIME

Two tons of agricultural limestone per acre shall be required.

2.2 FERTILIZER

A. Amounts. The following amounts of fertilizer are required per acre:

- | | |
|------------------------|----------|
| (1) Nitrogen (N) | 60 lbs. |
| (2) Phosphorous (P205) | 120 lbs. |
| (3) Potash | 120 lbs. |

B. Analysis. This requirement can be met by applying fertilizer having an analysis of 10-20-20 at the rate of 600 pounds per acre.

2.3 SEED

The following amounts of pure live seed are required per acre:

- | | |
|------------------------|---------|
| (1) KY-31 Fescue | 60 lbs. |
| (2) Perennial Ryegrass | 25 lbs. |
| (3) Red Clover | 10 lbs. |

2.4 MULCH

Mulch shall consist of wood fiber applied at a rate of 1600 pounds per acre, bituminous treated straw applied at a rate of 2000 pounds per acre or other mulch subject to the advance approval of the ENGINEER.

3.0 EXECUTION

3.1 TIME

The seeding shall be completed within two weeks after completion of the work or as soon thereafter as conditions are favorable.

3.2 PREPARATION OF SEEDBED

- A. Application of Lime and Fertilizer. Immediately prior to seedbed preparation, the CONTRACTOR shall apply the agricultural lime and fertilizer uniformly over the area to be seeded.
- B. Mechanical Tillage. The seedbed shall be prepared by pulverizing and breaking up the soil to a minimum depth of two inches with a disk harrow, drag harrow, spike tooth harrow or similar tool. All rocks, clods, and undesirable material that would interfere with seeding operations shall be removed.

3.3 SEEDING

- A. Time. The seeding operations shall be performed immediately after, or as soon as practicable, after the seedbed has been prepared.
- B. Equipment. The seed shall be drilled or broadcast uniformly over the seedbed with regular approved type of equipment or method acceptable to the ENGINEER.
- C. Tillage. The seeded area shall be passed over with a harrow or cultipacker to help cover more seed and improve seedling establishment. Excessive tillage shall be avoided.

3.4 MULCHING

The approved mulch shall be applied uniformly over the seeded area at the rate required.

4.0 CLEANING UP

4.1 After all construction work is complete, prior to final payment, all exposed areas shall be cleaned and left in a sightly manner.

4.2 All unused material shall be removed from the site. No burning will be allowed on the site.

5.0 HYDROSEEDING AND HYDROMULCHING

The CONTRACTOR may hydroseed and hydromulch if the following requirements are met.

1. The individual seed quantities shall be increased by 20%.
2. The mulch shall be a processed hay or straw applied at a rate of 3/4 ton per acre with 80 lbs. per acre of an organic tackifier.
3. The hydroseeder slurry shall not be allowed to drop below a pH of 5.0.

6.0 MAINTENANCE AND WARRANTIES

6.1 MAINTENANCE

The CONTRACTOR shall be responsible for the maintenance of all work under this Section until final acceptance. Adequate protection of exposed slopes shall be provided at all times to prevent excessive erosion. No work will be accepted unless there is evidence of healthy growth and sufficient cover to prevent erosion.

6.2 WARRANTIES

Work executed under this Section shall be guaranteed for one year with the guarantee beginning on the date of final acceptance of all work under this Contract. Any seeded areas of the site which are found to not have an adequate growth of cover during the guarantee period, shall be re-seeded as soon as weather conditions permit, at no cost to the OWNER.

7.0 PAYMENT

Payment for all revegetation work and cleanup shall be included in the work to which it is subsidiary in the Bid Schedule and no measurement of the quantities will be made.



SECTION 02072

HORIZONTAL DIRECTIONAL DRILLING

1.0 GENERAL

1.1 WORK INCLUDED

The work specified in this section consists of furnishing and installing underground utilities using the directional boring (horizontal directional drilling, HDD) method of installation, also commonly referred to as guided horizontal boring. This work shall include all services, equipment, materials, and labor for the complete and proper installation, testing, restoration of underground utilities and environmental protection and restoration.

1.2 QUALITY ASSURANCE

The requirements set forth in this document specify a wide range of procedural precautions necessary to insure that the very basic, essential aspects of a proper directional bore installation are adequately controlled. Strict adherence shall be required under specifically covered conditions outlined in this specification. Adherence to the specifications contained herein, or the Engineer's approval of any aspect of any directional bore operation covered by this specification, shall in no way relieve the Contractor of their ultimate responsibility for the satisfactory completion of the work authorized under the Contract.

1.3 SUBMITTALS

A. **WORK PLAN:** Prior to beginning work, the Contractor must submit to the Engineer a general work plan outlining the procedure and schedule to be used to execute the project. Plan should document the thoughtful planning required to successfully complete the project. At a minimum, the Plan shall cover general construction activities, job safety, emergency response, and scheduling.

B. **EQUIPMENT:** Contractor will submit specifications on directional boring equipment to be used to ensure that the equipment will be adequate to complete the project. Spares inventory shall be included.

C. **MATERIAL:** Specifications on material to be used shall be submitted to Engineer. Material shall include the pipe, fittings and any other item which is to be an installed component of the project.

D. **PERSONNEL:** Documentation of training and relevant experience of personnel shall be submitted.

2.0 EQUIPMENT REQUIREMENTS

2.1 GENERAL

The directional boring equipment shall consist of a directional boring rig of sufficient capacity to perform the bore and pullback the pipe, a boring fluid mixing and delivery system of sufficient capacity to successfully complete the crossing, a guidance system to accurately guide boring operations and trained and competent personnel to operate the system. All equipment shall be in good, safe operating condition with sufficient supplies, materials and spare parts on hand to maintain the system in good working order for the duration of this project.

2.2 BORING SYSTEM

A. **BORING RIG:** The directional boring machine shall consist of a hydraulically powered system to rotate, push and pull hollow drill pipe into the ground at a variable angle while delivering a pressurized fluid mixture to a guidable drill (bore) head. The machine shall be anchored to the ground to withstand the pulling, pushing and rotating pressure required to complete the crossing. The hydraulic power system shall be self-contained with sufficient pressure and volume to power boring operations. Hydraulic system shall be free of leaks. Rig shall have a system to monitor and record maximum pull-back pressure during pull-back operations. The rig shall be grounded during boring and pull-back operations. Sufficient spares shall be kept on hand for any break-downs which can be reasonably anticipated.

B. **BORE HEAD:** The bore head shall be steerable by changing it's rotation and shall provide the necessary cutting surfaces and boring fluid jets.

C. **MUD MOTORS (if required):** Mud motors shall be of adequate power to turn the required boring tools.

D. **DRILL PIPE:** Shall be constructed of high quality 4130 seamless tubing, grade D or better, with threaded box and pins. Tool joints should be hardened to 32-36 RC.

2.3 GUIDANCE SYSTEM

The Guidance System shall be of a proven type and shall be setup and operated by personnel trained and experienced with this system. The Operator shall be aware of any magnetic anomalies and shall consider such influences in the operation of the guidance system if using a magnetic system.

2.4 BORING FLUID (MUD) SYSTEM

A. **MIXING SYSTEM:** A self-contained, closed, boring fluid mixing system shall be of sufficient size to mix and deliver boring fluid composed of bentonite clay, water and appropriate additives. Mixing system shall be able to molecularly shear individual bentonite particles from the dry powder to avoid clumping and ensure thorough mixing. Mixing system shall continually agitate the boring fluid during boring operations.

B. **Boring FLUIDS:** Drilling fluid shall be composed of clean water and an appropriate additive. Water shall be from a clean source with a pH of 8.5 - 10. Water of a lower pH or with excessive calcium shall be treated with the appropriate amount of sodium carbonate or equal. The water and additives shall be mixed thoroughly and be absent of any clumps or clods. No hazardous additives may be used. Boring fluid shall be maintained at a viscosity sufficient to suspend cuttings and maintain the integrity of bore wall.

C. **DELIVERY SYSTEM:** The mud pumping system shall have an adequate flow and pressure for the directional bore. The delivery system shall have filters in-line to prevent solids from being pumped into the drill pipe. Connections between the pump and drill pipe shall be relatively leak-free. Used boring fluid and boring fluid spilled during boring operations shall be contained and properly disposed of. A berm, minimum of 12" high, shall be maintained around boring equipment, boring fluid mixing system, entry and exit pits and boring fluid recycling system (if used) to prevent spills into the surrounding environment. Pumps of sufficient size shall be in place to convey excess boring fluid from containment areas to storage facilities.

2.5 OTHER EQUIPMENT

A. **PIPE ROLLERS:** Pipe rollers, if required, shall be of sufficient size to fully support the weight of the pipe while being tested and during pull-back operations. Sufficient number of rollers shall used to prevent excess sagging of pipe.

B. **PIPE RAMMERS/PULLERS:** Hydraulic or pneumatic pipe rammers or pullers may only be used if necessary and with the authorization of Engineer.

3.0 **OPERATIONS**

3.1 GENERAL

The Engineer shall be notified 7 days in advance of starting work. The Directional Bore shall not begin until the Engineer is present at the job site and agrees that proper preparations for the operation have been made. The Engineer approval for beginning the installation shall in no way relieve the Contractor of the ultimate responsibility for the satisfactory completion of the work as authorized under the

Contract. It shall be the responsibility of Engineer to provide inspection personnel at such times as appropriate without causing undue hardship by reason of delay to the Contractor.

3.2 PERSONNEL REQUIREMENTS

All personnel shall be fully trained in their respective duties as part of the directional boring crew and in safety. Training shall be provided specific to the project if any potential hazards may be encountered which has not already been included in personnel's training.

3.3 BORING PROCEDURE

A. **SITE PREPARATION:** Prior to any alterations to work-site, Contractor shall photograph or video tape entire work area, including entry and exit points. One copy of which shall be given to the Engineer and one copy to remain with Contractor for a period of one year following the completion of the project. Work site, as indicated on drawings and within right-of-way, shall be graded or filled to provide a level working area. No alterations beyond what is required for operations are to be made. Contractor shall confine all activities to designated work areas.

B. **BORE PATH SURVEY:** Entire drill path shall be accurately surveyed with entry and exit stakes placed in the appropriate locations within the areas indicated on drawings. If Contractor is using a magnetic guidance system, drill path will be surveyed for any surface geo-magnetic variations or anomalies.

C. **ENVIRONMENTAL PROTECTION:** Contractor shall place silt fence between all boring operations and any drainage, wetland, waterway or other area designated for such protection by contract documents, state, federal and local regulations. Additional environmental protection necessary to contain any hydraulic or boring fluid spills shall be put in place, including berms, liners, turbidity curtains and other measures. Contractor shall adhere to all applicable environmental regulations. Fuel or oil may not be stored in bulk containers within 200' of any water-body or wetland.

D. **UTILITY LOCATES:** Contactor shall notify all companies with underground utilities in the work area via the state or local "one-call" (BUD) to obtain utility locates. Once the utilities have been located Contractor shall physically identify the exact location of the utilities by vacuum or hand excavation, when possible, in order to determine the actual location and path of any underground utilities which might be within 20 feet of the bore path. Contractor shall not commence boring operations until the location of all underground utilities within the work area have been verified.

E. SAFETY: Contractor shall adhere to all applicable state, federal and local safety regulations and all operations shall be conducted in a safe manner. Safety meetings shall be conducted at least weekly with a written record of attendance and topic submitted to Engineer. The Contractor shall implement the safety guidelines and practices established by:

1. Occupational Safety and Health Act (OSHA).
 - (a) In particular, Subpart P, Excavations of 29 CFR 1926.650, .651, 652, and OSHA Publication 2226, "Excavation, Trenching & Shoring"

F. BORE PIT: The boring pit shall be solid sheeted, braced, and shored as necessary to provide a safe work environment. The Contractor shall take all precautions, and comply with all requirements as may be necessary to protect employees, and private and public property. As required by federal and/or state regulations, bore pit excavation and shoring shall be designed by a professional engineer registered in Kentucky. Tabulated data, calculations, and/or drawings shall be signed and sealed by the bore pit design professional engineer and submitted for review.

G. PIPE: Pipe shall be connected together in one length prior to pull-back operations, if space permits. Steel pipe welds will be X-rayed prior to being placed in bore hole. Pipe will be placed on pipe rollers before pulling into bore hole with rollers spaced close enough to prevent excessive sagging of pipe.

H. PILOT HOLE: Pilot hole shall be drilled on bore path with no deviations greater than 5% of depth over a length of 100'. In the event that pilot does deviate from bore path more than 5% of depth in 100', Contractor will notify Engineer and Engineer may require Contractor to pull-back and re-drill from the location along bore path before the deviation.

In the event that a boring fluid fracture, inadvertent returns or returns loss occurs during pilot hole boring operations, Contractor shall cease boring, wait at least 30 minutes, inject a quantity of boring fluid with a viscosity exceeding 120 seconds as measured by a March funnel and then wait another 30 minutes. If mud fracture or returns loss continues, Contractor will cease operations and notify Engineer. Engineer and Contractor will discuss additional options and work will then proceed accordingly.

I. REAMING: Upon successful completion of pilot hole, Contractor will ream bore hole to a minimum of 25% greater than outside diameter of pipe using the appropriate tools. Contractor will not attempt to ream at one time more than the boring equipment and mud system are designed to safely handle.

J. PULL-BACK: After successfully reaming bore hole to the required diameter, Contractor will pull the pipe through the bore hole. In front of the pipe will be a swivel. Once pull-back operations have commenced, operations must continue without interruption until pipe is completely pulled into bore hole. During pull-back operations Contractor will not apply more than the maximum safe pipe pull pressure at any time.

In the event that pipe becomes stuck, Contractor will cease pulling operations to allow any potential hydro-lock to subside and will commence pulling operations. If pipe remains stuck, Contractor will notify Engineer. Engineer and Contractor will discuss options and then work will proceed accordingly.

3.4 PIPE TESTING

The pipe will be pressure tested as required in the Section 15103 – Pressure Testing and Sterilization

3.5 SITE RESTORATION

Following boring operations, Contractor will de-mobilize equipment and restore the work-site to original condition. All excavations will be backfilled and compacted to 95% of original density. Landscaping will be restored to original.

3.6 RECORD KEEPING, AS-BUILTS

Contractor shall maintain a daily project log of boring operations and a guidance system log with a copy given to Engineer at completion of project. As-built drawings shall be certified as to accuracy by the Contractor. Third-party verification of as-built drawings may be done at Owner's expense.

SECTION 02100

FENCE CONSTRUCTION

1.0 SCOPE

Fencing is normally bid as an alternate construction item and if included is to be constructed at locations and in the manner shown on the plans.

1.1 CHAIN LINK FENCING

Fencing shall be of non-climable type as manufactured by the Cyclone Fence Company, or approved equal. It shall be standard overall height as shown in Drawings and constructed of chain link fabric with three rows of barb wire on top of steel brackets. Chain link fabric shall be one foot less than complete overall height of fence.

1.1.1 Option. These Specifications are based upon the use of steel, chain link, galvanized fencing. At Contractor's option, and at no additional expense to Owner, fencing may be constructed of aluminum products and accessories. Basic specification requirements for aluminum shall be equivalent to specifications for steel fencing. Aluminum fencing products and accessories shall also conform to applicable portion of the "Recommended Commercial Standard for Aluminum Alloy Chain Link Fencing" as published by the Chain Link Fence Manufacturers Institute.

1.1.2 Material. All fencing materials shall conform to applicable portions of the Standards of the Chain Link Fence Manufacturers Institute (CLFMI). Material for framework shall be open hearth, copper-bearing steel conforming to the applicable requirements of the latest ASTM for Standard Specifications, Serial Designation A7 for Steel for Bridges and Buildings.

End, corner, angle and pull posts shall be 3-inch outside diameter, standard tubular steel weighing not less than 5.79 pounds per linear foot. Line posts shall be 2 1/4-inch structural "H" sections weighing 4.1 pounds per linear foot or 2 3/8-inch outside diameter steel pipe weighing 3.65 pounds per linear foot. Top rail shall be 1 5/8-inch outside diameter steel pipe weighing 2.27 pounds per linear foot or "H" section weighing 2.27 pounds linear foot. Top rails shall be provided with expansion rail couplings spaced at not less than 20 foot intervals. Gate posts for pedestrian gates shall be 3-inch outside diameter pipe weighing 5.79 pounds per linear foot. Gate posts for vehicular gates shall be 4-inch outside diameter pipe weighing 9.1 pounds per linear foot.

Braces shall be provided at all corners and wherever fabric is not continuous, such as at gates or at other openings. Braces shall be of the same material as top rail. Extension arms on intermediate posts shall be of pressed steel. Extension arms on end and corner posts shall be heavy malleable iron. Extension arms shall carry 3 barbed wires. Fittings used in connection with the fence and gates shall be malleable iron or pressed steel. Barbed wire shall be four-point pattern, two strand, No. 12-1/2 gauge, copper-bearing steel wire, heavily hot galvanized after weaving, with large barbs placed 3 inches apart. Chain link fabric shall be copper-bearing base metal No. 9 gauge wire heavily zinc coated by hot dip process after weaving. The fabric shall have a knuckled selvage along the top rail and a twisted and barbed selvage at the bottom. The barbing shall be done by cutting the wire on a bias, creating sharp points. A 2-inch padlock and chain shall be furnished with each gate. Three keys shall be furnished with each padlock. Chain shall be welded to the gate. Gate frames shall be of 1.9 inch outside diameter pipe weighing 2.72 pounds per linear foot. Corner fittings shall be heavy, malleable iron castings or pressed steel. Fabric shall be same as in fence. Each gate frame shall be equipped with 3/8-inch diameter adjustable ball-and-socket hinges, catch and stops. Double gates shall have center rests. Hinges shall provide for swinging the gate open through an arc of not less than 180 degrees. Gates shall be suitably braced and reinforced to prevent sagging. Double gates shall be provided with center plumber rod, catch and semi-automatic outer catches to secure gate in opened position. All materials entering into the construction of required fencing shall be heavily galvanized by the hot dip process.

1.1.3 Construction. End, corner and gate posts shall be set in a concrete base not less than 18 inches in diameter which shall extend at least three inches below the bottom of the post. The post shall extend to a depth of at least three feet below the surface of the ground. A brace shall be spaced midway in height of each end, corner and gate post and shall extend to the first line post. Braces shall be securely fastened to posts by means of malleable iron connections and trussed from line post back to end, corner or gate post with a 3/8-inch diameter rod.

Line posts shall be set in a concrete base not less than 12 inches in diameter which shall extend at least three inches below the bottom of the post. The post shall extend to a depth of at least thirty inches below the surface of the ground. Line posts shall be equally spaced along the line of fence at intervals not to exceed ten (10') feet.

Galvanized steel pipe sleeves, 4-inch O.D. for corner, pull and gate posts and 3 1/2-inch O.D. for line posts shall be embedded in concrete as shown on the plans for all fence posts to be installed on concrete structures.

Top rail shall be installed between line posts. Fabric shall not be erected until concrete has had sufficient time to cure. Chain-link fabric shall be stretched to

uniform tightness on the outside of the posts with suitable tools and shall be attached with No. 6 gauge galvanized wire clips securely clinched and attached by means of adjustable clamps. Fabric shall be fastened to line posts at 14-inch intervals. Fabric shall be attached to rail at 24-inch intervals by galvanized tie wires.

A No. 7 coil spring galvanized wire shall be stretched along the bottom of the fence and securely fastened to the posts. The chain-link fabric shall be attached to the tension wire at intervals not to exceed two feet.

1.2 MEASUREMENT AND PAYMENT

Payment for all work on the fencing shown on the Drawings and herein specified shall be included in the payment for Bid Item "90 GPM Booster Pump Station" as contained in the Bid Schedule and no measurement of the quantities will be made. This shall include posts, gates, concrete, and any other work, incidentals or equipment required for a satisfactory installation as shown on the Drawings.



SECTION 03001

CONCRETE

1.0 CAST IN PLACE CONCRETE

1.1 SCOPE

This specification covers the furnishing of all materials, except as may be otherwise provided in the contract, equipment, labor and plant, and performing all operations specified herein, including the manufacturing, transporting, placing, finishing and curing of the concrete. The furnishing and placing of reinforcing steel when specified is covered in a separate technical specification.

1.2 COMPOSITION

Concrete shall be composed of Portland cement, water, fine aggregate, coarse aggregate, and when specified or approved in writing by the Engineer, admixtures for entraining air or retarding agents. The design of the concrete mixture will be based on the water-cement ratio necessary to secure (a) a plastic workable mixture suitable for the specific conditions of placement, and (b) when properly cured, a product having durability, impermeability and strength, in accordance with all the requirements of the structures covered by these specifications. The concrete mixture shall be designed so that the concrete placed according to plans shall produce a minimum laboratory cylinder compressive strength equal to the strength designated in item 1.3 of this section for the class of concrete specified.

1.3 CLASSIFICATION

Concrete shall be classified as Class A. The basis of classification of concrete shall be the minimum compressive strength at twenty-eight (28) days as listed below. Other minimum design requirements are also shown.

Minimum Strength			Cement Factor	
Class	(7-day)	(28-day)	(Bags/C.Y.)	Air Entrainment
A	2850	4000 psi	6.0	4-½ ± 1-½ %

1.4 CEMENT

1.4.1 Portland Cement. Portland cement shall meet the requirements of ASTM Designation: C-150 for the type of cement specified.

1.4.2 Air-Entraining Portland Cement. Air entraining Portland cement shall meet the requirements of ASTM Designation: C-175 for the type of cement specified.

1.4.3 Storage of Cement on the Site. Cement shall be properly stored and protected from weather, dampness or other destructive agents and any cement which is damaged will be rejected and not permitted to be used in the work.

1.4.4 Sampling and Testing. Portland cement shall be subject to sampling and testing in accordance with ASTM Designation: C-150.

Air-entraining Portland cement shall be subject to sampling and testing in accordance with ASTM Designation: C-175.

1.5 AGGREGATES

1.5.1 Fine and Coarse Aggregates. Shall conform to the provisions of ASTM Designation: C-136 and ASTM Designation: C-33. Sand shall consist of clean, well graded particles of hard, durable stone and shall contain limited amount of deleterious substances. It shall be equivalent to washed Ohio, Scioto, or Cumberland River sand.

Coarse aggregate shall be washed river gravel or crushed limestone of hard durable particles and shall contain limited amounts of deleterious substances. The maximum size of coarse aggregate will be limited to one and one-half (1 1/2) inches.

1.5.2 Handling and Measurement of Materials. Aggregates shall be stored or stockpiled in such a manner that separation of coarse and fine particles of each size will be avoided and that various sizes will not become intermixed before proportioning. Methods of handling and transporting aggregates shall be such as to avoid contamination, excessive breakage, segregation or degradation, or intermingling or various sizes.

Scales for weighing aggregates and cement shall be beam type or springless dial type. They shall be accurate within 1 percent under operating conditions. All exposed fulcrums, clevises and similar working parts of scales shall be kept clean.

The quantities of cement and aggregates in each batch of concrete as indicated by the scales, shall be within the following percentages of the required batch weights:

Cement - plus or minus 1.0 percent
Aggregates - plus or minus 2.0 percent

Measuring tanks for mixing water shall be of adequate capacity to furnish the maximum amount of mixing water required per batch and shall be equipped with outside taps and valves to provide for checking their calibration unless other means are provided for readily and accurately determining the amount of water in the tank.

Cement shall be measured by weight or in bags of 94 lbs. each. When cement is measured by weight, it shall be weighted on scale separate from that used for other materials, and in a hopper entirely free and independent of the hopper used for weighing the aggregates. When cement is measured in bags, no fraction of a bag shall be used unless weighed.

Aggregates shall be measured by weight. Mix proportions shall be based on saturated, surface-dry weights. The batch weight of each aggregate shall be the required saturated, surface-dry weight plus the weight of surface moisture it contains.

Mixing water shall consist of water added to the batch, ice added to the batch, water occurring as surface moisture on the aggregates and water introduced in the form of admixtures. The added water shall be measured by weight or volume to an accuracy of 1 percent of the required total mixing water. Added ice shall be measured by weight. Wash water shall not be used as a portion of the mixing water for succeeding batches.

Dry admixtures shall be measured by weight, and paste or liquid admixtures by weight or volume, within a limit of accuracy of 3 percent.

1.5.3 Sampling and Testing. When testing is required, the sampling shall be done in accordance with, and the testing results shall conform to, the ASTM Standards referenced herein. The source from which the aggregates are to be obtained shall be selected well in advance of the time when the material will be required in the work. Samples of the aggregates, when requested, shall be furnished at least fifteen (15) days in advance of the time when the placing of concrete is expected to begin.

Usually 150 pounds of sand for initial tests and 150 pounds for periodic tests will be sufficient. Usually 200 pounds of coarse aggregate for initial tests and 200 pounds for periodic tests will be sufficient.

Unless otherwise specified, all test samples shall be taken under the supervision of the Engineer and delivered to the designated point by the Contractor at his expense. Tests will be made by and under the supervision of the Engineer. Routine control tests and analysis of the aggregates at various stages in the processing operations will be made by the Engineer. The Contractor shall provide such facilities as the Engineer may consider necessary for the ready procurement of representative test samples.

It shall be the responsibility of the Owner to pay for the necessary tests. Once a material has been tested and approved for use, it shall be the Contractor's responsibility to use material throughout the job which is equal in all respects and from the same source as that approved material he delivered to the testing laboratory.

The Engineer shall order additional material tests, if in his opinion the material stored or being used is not equal to the approved tested material. The Contractor shall pay for additional tests if the material is not suitable in accordance with these specifications or if the characteristics of the material are such that a redesign of concrete mix is necessary.

If the Contractor desires to change supplier and/or source of materials after materials have been tested and approved, the Engineer may order additional material tests, the cost of which shall be charged to the Contractor.

In rare instances, a material may meet the requirements of these specifications, but have unusual characteristics which render it unsuitable for the use intended. Therefore, the Owner reserves the right to reject materials if adequate reason is furnished. The Owner also reserves the right to reject material suppliers and sources if quality, uniformity, and other important considerations are not and/or cannot be acceptably maintained. If suppliers or sources of material are rejected after work begins, it may be necessary to test materials from different suppliers and/or sources. If the Engineer deems that tests are necessary, the Contractor shall pay the cost of the necessary tests and all concreting shall be stopped until material is approved for use by the Engineer.

Each material must come from a single source, unless otherwise approved in writing by the Engineer.

All materials must be tested in accordance with these specifications and approved by the Engineer in writing before used in the work, unless the Engineer establishes that some or all of the tests will not be required because of the size of the project or for other reasons. Reports of test results shall be submitted to the Engineer in four (4) copies. It is the intent that the Owner shall pay for material tests necessary to insure suitability for the work, but the Owner shall not pay for material tests caused by negligence, indecision, or carelessness on the part of the Contractor, his subcontractors, or his suppliers.

In the case of ready-mixed concrete the requirements for design mix and testing shall be the same unless waived by the Engineer.

After award of the contract, the Contractor shall submit in writing to the Engineer the name, address and qualifications of the ready mix supplier who will furnish concrete for the project. The Contractor shall also submit the supplier and source of the sand, coarse aggregate, cement and admixture. The Engineer shall then select a testing laboratory and request proposed mixes from the Contractor or ready-mix plant. The Engineer will then indicate tests and design mixes required, to the testing laboratory. The testing laboratory shall also receive a copy of the materials specifications. After receiving the requisition for tests, the Contractor shall send materials per these specifications to the testing laboratory.

1.6 WATER

Water used in mixing concrete shall be fresh, clean and free from injurious amounts of sewage, oil, acid, alkali, salts, or organic matter, and its source shall be subject to the approval of the Engineer. The water used in mixing must be a minimum required for a plastic mix. No water will be permitted for purposes of hastening mixing and reducing tamping or vibration.

1.7 ADMIXTURES

1.7.1 Air-Entrainment. The air-entraining admixtures shall fully meet the requirements of ASTM Designation: C-260 and shall be subject to tests in accordance with ASTM Designation: C-233.

1.7.2 Retarding Agents. Approved types of retarding agents shall be included in the concrete mix when specified on drawings or authorized in writing by the Engineer.

1.7.3 Other Compounds. The use of calcium chloride or other accelerators or anti-freeze compounds will not be allowed.

1.8. CONSISTENCY

The consistency of any concrete shall be such that it can be worked readily into the corners and angles of the forms and around reinforcement with the method of placing employed on the work, but without permitting the materials to segregate or excess free water to collect on the surface. The following ranges represent the extreme limits of allowable slump when tested, in accordance with ASTM Designation: C-143. Where vibrators are used, the Engineer may allow a slightly less slump than the specified minimum.

Class of Concrete	Slump Range (Inches)
Class A	1½ to 3 ½

The quantity of mixing water shall not be changed without the consent of the Engineer.

1.9 AIR-ENTRAINED CONCRETE

1.9.1 General. When air-entrained concrete is specified, air-entrainment shall be accomplished by using an air-entrained Portland cement or by using an air-entraining admixture with normal Portland cement. If the entrained air content falls below the specified limit when using air-entrained cement, an air-entraining admixture shall be added in sufficient quantity to bring the entrained air content within the specified limits. If the entrained air content is found to be greater than the maximum specified, when using an air-entrained cement, the use of an air-entraining cement shall be prohibited and air-entrainment shall be accomplished by using an air-entraining admixture with normal Portland cement. Air-entraining admixtures shall be added in solutions to a portion of the mixing water by means of a mechanical batcher in a manner that will insure uniform distribution of the agent throughout the batch. The air content of freshly mixed air-entrained concrete shall be determined as a percentage of the volume of the concrete by following the methods specified in ASTM Designation: C-138, C-173, or C-231. Air content determination shall be made on samples of concrete during placement of the concrete in the forms.

Unless otherwise specified the air content (by volume) of the concrete at the time of placement shall be:

Maximum Size Aggregate	Air Content (%)
3/8 inch to 1/2 inch	6 to 9
over 1/2 inch to 1 inch	5 to 8
over 1 inch to 2 1/2 inches	3 to 6

1.9.2 Adjustment of Mix Proportions. When air-entrained concrete is specified, the amount of water and fine aggregate prescribed for normal concrete shall be reduced to compensate for the increased volume of air contained in the air-entrained concrete. This is to maintain the concrete's strength.

1.10 QUALITY OF CONCRETE

1.10.1 Control. The Contractor shall be responsible for the design of the concrete mixtures and the quality of the concrete including ready-mix. Prior to any concrete construction or any change in the mix during construction, the Contractor shall furnish a statement to the Engineer giving the proportions by dry weight of cement and of fine and coarse aggregate that will be used in the manufacture of each class of concrete contained in the contract. The Contractor will also furnish material samples to the laboratory for testing a design mix. Based on laboratory evidence, the Engineer will either approve the proposed mix or indicate the necessary proportions to meet the specified requirements.

1.10.2 Measurements. All materials entering into the concrete shall be mechanically measured by weight except the air-entraining admixture and water which may be measured by volume.

1.10.3 Delivery Ticket. Where truck mixers or ready-mix are used, the Contractor shall submit, for each load, a certified delivery ticket given the quantities of cement, fine and coarse aggregate, water, admixture, and the time that water was added to the batch.

1.11 DESIGN MIX AND CYLINDER TESTS

Standard tests of the strength of the concrete may be made by the Engineer at any time he elects to do so. The following tests will be performed by the methods indicated:

Test	Method (ASTM Designation)
Sampling	C-172
Slump Test	C-143
Air Content	C-231 or C-173
Compression Test Specimens	C-31 or C-42
Compressive Strength	C-39 or C-42
Unit Weight	C-138

Test of a portion of a batch may be made on samples representative of that portion for any of the following purposes:

- (1) Determining uniformity of the batch.
- (2) Checking compliance with requirements for slump and air content when the batch is discharged over an extended period of time.

- (3) Checking compliance of the concrete with the specifications when the whole amount being placed in a small structure, or a distinct portion of a larger structure, is less than a full batch.

1.11.1 Slump Test. At least one slump test shall be made before first concrete pour, at the start of pouring any concrete and at each seven cubic yards deposited during one operation. These shall be made from same samples as those taken for cylinder tests, and records of same kept therewith. Tests shall be made according to ASTM Designation C-143 and as required under ASTM Designation C-94 for ready-mixed concrete. The Contractor shall furnish the necessary equipment and labor for making slump tests. Water in excess of the maximum required for a practical concrete mix will have adverse effects on shrinkage, durability, and strength of concrete. Concrete which has a greater slump than specified or directed by the Engineer can be rejected by the Engineer without cost to the Owner.

1.11.2 Entrained Air Tests. The Contractor shall furnish and have on the job at all times, one (2) LA-345 Chase Air Indicator Kit, one (1) LA-340 Spare Chase Air Indicator, and two (2) quarts of isopropyl alcohol (rubbing alcohol) for the Engineer's use in making entrained air measurements. The alcohol can be obtained locally at any drug store and the one (1) LA-345 and one (1) LA-340 can be procured from Forney's Inc., Route 18, R.D. No. 2, Wampum, Pennsylvania 16157, for approximately \$40.00.

The amount of measured entrained air shall be recorded by the Engineer. Mortar shall be sampled only from concrete taken directly from the mixer. At least one (1) air measurement shall be made for each test cylinder taken. Concrete which has more or less entrained air than specified or directed by the Engineer can be rejected by the Engineer without cost to the Owner.

1.11.3 Initial Design Mix Cylinder Tests. Where more than 50 cubic yards of concrete are placed: The testing laboratory selected by the Owner shall make a set of six (6) test cylinders from the design mix. Three (3) shall be tested at 7 days and three (3) shall be tested at 28 days per ASTM Designation C-39. Test cylinders shall have a compressive strength per Article 3 of this section. The CONTRACTOR shall pay the cost of the design mix and design mix cylinder tests, and the Owner shall not pay for additional design mixes and design cylinder tests, caused by negligence, indecision, or carelessness on the part of the Contractor or his suppliers.

It is important for the Contractor to pursue all concrete testing requirements with dispatch so that approval of concrete can be granted by the Engineer in writing after all tests are completed.

1.11.4 Periodic Cylinder Tests. All cylinders shall be made per ASTM C-31 and tested per ASTM C-39. The Contractor shall furnish all labor and equipment for

sampling and curing cylinders on the job site and transportation to the laboratory for testing. The Owner shall select the laboratory and the Contractor shall bear the cost for testing the concrete cylinders.

At the start of concreting, three cylinders shall be made. One shall be tested at 7 days and two shall be tested at 28 days.

Throughout the remainder of the job, the Engineer shall direct when cylinders shall be taken and in what number they shall be taken. At each time when twenty (20) or more cubic yards of concrete are placed during one operation, and when the sum of smaller deposits of concrete equal thirty (30) cubic yards since previous test, and at any change in mix, three (3) cylinders shall be made. One (1) shall be tested at 7 days and two (2) shall be tested at 28 days.

For a strength test, three (3) test specimens will be made from a composite sample. The test result will be the average of the strength of the three specimens, except that, if one specimen in a test shows manifest evidence of improper sampling, molding, or testing, it shall be discarded and the remaining two strengths averaged. Should more than one specimen, representing a given test, show definite defects due to improper sampling, molding or testing, the entire test shall be discarded.

The Engineer will ascertain and record the batch number for the concrete and the exact location in the work at which each batch represented by a strength test is deposited.

The Engineer shall have free entry to the plant and equipment furnishing concrete under the contract. Proper facilities shall be provided for the Engineer to inspect materials, equipment and process and to obtain samples of the concrete. All tests and inspections will be conducted so as not to interfere unnecessarily with the manufacture and delivery of the concrete.

1.12 FAILURE TO MEET STRENGTH REQUIREMENTS

If cylinders do not meet strength requirements, the Engineer can order shutdown on all concreting and redesign of concrete mix by the laboratory selected by the Owner. The cost of mix redesign shall be paid for by the Contractor. The Engineer can also order additional tests, such as load tests, Swiss Hammer tests, and/or core tests in the areas of the work represented by unacceptable cylinders. If areas of work are found to be under strength requirements, the Engineer can order the Contractor to strengthen or replace those areas as the expense of the Contractor.

When it is determined that such concrete shall be removed and replaced the Contractor shall be notified in writing, stating the extent of the replacement to be made.

1.13 BATCHING AND MIXING

1.13.1 Equipment. The Contractor shall provide at the site of the work a modern and dependable batch-type mixing plant with a capacity consistent with the size of the job. The equipment shall be capable of combining the aggregate, cement and water into a uniform mixture and of discharging this mixture without segregation. Adequate facilities shall be provided for the accurate measurement and control of each of the materials entering the concrete. The complete plant assembly shall include provisions to facilitate the inspection of all operations at all times. Ready-mix concrete may be used, if approved by the Engineer, in which case the mixing plant at the site will not be required. All mixing requirements specified herein for concrete mixed at the site shall be applicable to ready-mixed concrete. Measurements of materials for ready-mixed concrete shall conform to ASTM Designation: C-94. The Engineer shall have free access to the mixing plant at all times. Truck mixers will be allowed, provided the use of this method will cause no violation of any applicable provisions of specifications for concrete contained herein. Truck mixers, unless otherwise authorized by the Engineer, shall be of the revolving drum-type, watertight, and so constructed that the concrete can be mixed to insure the uniform distribution of materials throughout the mass. Each truck mixer shall be equipped with a tank of known capacity which shall be equipped with an accurate device for measuring the amount of water added. Truck mixers and agitator shall be operated within the limits of capacity and speed of rotation designated by the manufacturer of the equipment.

1.13.2 Mixing Time. Neither the speed nor the volume capacity of the mixer shall exceed those recommended by the manufacturer. Excessive overmixing, requiring additions of water to preserve the required consistency, will not be permitted. The mixing time for each batch after all solid materials are in the mixer drum, provided that all the mixing water shall be introduced before one-fourth (1/4) of the mixing time has elapsed, shall be not less than two (2) minutes for mixers having capacities up to two (2) cubic yards. For mixers of larger capacities, this minimum shall be increased fifteen (15) seconds for each cubic yard or fraction thereof of additional capacity.

When a truck mixer is used, each batch of concrete shall be mixed not less than fifty (50) nor more than three hundred (300) revolutions, at a mixing speed of not less than four (4) r.p.m. after all materials are in the mixer drum. In all such cases, however, the concrete shall be delivered to the job site and discharged within 1 1/4 hours or before the drum has revolved 300 times, whichever comes first, after the mixing water has been added.

1.14 CONVEYING

Concrete shall be conveyed from mixer to forms as rapidly as practicable, by methods which will prevent segregation or loss of ingredients. There shall be no

vertical drop greater than five feet (5'), except where suitable equipment is provided, to prevent segregation and where specifically authorized by the Engineer. Chuting from towers or elevated positions of the mixer will be permitted, but the water content will be subject to the Engineer's control and excess water will not be allowed, in order to force the concrete to flow clean from the chutes, unless all flushing of chutes is discharged outside the forms.

Belt conveyors, chutes or other similar equipment in which the concrete is delivered to the structure in a thin, continuously exposed flow, will not be permitted, except for very limited or isolated sections of the work and only then if approved in writing by the Engineer. Such equipment shall be arranged to prevent objectionable segregation.

Where wall forms exceed five feet (5') in height, suitable measures, such as the use of tremie tubes, where practicable, or portholes, shall be provided in the forms to limit the vertical drop of the concrete to a maximum of five feet (5'). Openings shall be spaced around the perimeter of the formed area so that lateral flow of fresh concrete will be limited to three feet (3'). Drop chutes which may be provided to convey the concrete through wall ports shall have an outside pocket under each form opening to stop the concrete and allow it to flow easily over into the form without separation.

No concrete shall be placed until the Engineer has given his approval of the subgrade, forms and reinforcing steel in place. If the reinforcing steel is not placed in accord with the drawings, the Engineer shall stop the Contractor from placing any concrete until the error is corrected. Under no circumstances will an attempt be made to correct errors by inserting additional unscheduled bars. No concrete shall be placed except in the presence of the Engineer or his representative, and the Contractor shall give reasonable notice of his intention to pour.

Before any concrete is placed, the forms and subgrade shall be free of chips, dirt, sawdust, or other extraneous materials.

1.15 PLACING

1.15.1 General. Concrete shall be placed within one and one-quarter (1-1/4) hours after the introduction of the water to the cement and aggregates. In hot weather or under conditions contributing to quick stiffening of the concrete, or where the temperature of the concrete is 85°F or above, the time shall be reduced to 45 minutes. The Engineer may allow a longer time, providing the setting time of the concrete is increased a corresponding amount by the addition of an approved set-retarding mixture. Concrete shall be deposited as closely as possible to its final position in the forms so that flow within the mass and consequent segregation are reduced to a minimum.

Vibrators may be used to aid in the placement of the concrete provided they are used under experienced supervision, and the forms designed to withstand their action. The duration of vibration shall be limited to that necessary to produce satisfactory consolidation without causing objectionable segregation. Vibration shall not be applied directly to the reinforcement steel or the forms nor to concrete which has hardened to the degree that it does not become plastic when vibrated.

The Contractor shall keep at least one spare vibrator on the job during all concrete placing operations.

When a vibrator is used the Contractor shall also spade the concrete along form surfaces a sufficient amount to prevent excessive size or numbers of air-void pockets in the concrete surface, except where an approved absorptive form lining is used; in which case the spading specified above will not be permitted.

1.15.2 Lifts in Concrete. The permissible depth of concrete placed in each lift shall be as shown on the drawings or specified herein. All concrete shall be deposited in horizontal layers not exceeding twenty inches (20") in thickness, unless otherwise authorized or directed. The placement shall be carried on at such a rate that the formation of cold joints will be prevented. If a delay occurs in excess of a thirty (30) minute interval between any two (2) consecutive batches or loads, or in case of any delay between placing batches that allows previously placed concrete to take initial set, the Contractor shall discontinue the placing of concrete and make, at his own expense, a construction joint satisfactory to the Engineer before proceeding with the placing operations. He shall remove any portion of the previously placed concrete that is deemed necessary for the proper formation of the construction joint and no payment shall be made to the Contractor for the concrete removed. The thirty (30) minute limitation, cited immediately above, may be extended in those cases where an approved type retarder is added to the concrete mixture to delay the set of the concrete. Use of a retarder in the mix shall be subject to approval of the Engineer.

Hoppers, chutes, and pipes shall be used as necessary to prevent splashing of mortar on forms and reinforcing above the layer being placed.

1.15.3 Placing Temperature. Concrete shall be mixed and placed only when the temperature is at least forty (40) degrees F. and rising, unless permission to pour is obtained from the Engineer, in which event all material shall be heated and otherwise properly prepared so that batching and mixing can proceed in full accord with the provisions of this specification. The methods proposed for heating the materials and protecting the concrete shall be approved by the Engineer. Salt, chemicals, or other materials shall not be mixed with the concrete for the purpose of preventing freezing. Accelerating agents shall not be used.

Concrete placement will not be permitted when, in the opinion of the Engineer, the sun, heat, wind, or humidity prevents proper placement and consolidation.

When the atmospheric temperature may be expected to drop below 40°F at the time concrete is delivered to the work site, during placement or any time during the curing period, the following provisions also shall apply:

- (1) The temperature of the concrete at the time of placing shall not be less than 50°F nor more than 90°F. The temperature of neither aggregates nor mixing water shall be more than 100°F just prior to mixing with the cement.
- (2) When the daily minimum temperature is less than 40°F, concrete structures shall be insulated or housed and heated after placement. The temperature of the concrete and air adjacent to the concrete shall be maintained at not less than 50°F nor more than 90°F for the duration of the curing period.
- (3) Methods of insulating, housing and heating the structure shall conform, to "Recommended Practice for Cold Weather Concreting," ACI Standard 306.
- (4) When dry heat is used to protect concrete, means of maintaining an ambient humidity of at least 40 percent shall be provided unless the concrete has been coated with curing compound or is covered tightly with an approved impervious material.

For obtaining the proper curing conditions for the concrete poured, steam heating equipment, oil-fired blowers (airplane heaters) located outside the enclosure and blowing hot air into the enclosure, or other similar equipment of a capacity sufficient to maintain the required minimum temperature all over, will be required. In conjunction with forced air heaters, means of supplying moisture to the area being cured will also be required. Oil or coke burning salamanders and other fuel-burning heaters produce carbon dioxide which combines with calcium hydroxide in fresh concrete to form a weak layer of calcium carbonate. When this occurs, the surface of the concrete floor will dust under traffic. For this reason, carbon dioxide producing heaters shall not be used while placing concrete and for the first 24 to 36 hours of the curing period unless they are properly vented.

The Contractor must have a sufficient steam retaining canvas or other protective covering at the site to cover all sides and tops of forms to be poured and concrete to be cured, before pouring of concrete will be allowed. This covering must be placed over and around forms and concrete being cured in such a manner that circulation of curing air will prove effective to the tops of floors and to the outside, top and corners of concrete structures, as well as to their interiors. Concrete shall be moist cured in accordance with paragraph 18 of this section. The Contractor may strip forms during curing period with covering removed,

provided atmospheric temperatures are above specified curing temperatures, concrete surfaces are kept moist, and time and labor is available for recovering for lower night temperatures.

When climatic or other conditions are such that the temperature of the concrete may reasonably be expected to exceed 85°F at the time of delivery at the work site, during placement, or during the first 24 hours after placement, the following provisions also shall apply:

- (1) The Contractor shall maintain the temperature of the concrete below 85°F during mixing, conveying, and placing. Methods used shall conform to "Recommended Practice for Hot Weather Concreting," ACI Standard 605.
- (2) The concrete shall be placed in the work immediately after mixing. Truck mixing shall be delayed until only time enough remains to accomplish it before the concrete is placed.
- (3) Exposed concrete surfaces which tend to dry or set too rapidly shall be continuously moistened by means of fog sprays or otherwise protected from drying during the time between placement and finishing, and after finishing.
- (4) Finishing of slabs and other exposed surfaces shall be started as soon as the condition of the concrete allows and shall be completed without delay.
- (5) Concrete surfaces exposed to the air shall be covered as soon as the concrete has hardened sufficiently and shall be kept continuously wet for at least the first 24 hours of the curing period, and for the entire curing period unless curing compound is applied as specified in subsection 7, below.
- (6) Formed surfaces shall be kept completely and continuously wet for the duration of curing period (prior to, during and after form removal) or until curing compound is applied as specified in subsection 7, below.
- (7) If moist curing is discontinued before the end of the curing period, white pigmented curing compound shall be applied immediately.

1.15.4 Concrete on Rock Foundations. Rock surfaces upon which concrete is to be placed shall be clean, free from oil, standing or running water, mud, objectionable coatings, debris, loose semidetached, or unsound fragments. Faults or seams shall be cleaned to a depth satisfactory to the Engineer, and to firm rock on the sides. Immediately before concrete is placed, all such rock surfaces shall be cleaned thoroughly by use of high velocity air-water jets, wet sandblasting, or other means satisfactory to the Engineer. All rock surfaces shall be kept continuously wet for forty-eight (48) hours and all approximately horizontal surfaces shall be covered, immediately before the concrete is placed, with a layer of mortar of the same sand-cement ratio as used in the concrete.

1.15.5 Concrete on Earth Foundations. Unless otherwise authorized all concrete shall be placed upon clean, damp surfaces free from frost, ice, or deleterious materials, and standing or running water. Concrete shall not be placed in mud, dried porous earth or upon fill that has not been subject to approved rolling or tamping until optimum compaction has been obtained. The Contractor shall take all measures to accomplish the results specified in this paragraph.

1.15.6 Vertical Point Spacing. The layout of all monoliths shall be as shown on the drawings or as directed and approved by the Engineer before construction is started.

1.15.7 Placing Concrete Through Reinforcement. In dropping concrete through reinforcement, care shall be taken that no segregation of the coarse aggregate occurs.

1.16 CONSTRUCTION JOINTS

Contractor shall furnish and install vinyl or plastic waterstops as manufactured by W.R. Meadows, Inc., Waterstops Inc., or B.F. Goodrich Inc., or approved equal quality. Waterstops shall be center bulb type 6 inches wide unless shown otherwise in the plans. Care and diligence shall be exercised in securing proper embedment in the concrete mix.

The waterstop shall be extruded from elastomeric polyvinyl-chloride material and joints shall be cemented as recommended by the manufacturer. The Contractor may use other waterstop materials subject to the Engineer's approval.

Construction joints shall be located as indicated on the contract drawings, or as approved by the Engineer. The surfaces of construction joints shall be clean when covered with fresh concrete. Cleaning shall consist of the removal of all laitance, loose or defective concrete and foreign material. Cleaning of the surface of construction joints shall be accomplished by the use of high velocity air-water jets, wet sandblasting, or other effective means satisfactory to the Engineer. Surfaces of construction joints that have been permitted to dry by reason of the succeeding lift or adjoining concrete not being placed within the specified post-curing period shall be moistened and kept continuously moist for at least forty-eight (48) hours immediately prior to the placing of the succeeding lift or adjoining concrete. All pools of water shall be removed from the surfaces of construction joints before the new concrete is placed.

1.17 FINISHING

1.17.1 Defective concrete, honeycombed areas, voids left by the removal of tie rods, ridges on all concrete surfaces permanently exposed to view or exposed to water on the finished structure, shall be repaired immediately after the removal

of forms unless otherwise authorized or directed. Voids left by removal of tie rods shall be reamed and completely filled with dry-patching mortar.

Defective concrete shall be repaired by cutting out the unsatisfactory material and placing new concrete which shall be secured with keys, dovetails, or anchors. Defective areas shall be chipped away to a depth of not less than 1 inch with the edges perpendicular to the surface. The area to be patched and a space at least 6 inches wide entirely surrounding it shall be wetted to prevent absorption of water from the patching mortar. A grout of equal parts Portland Cement and sand, with sufficient water to produce a brushing consistency, shall then be well brushed into the surface, followed immediately by the patching mortar. The patch shall be made of the same material and of approximately the same proportions as used for the concrete except that the coarse aggregate shall be omitted. The mortar shall not be richer than 1 part cement to 3 parts sand. On exposed surfaces, white Portland Cement shall be substituted for a part of the grey Portland Cement to match the color of the surrounding concrete. The proportion of white and grey cements shall be determined by making a trial patch. The amount of mixing water shall be as little as consistent with the requirements of handling and placing. The mortar shall be retempered without the addition of water by allowing it to stand for a period of 1 hour during which time it shall be mixed occasionally with a trowel to prevent setting.

The mortar shall be thoroughly compacted into place and screeded off so as to leave the patch slightly higher than the surrounding surface. It shall then be left undisturbed for a period of 1 to 2 hours to permit initial shrinkage before being finally finished. The patch shall be finished in such a manner as to match the adjoining surface.

Excessive rubbing of formed surfaces will not be permitted. All unformed surfaces of concrete, exposed in the completed work, shall have a wood float finish without additional mortar.

1.17.2 When concrete is honeycombed, damaged or otherwise defective, the Contractor shall remove and replace the structure or structural member containing the defective concrete, or correct or repair the defective parts. The Engineer will determine the required extent of removal, replacement or repair.

Prior to starting repair work the Contractor shall obtain the Engineer's approval of his plan for making the repair. Such approval shall not be considered a waiver of the Contracting Officer's right to require complete removal of defective work if the completed repair does not produce concrete of the required quality and appearance. Repair work shall be performed only when the Engineer is present. Repair of formed surfaces shall be started within 24 hours after removal of the forms.

Joints and edges of unformed surfaces that will be exposed to view shall be chamfered or finished with molding tools.

1.17.3 In order that the rubbing required by these specifications shall be effective, non-supporting forms may be stripped with 24 hours after concrete pouring is completed, and initial rubbing required completed with 48 hours. If possible, patching and rubbing shall be done at the same time. This requirement regarding form removal is secondary to heating requirements, and the specifications heretofore included regarding heating of concrete shall take precedence.

After the required curing time has elapsed, support forms may be removed to allow finishing. Finish shall be Type I, II, or III as required by the "Concrete Finishes" section. In general, surfaces that will show in the finished work will be rubbed down with a coarse carborundum stone. Floors and slabs shall be float finished as soon as possible after pouring unless otherwise specified. Cement or mortar coating will not be permitted. The Contractor should refer to the section on "Concrete Finishes" for complete finish requirements for all concrete units.

Rubbing is not required lower than 6 inches below water levels in basins, but all fins must be removed and holes patched. Exposed inside surfaces to be painted must be rubbed smooth.

The surfaces of exposed concrete roofs, walks, and copings shall be finished with a wooden float and left with a gritty surface similar to that in general use for sidewalks. This finish and floating must be done at the proper period in the setting of the concrete. These outside exposed surfaces of floors and roofs must be finished as one piece of work without a separate top coat.

Basin and channel floors shall be struck off smooth and finished with a steel float to produce a surface easily cleaned. The inside exposed floors must be finished with a steel float to even surfaces and present a neat, smooth, and satisfactory appearance. Finish with bevel around all curbs, and other openings. Floors must be finished to drain to floor traps and sump with slopes as shown on the plans. Floors at the walls must be level except where shown otherwise on the plans.

Surfaces of precast concrete members that are to be painted shall have all air holes and other imperfections filled and dressed to present surfaces comparable in smoothness and appearance to rubbed concrete as set forth above.

1.17.4 Watertightness. All concrete when finished must be watertight. Exposed concrete surfaces shall show no dampness when the interior of basins or exterior of pits have been filled with water for seven days. To obtain this result, the foregoing specifications must be rigidly followed. In case any leakage or

dampness shows on the surface of any such walls after testing the time stated, then such defects must be remedied by the Contractor and work will not be accepted until this is done.

1.17.5 Openings for Pipes and Joints to Pipes. Where pipes pass through concrete walls or floor pours they shall do so by the use of a mechanical joint wall sleeve. The sleeve shall be cast into the pour and it shall be of sufficient length to allow easy installation or removal of the main line pipe.

Where malleable pipe (steel, wrought iron, or copper), brittle pipe (hard rubber), rubber hose, or any pipe cut to fit on the job, passes through any concrete slab, floor or wall, a wrought or cast iron pipe nipple with about 1/2 inch greater diameter than the outside of the pipe shall be used as a sleeve and cast into the slab. In case of floors above ceilings, these sleeves shall extend 1/2 inch to 1 inch above floor surface, to prevent scouring water from running into them. If joint about pipe is required for watertightness or pipe support, the annular ring shall be caulked with dry, unbraided oakum to within 2 inches of surface. The ring at surface shall be filled with nonshrink grout, raked back 1/2 inch, and filled with 1/2 inch cap of Portland Cement grout as previously mentioned.

Where holes greater than 10 inch diameter have to be cut for pipe in existing concrete slabs or walls, the space about the pipe shall be formed to original surfaces and the pipe wrapped with 1/2 inch braided hemp. In grouting this space, use a nonshrink grout, such as Sonneborn "Ferrolith G" or Masters Builders "Embeco". Where walls and spaces give sufficient room for safely using large aggregate, this may be added in a quantity equal to the sand specified. After removal of forms, the yarn shall be removed for a depth of 2 inches from water side and/or exposed surfaces, and the space refilled to surface with a nonshrink grout. Then the joint shall be raked back 1/2 inch from the surface and filled with a one to two mix grout of Portland Cement and sand.

1.18 CURING AND PROTECTION

1.18.1 General. All concrete shall be cured for a period of not less than seven (7) consecutive days by an approved method, or combination of methods. The curing process shall be done so as to prevent loss of moisture from the concrete for the duration of the entire curing period. Unhardened concrete shall be protected from heavy rains and flowing water. All concrete shall be adequately protected from damage.

1.18.2 Moist Curing. Concrete shall be moist cured by maintaining all surfaces continuously (not periodically) wet for the duration of the entire curing period. Water for curing shall be clean and free from any elements which will cause staining or discoloration of the concrete. Where forms of wood are used and left in place during curing, the wood shall be kept wet at all times.

1.18.3 Membrane Curing. At the option of the Contractor and when approved by the Engineer, the concrete may be cured with an approved curing compound of the surface membrane type in lieu of moist curing with water provided a permanent stain is not produced and provided the concrete surface is not to receive rubbed finish, terrazzo, tile, paint, chemical hardening, grout, cement patch, or concrete topping. The curing compound shall be applied to formed surfaces immediately after the forms have been removed and the surfaces cleaned of any loose sand, mortar and debris. The surface to receive the compound shall be moistened thoroughly with water and the compound applied as soon as the moisture film has disappeared but when the surface is still damp. On unformed surfaces the compound shall be applied immediately after the surface loses its free water and has a dull appearance.

The curing compound shall be applied in a twocoat continuous operation by approved spraying equipment and at a coverage of not more than two hundred (200) square feet per gallon for both coats. The second coat shall be applied to overlap the first coat in a direction at approximately right angles to the direction of the first application. Concrete surfaces which are subjected to heavy rainfall within three (3) hours after the curing compound has been applied shall be resprayed by the method and at the coverage herein specified. All concrete surfaces on which curing compound has been applied shall be adequately protected for the duration of the entire curing period from any damage that would disrupt the continuity of the curing membrane.

The curing compound shall conform to Type 2 or Type 3 of ASTM Designation: C-309.

All curing compound shall be delivered to the site of the work in the original sealed container bearing the name of the manufacturer, the brand name and the manufacturer's batch number. The compound shall be approved prior to use. The compound shall be stored so as to prevent damage to the containers, and water-emulsion types shall be protected from freezing.

1.18.4 Cold Weather. The air and forms in contact with the concrete shall be maintained at temperatures above forty (40) degrees for at least seven (7) days and at a temperature above freezing for at least 21 days. Concrete, permitted to be cured with curing compounds, shall be provided the same protection against freezing and low temperatures as provided herein. No fire or excessive heat shall be permitted near or in direct contact with concrete at any time.

1.19 FORMS

1.19.1 Material. Forms shall be wood, steel, or other approved material. Wood forms shall be tongue-and-groove lumber of uniform width and thickness, or plywood having a minimum of five (5) plies, a minimum thickness of 9/16 inch, and a type made especially for concrete forms. Steel forms shall be of a type

acceptable to, and commonly used in the construction field. The type, shape, size, quality and strength of all material of which the forms are made shall be subject to the approval of the Engineer.

1.19.2 Construction. Forms shall be true to line and grade, mortartight, and sufficiently rigid to prevent objectionable deformation under load. Where forms for continuous surfaces are placed in successive units, care shall be taken to fit the forms over the complete surface so as to obtain accurate alignment of the surface and to prevent leakage of mortar. Forms shall be constructed such that keyways, waterstops, and dowels can be placed as shown in the plans.

Responsibility for their adequacy shall rest with the Contractor. The form surfaces shall be smooth, free from irregularities, depressions, sags, or holes when used for permanently exposed faces. Bolts and rods used for internal ties shall be so arranged that, when all forms are removed, all metal will not be less than one inch (1") from any concrete surface. Wire ties will not be permitted. All forms shall be so constructed so that they can be removed without hammering or prying against the concrete. All exposed joints shall be chamfered and suitable molding shall be placed to bevel or round exposed edges or corners, unless otherwise directed by the Engineer.

Temporary openings shall be provided in the inside form of all wall forms and column forms to facilitate cleaning and inspection immediately before depositing concrete. When wood sheathing is used for the inside form, the bottom board shall be fitted and removed to provide a continuous cleanout space and if plywood is used, the forms shall be started with a 6-inch wide piece for the same purpose. Washing out of all forms and other concrete before pouring new materials must be done with water or air from a hose under pressure. The hose must be provided with a suitable nozzle for this work. The intent of these specifications is to produce a perfectly watertight structure in all cases, without any subsequent repair work. Forms shall be so assembled that their removal will not damage the concrete.

Contact surfaces of forms shall be divided into two categories; forms for exposed concrete, and forms for unexposed concrete. Exposed concrete shall mean concrete normally exposed to view and shall be considered extending 6 inches below planned regrade or water level. Exposed concrete shall exclude interior surfaces of covered water holding basins and unpainted, unfinished, interior surfaces of manholes and vaults. Unexposed concrete shall be concrete not normally exposed to view and shall include all concrete not included by exposed concrete, unless otherwise noted on the plans or in the specifications. Either unlined forms or lined forms (as hereinafter specified) shall be used for exposed concrete. A combination of lined forms for exposed concrete and unlined forms for unexposed concrete may be used in a structure where only a part of the structure is exposed. When this combination occurs, the Engineer will determine, upon request of the Contractor, if that portion of the structure which

requires lined forms can be reduced in section to accommodate the liner without offsetting the liner backing from the sheathing used for the unexposed portion of the structure.

(1) Forms for Exposed Concrete

- (a) Unlined. The contact surface of forms shall be constructed from 5/8 inch or 3/4 inch 5 ply structural plywood of concrete form grade. All concrete form plywood shall be designated by grade marking each panel. Full sized sheets of plywood must be used except where smaller pieces will cover an entire area. The edges of all plywood sheets shall be straightened on the bench to insure close fitting, tight joints. All vertical joints shall be backed solidly and the edge of abutting sheet shall be nailed to the same stud.

When the one form is erected and reinforcement is in place, and before the other form is erected, the Engineer shall be notified and the other form shall not be placed until work already done is approved. Open joints which would permit leakage of grout shall be sufficient cause for rejection of forms. If, in the opinion of the Engineer, pointing of slightly open joints will prevent leakage, then such pointing shall be done with an approved mixture. Pointing shall be carefully done and there shall be no trace of the pointing mixture on the surface of the sheathing.

Contact surfaces of forms shall be in good condition. The Engineer has the right to reject forms which will not produce a smooth, uniform, concrete surface.

- (b) Lined. The backing for form lining shall be constructed of a good grade of form lumber that is solid, straight, and free from defects that might impair its strength but need not be of the quality used for contact forms. Square-edged, sized lumber may be used for form boarding in place of shiplap or tongue-and-groove.

The boarding for lined forms may be horizontal or vertical, depending upon convenience. Form sheathing shall be securely nailed to the studs and the edges of the boards shall be in contact to prevent any bulging of the lining.

Plywood faced panel or patented forms in good condition, with tight fitting joints, such as steel-ply forms, can be substituted for lined forms if a smooth wall surface, as required by these specifications, can be obtained. Minor variations in concrete texture at form joints will be permitted.

Lining material shall be 1/4 inch structural plywood securely nailed to the form sheathing. All lining material shall be used in as wide pieces as

possible. Areas less than 4 feet in width shall be lined with a single width of plywood.

Joints in lining and backing shall not occur at the same place and butting edges of adjacent sheets shall be nailed to the same board. The lining material shall be nailed to the backing beginning at the center of the board and working toward the edges to prevent buckling. Lining material may be re-used, if it is in satisfactory condition and is approved by the Engineer. Open joints which would permit leakage of grout shall be sufficient cause for rejection of forms. If, in the opinion of the Engineer, pointing of slightly open joints will prevent leakage, then such pointing shall be allowed.

In the case of lined circular forms where the backing for form lining is constructed in chords of a circle, the form lining shall be adequately supported by variable thickness shim strips on at least 6 inch centers so that the liner forms a circular surface within tolerances specified herein.

(2) Forms for Unexposed Concrete

Forms shall be constructed of a good grade of form lumber that is solid, straight and free from defects which might impair its strength, but need not be of the quality required for contact surfaces of forms for exposed concrete. Forms shall be of shiplap of T & G No. 2 wood sheathing, 3/4 inch plywood, 5/8 inch plywood or approved equal. Panel or patented forms may be used upon approval of the Engineer.

(3) Form Ties

Forms ties shall be as follows:

- (a) "Water-Seal" type of ties shall be used for water holding structures or structures subject to flooding.
- (b) Nonwater holding structures, which are not subject to flooding, shall have ties approved by the Engineer.

Form ties shall have a minimum working strength when fully assembled of at least 3,000 pounds. Ties shall be so adjustable in length as to permit tightening of forms and of such type as to leave no metal closer than 1 inch from the surface and they shall not be fitted with any lugs, cones, washers or other device to act as a spreader within the form or for any other purpose which will leave a hole larger than 7/8 inch in diameter or a depression back of the exposed surface of the concrete. Wire ties shall not be permitted.

1.19.3 Construction Tolerance. The forms shall be constructed and rigidly braced in place within the following tolerances:

(1) Variation from true alignment as shown on the drawings in the lines and surfaces of walls:

In 10 feet	1/4 inch
In 20 feet maximum	3/8 inch
In 40 feet or more	3/4 inch

(2) Variation from the level or from the grades indicated on the drawings in floors or slabs:

In 10 feet	1/4 inch
In 20 feet maximum	3/8 inch
In 40 feet or more	3/4 inch

(3) Variation in sizes and/or locations of floor and/or wall openings:

1/4 inch

(4) Variation in thickness of slabs and walls and in cross-sectional dimensions of columns and beams:

Minus	1/4 inch
Plus	1/2 inch

(5) Variation in plan dimension of footings:

Minus	1/2 inch
Plus	2 inches

1.19.4 Wetting and Oiling Forms. The inside surface of wood board forms shall be soaked with clean water and kept continuously wet for 12 hours before any concrete is placed. In case forms have been erected for some time and have become dry so that joints have opened, then the forms shall be thoroughly soaked at least twice each day for at least 3 days prior to placing concrete. If the forms cannot be tightened to the satisfaction of the Engineer, they shall be torn down and rebuilt. Plywood forms may be treated with a nonstaining form oil, mineral oil or lacquer. If oil is used, all excess oil shall be wiped off with rags to leave the surface of the forms just oily to the touch. In freezing weather oil shall be used.

Coatings of dust shall be removed from contact surfaces of forms before placing concrete. Concrete shall not be placed in any form until inspected by the Engineer and permission is given to start placing.

1.19.5 Removal. Forms shall not be removed without approval of the Engineer. All form removal shall be accomplished in such a manner as to prevent injury to the concrete.

Forms shall not be removed sooner than the following minimum times after the concrete is placed. These periods represent cumulative number of days and fractions of days, not necessarily consecutive, during which the temperature of the air adjacent to the concrete is above 50°F.:

Element	Time
Beams, arches - supporting forms and shoring	14 days
Conduits, deck slabs - supporting (inside) forms and shoring	7 days
Conduits (outside forms), sides of beams, small structures	24 hours
Columns, walls, spillway risers - with side or vertical load	7 days
Columns, walls, spillway risers - with no side or vertical load	4 days
Concrete supporting more than 30 feet of wall in place above it.	7 days
Concrete supporting 20 to 30 feet of wall in place above it.*	4 days
Concrete supporting not more than 20 feet in place above it.*	24 hours

* Age of stripped concrete shall be at least 7 days before any load other than the weight of the column or wall itself is applied.

When conditions on the job are such as to justify the requirements, forms will be required to remain in place for longer periods. Forms for beams, girders, and flood slabs shall remain in place for at least seven (7) days and shall only be removed when test cylinders used under the same conditions as the members break with a compressive strength as required in these specifications.

1.19.6 Design, Inspection and Approval of Form Work. The design and engineering of the form work, as well as the construction, shall be the responsibility of the Contractor. The Engineer's approval of form work design and/or drawings, as submitted or as corrected in no way shall relieve the Contractor of his responsibility for adequately constructing and maintaining the forms so that they will function properly.

Forms, form joints, and reinforcing steel placement shall be checked by the Resident Engineer before closing up the forms. Concrete shall not be placed in any form until the placing of steel and erection of form work have been

completed and approved in the completed state by the Resident Engineer. Immediately after completion of pouring, tops of all forms shall be adjusted to line and approved by the Resident Engineer as to conformity with the tolerances specified herein.

1.20 EXPANSION OR CONTRACTION JOINTS

1.20.1 General. Where required, joints shall be provided at the location indicated on the drawings and according to the details shown, or as otherwise approved. The methods and materials used shall be subject to approval and the materials shall conform to the specification applicable. In no case shall any fixed metal, embedded in concrete be continuous through an expansion or contraction joint, except as specifically detailed in the drawings.

1.20.2 Expansion Joint Filler. At all expansion joints shown on the drawings, a premolded joint filler of the thickness specified, shall be provided to prevent bond between and allow for the expansion and contraction of adjacent parts. The filler material shall be of sufficient length and width, and shall be accurately cut, matched and placed to prevent contact of the concrete in the parts of the structure to be separated.

Preformed expansion joint filler shall conform to the requirements of ASTM Specification D 1752, Type I, Type II or Type III, unless bituminous type is specified.

Bituminous type preformed expansion joint filler shall conform to the requirements of ASTM Specification D 994.

1.20.3 Asphalt-Treated Roofing Felt. Two layers of heavy, smooth surface asphalt-treated roofing felt, approximate weight 55 pounds per 100 square feet, shall be placed at expansion joints, as shown on the drawings.

1.20.4 Waterstops. Where required, waterstops shall be installed in joints as shown on the drawings or as otherwise directed to provide a continuous water-tight diaphragm in the joint. All joints in metal waterstops shall be brazed or welded. Joints in rubber and plastic waterstops shall be cemented, fused, or vulcanized as recommended by the manufacturer. Adequate provisions shall be made to support and completely protect the waterstops during progress of the work. The Contractor shall replace or repair, at his own expense, any waterstops punctured, ruptured, or otherwise damaged before final acceptance of the work.

Copper used for waterstops shall conform to ASTM Designation: B-248.

Steel used for waterstops shall conform to ASTM Designation: A-366 or ASTM Designation: A-93.

Wrought iron used for waterstops shall conform to ASTM Designation: A-162 or ASTM Designation: A-163.

Plastic material used for waterstops shall conform to ASTM Designation: D-742.

The rubber waterstop material shall meet the following physical requirements when and if tested, in accordance with the appropriate sections of Federal Test Method Standard No. 601, ASTM Designation: D-395, and ASTM Designation: D-1432.

Hardness. The Shore A durometer hardness shall be 60 to 70.

Elongation. The elongation shall be a minimum of 400 percent.

Tensile Strength. The tensile strength shall be a minimum of 2,500 pounds per square inch.

Water Absorption. The water absorption shall be a maximum of 5 percent by weight after immersion in water for two (2) days at 158°F.

Tensile Strength After Aging. The tensile strength after accelerated aging for five (5) days at 158°F., shall not be less than 80 percent of the original tensile strength.

Compression Set. The compression set after 22 hours at 158°F., shall not be more than 30 percent.

Specific Gravity. The specific gravity shall be 1.20 plus or minus .05.

1.20.5 Dowel Bar Assembly. Where required, dowel bar assembly shall be installed at the expansion joints as shown on the drawings. The dowel bars shall be plain, smooth steel bars of the size specified on the drawings and shall conform to ASTM Designation: A-15. An expansion sleeve shall be provided on one end of each dowel bar. The sleeve shall be metal of an approved type, crimped or capped on one end, and provided a minimum of three (3) inch length of covering of the dowel bar with a minimum of three-quarters (3/4) of an inch expansion chamber beyond the end of the dowel bar. The portion of the dowel bar on the expansion sleeve side of the joint shall be coated with a heavy grease to prevent bond between the bar and the concrete. The dowel bar assembly shall be securely held in place by use of metal dowel chairs at each intersection of a dowel bar and spacer bar. The dowel bars shall be installed on proper horizontal and longitudinal alignment to assure a workable expansion device. The premolded joint filler at these expansion joints shall be held in a true vertical plane by means of a header board. The header board shall remain in place for a minimum of thirty (30) minutes after the concrete has been placed on one side or

until the concrete has set sufficiently to prevent sloughing, before the header is removed and the work of placing concrete continued.

1.21 FURNISHING AND PLACING STEEL REINFORCEMENT

The furnishing and placing of reinforcing steel, when specified, is covered in a separate technical specifications.

1.22 EMBEDDED ITEMS

1.22.1 General. Before placing concrete, care shall be taken to determine that all embedded items are firmly and securely fastened in place as indicated on the drawings or required by the Engineer. All embedded items shall be thoroughly clean and free of oil and other foreign matter such as loose coatings, of rust, paint, and scale. The embedding of wood or other perishable materials in concrete shall be prohibited unless specifically directed or authorized by the Engineer. Any air lines, water lines, wall sleeves, or other materials embedded in structures, as construction expedients authorized by the Engineer, shall conform to the above requirements and, upon completion of their use, shall be backfilled with concrete or grout as directed by the Engineer.

1.22.2 Pipe Embedded in Concrete. Where pipe is partially or wholly encased in concrete, care shall be taken that the pipe is firmly and securely held in place so that the alignment and grade of the pipe is not disturbed while the concrete is placed around the pipe.

1.23 CONSTRUCTION

Concrete work shall be performed in accordance with these specifications on concrete. The vertical surfaces of the cradle, expansion and contraction joints shall be formed. The cradle shall be poured with the pipe in place and to line and grade. Construction joints that are used shall conform with the requirements of item 1.16 of this section. Expansion and contraction joints shall conform with requirements of item 1.20 of this section.

1.24 SEALING JOINTS IN CONCRETE AND CONCRETE PIPE

1.24.1 General. This specification covers the requirements for sealing or filling joints in concrete pipe and concrete structures where expansion joint material is not used.

1.24.2 Type. The sealing compound shall be a cold-application mastic, single component or multiple component type.

The single component type shall be a ready-mixed nondrying compound furnished in troweling consistency or in preformed rope or strip form.

The multiple component type shall be composed of two or more substances that are to be mixed prior to application.

1.24.3 Quality. Sealing compound shall conform to the requirements of one of the following specifications:

ASTM Specification D 1850; Concrete Joint Sealer, Cold-Application Type. Penetration, determined as specified in ASTM D 1850, shall be not greater than 120.

Federal Specification SS-S-00210; Sealing Compound, Preformed Plastic, for Expansion Joints and Pipe Joints.

Federal Specification TT-S-227; Sealing Compound; Rubber base, Two Component (For Caulking, Sealing and Glazing in Building Construction), Type II.

1.24.4 Application. The compound will be applied using manufacturer's instructions to joints identified in the plans or as otherwise required in accordance with good construction practices.

1.25 MEASUREMENT AND PAYMENT

Payment will be based on one of the following criteria as specified and described in the Contract Bid Item Descriptions and on the Drawings:

- A. Cost shall be included in the work to which it is subsidiary and no separate measurement and payment will be made.
- B. Payment will be based on Plan Quantities or a percentage of concrete installed to complete the structure as computed by the Engineer or as shown on the Drawings.

Payment as specified above shall be considered as full compensation for all labor, materials, equipment and incidentals necessary to perform the work as required.

Payment for concrete placed outside the lines shown on the drawings due to overexcavation or Contractor error will not be made. Where extra concrete is authorized by the Engineer in writing, payment will be made at a price agreed upon by the Contractor and the Engineer.

SECTION 03002

CONCRETE REINFORCEMENT

1. GENERAL

1.1. Description of Work. This specification covers furnishing, cutting, bending, handling, and placing of steel reinforcement for all reinforced cast-in-place concrete included in this Contract.

1.2. Codes and Standards. The provisions of the following codes, specifications, and standards latest editions shall apply:

- (1) American Concrete Institute, ACI-315, "Manual of Standard Practice for Detailing Reinforced Concrete Structures."
- (2) American Concrete Institute, ACI-318, "Building Code Requirements for Reinforced Concrete."
- (3) Concrete Reinforcing Steel Institute, "Placing Reinforcing Bars."

1.3. Submittals.

1.3.1. Shop Drawings. Within 15 days after award of the Contract, the CONTRACTOR shall prepare and submit to the ENGINEER for review complete shop drawings in accordance with Section 1A of these Specifications. The CONTRACTOR shall not allow delivery of the reinforcing steel to the job site until a review of the shop drawings has been completed by the ENGINEER. Shop drawings shall include the following:

- (1) Reinforcement bar schedules complete with the quantity, shape and size, dimensions, weight per foot and total weights, and bending details.
- (2) Details of bar supports including types, sizes, and support spacing and sequence.
- (3) Plan and elevation views detailing reinforcing placement.
- (4) Location and arrangement of accessories.
- (5) All details and notes appearing on the Drawings.

1.3.2. Mill Tests. Mill tests of reinforcement shall be submitted prior to use for each 15 tons or less shipped to the job site. Tests shall be conducted in conformance with ASTM A-615, and the methods described therein. Cost of the test shall be borne by the CONTRACTOR. Three (3) copies of each test report shall be submitted to the ENGINEER. The bars shall be properly tagged so as to permit identification of the heat number shown on the mill test report for any and all steel delivered to the Work.

2. MATERIALS

2.1. Reinforcing Steel Bars. All bar reinforcement shall be new billet steel deformed bars of American manufacture conforming to ASTM Designation: A-615, Grade 60. Bars shall be plainly marked showing size, type and grade in accordance with these Specifications.

2.2. Bar Supports. Bar supports shall conform to ACI-3125.

2.3. Wire Ties. Ties shall be 16-gage or heavier black annealed wire.

2.4. Other Materials. All other materials, not specifically described but required for proper completion of concrete reinforcement, shall be as selected by the CONTRACTOR subject to the approval of the ENGINEER.

2.5. Rejection of Materials. Reinforcement with any of the following defects will not be permitted in the Work:

- (1) Bar lengths, depth and bends exceeding the specified fabrication tolerances.
- (2) Bends or kinks not indicated on the Drawings or Shop Drawings.
- (3) Bars with reduced cross-section due to excessive rusting or other cause.

3. EXECUTION

3.1. Bending. Reinforcing bars may be mill or field bent. No bars partially embedded in the concrete shall be field bent. All bends shall be made in compliance with requirements of the American Concrete Institute Standard 315 and by approved machine methods except as noted otherwise on the drawings. All bends shall be made without heating.

3.2. Handling and Protection.

3.2.1. Protection. The CONTRACTOR shall use all means necessary to protect concrete reinforcement before, during, and after installation and to protect the installed work.

3.2.2. Storage. Steel reinforcement shall be stored above the surface of the ground upon platforms, skids, or other supports and shall be protected, as far as practicable, from mechanical injury, surface deterioration caused by conditions producing rust, and fouling with dirt, grease and other bond breaking coatings.

3.2.3. Identification. All necessary precautions to maintain identification of bars after bundles are broken shall be exercised.

3.3. Placing.

3.3.1. Surface Coatings. All reinforcement shall be free from dirt, oil, grease, paint, mill scale, loose or thick rust, or other coating which might destroy or reduce its bond with the concrete when the surrounding concrete is placed.

3.3.2. Bracing Reinforcement. All reinforcement shall be placed in accordance with the Drawings and shall be held so securely in position by wiring and blocking from the forms and by wiring together at intersections that it will not be displaced during the depositing and compacting of the concrete. Tack welding of bars will not be permitted.

3.4. Splices.

3.4.1. General. All splices in reinforcement shall be as shown on the Drawings or as directed by the ENGINEER. Unless otherwise specified on the Drawings, by statement or scaled distance, splices shall overlap at least 40 times the diameter of the smaller bar but not less than 12 inches.

3.4.2. Method of Splicing. Splice by lapping ends, placing bars in contact, and tightly wire tying.

3.4.3. Splices in Adjacent Bars. Alternate sides for splices of horizontal reinforcing bars in the riser.

3.5. Openings.

3.5.1. Amount of Reinforcement Removed. Where reinforcing bars must be field cut to allow for thimbles, manholes and other required openings, the amount of steel removed shall be the absolute minimum necessary to provide the opening and maintain the minimum concrete cover as required.

3.5.2. Additional Reinforcement for Cracking. All openings shall be reinforced against potential cracking by placing No. 5 bars or other size bars designated in the Drawings in both faces normal to the plane of cracking. The bars shall not be less than 3'-0" in length, except where otherwise shown on the Drawings, and shall be placed inside the main reinforcement and tied to the main reinforcement.

3.5.3. Supplemental Reinforcement. Where reinforcing bars are removed to provide an opening, supplemental reinforcement shall be provided in the direction of the bars removed. This reinforcement shall have a minimum area of the total bars removed, and shall extend at least 18 inches past the edges of the opening, unless shown otherwise in the Drawings.

3.6. Tolerances.

3.6.1. Minimum Cover. The minimum cover for all main reinforcement shall conform to the dimensions shown on the Drawings which will indicate the clear distance from the edge of the reinforcement to the concrete surface.

3.6.2. Allowable Tolerances. The following tolerances will be allowed in the placement of reinforcing bars as shown on the Drawings:

(1) Variation in protective cover

1/4 inch for 2.5-inch cover

1/2 inch for 4-inch cover

(2) Variation of spacing

1/12 of indicated spacing

3.7. Inspections.

3.7.1. Notice. The ENGINEER or his representative shall have 24 hours notice and the opportunity to inspect and approve the placement of reinforcing steel before concrete is placed.

3.7.2. Purpose. Such inspections are in the nature of assisting the CONTRACTOR to minimize errors, and in no case will they relieve the CONTRACTOR of his responsibility to provide the materials and workmanship required by the Contract Documents.

4. **MEASUREMENT AND PAYMENT**

No direct measurement or payment will be made for any concrete reinforcing. Payment shall be included in the payment for the work to which it is subsidiary in the Bid Schedule.

SECTION 04051

WATER REPELLENT CONCRETE MASONRY UNIT WALLS

1.0 GENERAL

The concrete masonry unit (CMU) wall shall be constructed with the DRY-BLOCK System as manufactured by Grace Construction Products, Cambridge, MA or approved equal. The DRY-BLOCK system consists of 3 separate products:

- DRY-BLOCK Block Admixture, a liquid polymeric admixture, is mixed into the concrete during manufacture of the CMU.
- DRY-BLOCK Mortar Admixture is added to the mortar mix.
- INFINISEAL DB Sealer is then either sprayed, rolled or brush applied to the outside surface of the walls.

2.0 MATERIALS

2.1 CONCRETE MASONRY UNITS

The CMU's shall be produced only by qualified producers who are subjected to annual qualifications of their mix designs and admixture dosage rates to ensure the ability to manufacture water repellent units. The units shall be heavy weight.

2.2 MORTAR

Mortar Admixture is added at the recommended dosage rate, which is dependent on the type of mortar being used.

Agitate Mortar Admixture before using. Mortar admixture should be added to the mix water prior to charging the cement and sand. Reduce the initial water used in the mortar. The mortar joints shall have a well tooled concave joint profile.

Excess mortar shall be removed promptly from the face of the masonry units. Strong acids, sand blasting, and high pressure cleaning to remove hardened mortar will not be allowed.

2.3 SEALER

The water repellent sealer shall be applied to the finished water repellent CMU wall. The sealer shall be equal to INFINISEAL DB as manufactured by Grace Construction Products, Cambridge, MA. The preparatory work, surface preparation, protection of surrounding areas, application methods, drying and

curing times, post-application cleaning shall be in strict accordance with manufacture's recommendations and data sheets.

3.0 INSTALLATION

The entire CMU water repellent system shall be installed in strict accordance with the manufacturer's recommendations. The contractor shall submit the specifications and data sheets to the engineer for approval prior to construction of the CMU walls.

4.0 PAYMENT

Cost shall be included in the work to which it is subsidiary. No separate measurement and payment will be made.

SECTION 04200

UNIT MASONRY

1.0 GENERAL

1.1 RELATED DOCUMENTS

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

Requirements of this section apply to masonry work specified in Division-4 section "Reinforced Unit Masonry".

2.0 DESCRIPTION OF WORK

Extent of each type of masonry work is indicated on drawings and schedule.

Types of masonry work: Concrete unit masonry;
Prefaced concrete unit masonry; and
Pre-insulated concrete unit masonry.

3.0 QUALITY ASSURANCE

3.1 FIRE PERFORMANCE CHARACTERISTICS

Where indicated, provide materials and construction which are identical to those of assemblies whose fire endurance has been determined by testing in compliance with ASTM E 119 by a recognized testing and inspecting organization or by another means, as acceptable to authority having jurisdiction.

3.2 SINGLE SOURCE RESPONSIBILITY FOR MASONRY UNITS

Obtain exposed masonry units of uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from one manufacturer for each different product required for each continuous surface or visually related surfaces.

3.3 SINGLE SOURCE RESPONSIBILITY FOR MORTAR MATERIALS

Obtain mortar ingredients of uniform quality, including color for exposed masonry, from one manufacturer for each cementitious component and from one source and producer for each aggregate.

4.0 SUBMITTALS

4.1 PRODUCT DATA

Submit manufacturer's product data for each type of masonry unit, accessory, and other manufactured products, including certifications that each type complies with specified requirements.

4.2 SAMPLES FOR VERIFICATION PURPOSES

Submit samples of the following materials:

Colored masonry mortar samples showing full extent of colors available.

Unit masonry samples for each type of exposed masonry unit required; include in each set the full range of exposed color and texture available.

5.0 DELIVERY, STORAGE AND HANDLING

Deliver masonry materials to project in undamaged condition.

Store and handle masonry units to prevent their deterioration or damage due to moisture, temperature changes, contaminants, corrosion or other causes.

Limit moisture absorption of concrete masonry units during delivery and until time of installation to the maximum percentage specified or Type I units for the average annual relative humidity as reported by the U.S. Weather Bureau Station nearest project site.

Store cementitious materials off the ground, under cover and in dry location.

Store aggregates where grading and other required characteristics can be maintained.

Store masonry accessories including metal items to prevent deterioration by corrosion and accumulation of dirt.

6.0 PROJECT CONDITIONS

6.1 PROTECTION OF WORK

During erection, cover top of walls with waterproof sheeting at end of each day's work. Cover partially completed structures when work is not in progress.

Extend cover a minimum of 24 inches down both sides and hold cover securely in place.

Do not apply uniform floor or roof loading for at least 12 hours after building masonry walls or columns.

Do not apply concentrated loads for at least 3 days after building masonry walls or columns.

Protect base of walls from rain-splashed mud and mortar splatter by means of coverings spread on ground and over wall surface.

Protect sills, ledges and projections from droppings of mortar.

6.2 STAINING

Prevent grout or mortar or soil from staining the face of masonry to be left exposed or painted. Remove immediately grout or mortar in contact with such masonry.

6.3 COLD WEATHER PROTECTION; GENERAL

Do not lay masonry units which are wet or frozen.

Remove any ice or snow formed on masonry bed by carefully applying heat until top surface is dry to the touch.

Remove masonry damaged by freezing conditions.

6.4 COLD WEATHER INSTALLATIONS

Perform the following construction procedure while the work is progressing. Temperature ranges indicated below apply to air temperatures existing at time of installation except for grout. For grout, temperature ranges apply to anticipated minimum night temperatures. In heating mortar and grout materials, maintain mixing temperature selected within 10 deg. F.

6.4.1 40 deg. F. to 32 deg. F.

MORTAR: Heat mixing water to produce mortar temperature between 40 deg. F and 120 deg. F.

GROUT: Follow normal masonry procedures.

6.4.2 32 deg. F. to 25 deg. F.

MORTAR: Heat mixing water and sand to produce mortar temperatures between 40 deg. F. and 120 deg. F.; maintain temperature of mortar on boards above freezing.

GROUT: Heat grout materials to 90 deg. F. to produce in-place grout temperature of 70 deg. F. at end of work day.

6.4.3 25 deg. F. to 20 deg. F.

MORTAR: Heat mixing water and sand to produce mortar temperatures between 40 deg. F. and 120 deg. F.; maintain temperature of mortar on boards above freezing.

GROUT: Heat grout materials to 90 deg. F. to produce in-place grout temperature of 70 deg. F. at end of work day.

Heat both sides of walls under construction using salamanders or other heat sources.

Use windbreaks or enclosures when wind is in excess of 15 mph.

6.4.4 20 deg. F. and below

MORTAR: Heat mixing water and sand to produce mortar temperatures between 40 deg. F. and 120 deg. F.

GROUT: Heat grout materials to 90 deg. f. to produce in-place grout temperature of 70 deg. F. at end of work day.

MASONRY UNITS: Heat masonry units so that they are above 20 deg. F. at time of laying.

Provide enclosure and auxiliary heat to maintain an air temperature of at least 40 deg. F. for 24 hours after laying units.

Do not heat water for mortar and grout to above 160 deg. F.

6.5 COLD WEATHER STORAGE

Protect completed masonry and masonry not being worked on in the following manner. Temperature ranges indicated apply to mean daily air temperatures except for grouted masonry. For grouted masonry, temperature ranges apply to anticipated minimum night temperatures.

6.5.1 40 deg. F. to 32 deg. F.

Protect masonry from rain or snow for at least 24 hours by covering with weather-resistive membrane.

6.5.2 32 deg. F. to 25 deg. F.

Completely cover masonry with weather-resistive membrane for at least 24 hours.

6.5.3 25 deg. F. to 20 deg. F.

Completely cover masonry with weather-resistive insulating blankets or similar protection for at least 24 hours, 48 hours for grouted masonry.

6.5.4 20 deg. F. and below

Except as otherwise indicated, maintain masonry temperature above 32 deg. F. for 24 hours using enclosures and supplementary heat, electric heating blankets, infrared lamps or other methods proven to be satisfactory. For grouted masonry maintain heated enclosure to 40 deg. F. for 48 hours.

7.0 CONCRETE MASONRY UNITS

7.1 GENERAL

Comply with referenced standards and other requirements indicated below applicable to each form of concrete masonry unit required.

Provide special shapes where required for lintels, corners, jambs, sash, control joints, headers, bonding and other special conditions.

Provide square-edged units for outside corners, except where indicated as bullnose.

7.2 CONCRETE BLOCK

Provide units complying with characteristics indicated below for Grade, Type, face size, exposed face and, under each form of block included, for weight classification.

Grade N unless otherwise specified.

Grade S may be used above grade in exterior walls with weather protective coatings and in walls not exposed to weather.

SIZE: Manufacturer's standard units with nominal face dimensions of 16" long x 8" high (15-5/8" x 7-5/8" actual) x thickness indicated.

TYPE I, moisture-controlled units.

EXPOSED FACES: Manufacturer's standard color and texture, unless otherwise indicated.

Provide split-face units for all exterior surfaces.

HOLLOW LOADBEARING BLOCK: ASTM C 90

SOLID LOADBEARING BLOCK: ASTM C145

7.3 CONCRETE BUILDING BRICK

Provide units complying with ASTM C 55 and characteristics indicated below for grade, type, size and weight classification.

GRADE: Same as indicated for concrete block.

TYPE: Same as indicated for concrete block.

SIZE: As indicated.

Non-Modular Standard: 2-1/4" x 3-3/4" x 8"

WEIGHT CLASSIFICATION: Lightweight.

7.4 PREFACED CONCRETE BLOCK

Provide lightweight concrete units indicated below with manufacturer's standard smooth resinous tile facing complying with ASTM C 744:

For units on which prefaced surfaces are molded, comply with the following requirements:

HOLLOW LOADBEARING BLOCK: ASTM C 90, Grade N, Type I.

SOLID LOADBEARING BLOCK: ASTM C 145, Grade N, Type I.

SIZE: Manufacturer's standard with nominal face dimensions of 16" long x 8" high (15-5/8" x 7-5/8" actual) x thicknesses indicated for units on which prefaced surfaces are molded; with 1/16" thick returns of facing to create 1/4" wide mortar joints with modular coursing.

COLOR AND PATTERN: Provide color and pattern selected by Architect from manufacturer's full range of standard colors and patterns.

AVAILABLE PRODUCTS: Subject to compliance with requirements, prefaced concrete block which may be incorporated in the work include, but are not limited to, the following:

"Astra-Glaze"; Nabco Glazed Products
"Spectra-Glaze II"; manufacturer approved by the Burns and Russell Co.

7.5 PRE-INSULATED CONCRETE BLOCK

Provide units complying with characteristics indicated below for grade, type, face size, exposed face and under each form of block included, for weight classification:

Grade N except Grade S may be used above grade in exterior walls with weather protective coatings.

SIZE: Manufacturer's standard units with nominal face dimensions of 16" long x 8" high (15-5/8" x 7-5/8" actual) x thickness indicated.

TYPE I: Moisture-controlled units.

EXPOSED FACES: Manufacturer's standard color and texture, unless otherwise indicated.

Provide split-faced units for all exterior surfaces.

HOLLOW LOADBEARING BLOCK: ASTM C90

7.6 INSULATION

Shall be an insulated liner, molded of modified grade expanded polystyrene bead at a nominal density of 1.3 pcf with a maximum vapor transmission factor of 1.2 perms at 75 deg. F, ASTM C578, minimum installed R-value of 7.9.

7.6.1 Available Products: Subject to compliance with requirements, pre-insulated concrete block which may be incorporated in the work include, but are not limited to, the following:

"Insul Block Corp."

8.0 MORTAR AND GROUT MATERIALS

8.1 PORTLAND CEMENT

ASTM C 150, Type I, except Type III may be used for cold weather construction. Provide natural color or white cement as required to produce required mortar color.

8.2 MASONRY CEMENT

ASTM C 91, non-staining.

8.2.1 For colored pigmented mortars use premixed colored masonry cements of formulation required to produce color indicated, or if not indicated, as selected from manufacturer's standard formulations.

A. Available Products: Subject to compliance with requirements, masonry cements which may be incorporated in the work include, but are not limited to, the following:

"Atlas Custom Color Masonry Cement"; Lehigh Portland Cement Co.

"Flamingo Color Masonry Cement"; The Riverton Corp.

8.2.2 For colored aggregate mortars use masonry cement of natural color or white as required to produce mortar color indicated.

8.3 HYDRATED LIME

ASTM C 207, Type S

8.4 AGGREGATE FOR MORTAR

ASTM C 144, except for joints less than 1/4" use aggregate graded with 100% passing the No. 16 sieve.

8.4.1 Colored Mortar Aggregates: Ground marble, granite or other sound stone, as required to match Architect's sample.

8.5 AGGREGATE FOR GROUT

ASTM C404

8.6 COLORED MORTAR PIGMENTS

Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes. Use only pigments with record of satisfactory performance in masonry mortars.

8.6.1 Available Products: Subject to compliance with requirements, colored mortar pigments which may be incorporated in the work include, but are not limited, the following:

“SGS Mortar Colors”; Solomon Grind-Chem Services, Inc.
“True Tone Mortar Colors”; Davis Colors, A Subsidiary of Rockwood Industries, Inc.

8.7 WATER

Clean and potable.

9.0 **JOINT REINFORCEMENT, TIES AND ANCHORING DEVICES**

9.1 MATERIALS

Comply with requirements indicated below for basic materials and with requirements indicated under each form of joint reinforcement, tie and anchor for size and other characteristics:

9.1.1 Zinc-Coated (galvanized) Steel Wire: ASTM A 82 for uncoated wire and with ASTM C 641 for zinc coating of class indicated below:

- A. Class 3 (0.80 oz. per sq. ft. of wire surface).
- B. Application: Use where indicated.
- C. Application: Use for masonry not exposed to exterior or earth.

9.1.2 Hot-Dip Galvanized Steel Wire: ASTM A 82 for uncoated wire and with ASTM A 123, Class B-2 (1.5 ox. per sq. ft. of wire surface) for zinc coating applied after prefabrication into units.

- A. Application: Use for masonry exposed to exterior and in contact with earth.

9.1.3 Hot-Dip Galvanized Carbon Steel Sheet: ASTM A 366, Class 2 of ASTM A 635; hot-dip galvanized after fabrication to comply with ASTM A 153, Class B.

- A. Application: Use for anchors.

9.2 JOINT REINFORCEMENT

Provide welded-wire units prefabricated with deformed continuous side rods and plain cross rods into straight lengths of not less than 10', with prefabricated corner and tee units, and complying with requirements indicated below.

9.2.1 Width: Fabricate joint reinforcement in units with widths of approximately 2" less than nominal width of walls and partitions as required to provide mortar coverage of not less than 5/8" on joint faces exposed to exterior and 1/2" elsewhere.

9.2.2 Wire Size for Side Rods: 9 gage.

9.2.3 Wire Size for Cross Rods: 9 gage.

9.2.4 For single-wythe masonry provide type as follows with single pair of side rods:

A. Ladder design with perpendicular cross rods spaced not more than 16" o.c.

9.3 FLEXIBLE ANCHORS

Where flexible anchors are indicated for connecting masonry to structural framework, provide 2-piece anchors as described below which permit vertical or horizontal differential movement between wall and framework parallel to, but resist tension and compression forces perpendicular to, plane of wall.

9.3.1 For anchorage to steel framework provide manufacturer's standard anchors with crimped 1/4" diameter wire anchor section for welding to steel and triangular-shaped wire tie section sized to extend within 1" of masonry face.

A. Wire Size: 0.25" diameter

9.4 RIGID ANCHORS

Provide straps of form and length indicated, fabricated from sheet metal strips of following width and thickness, unless otherwise indicated.

Width: 1"

Thickness: 1/8"

9.5 ANCHOR BOLTS

Provide steel bolts with hex nuts and flat washers complying with ASTM A 307, Grade A, hot-dip galvanized to comply with ASTM C 153, Class C, in sizes and configurations indicated.

9.6 AVAILABLE MANUFACTURERS

Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to, the following:

AA Wire Products Co.
National Wire Products Corp.
Dur-O-Wall, Inc.
Heckman Building Products, Inc.
Hohmann & Barnard, Inc.
Masonry Reinforcing Corp. of America

10.0 **CONCEALED FLASHING MATERIALS**

10.1 VINYL SHEET FLASHING

Flexible sheet flashings especially formulated from virgin polyvinyl chloride with plasticizers and other modifiers to remain flexible and waterproof in concealed masonry applications, black in color and of thickness indicated below:

A. Thickness: 20 mils

10.2 ADHESIVE FOR FLASHINGS

Of type recommended by manufacturer of flashing material for use indicated.

10.3 AVAILABLE PRODUCTS

Subject to compliance with requirements, products which may be incorporated in the work include, but are not limited to, the following:

A. Vinyl Sheet Flashing:

"Vi-Seal Plastic Flashing"; Alco Products, Inc.
"BFG" Vinyl Water Barrier; B.F. Goodrich Co.
"Nuflex"; Sandell Manufacturing Co., Inc.
"Wascoseal"; York Manufacturing, Inc.

11.0 **MISCELLANEOUS MASONRY ACCESSORIES**

11.1 REINFORCING BARS

Deformed steel, ASTM A 615, Grade 60 for bars No. 3 to No. 18.

11.2 NON-METALLIC EXPANSION JOINT STRIPS

Premolded, flexible cellular neoprene rubber filler strips complying with ASTM D 1056, Grade RE41E1, capable of compression up to 35% of width and thickness indicated.

11.3 PREMOLDED CONTROL JOINT STRIPS

Material as indicated below, designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.

A. Styrene-butadiene rubber compound complying with ASTM D 2000, Designation 2AA-805.

11.4 BOND BREAKER STRIPS

Asphalt-saturated organic roofing felt complying with ASTM D 226, Type I (No. 25 asphalt felt).

11.5 WEEPHOLES

Provide the following for weepholes:

A. Plastic Tubing: Medium density polyethylene, outside diameter and length as indicated below:

3/8" x 4"

12.0 **MASONRY CLEANERS**

12.1 JOB-MIXED DETERGENT SOLUTION

Solution of trisodium phosphate (1/2 cup dry measure) and laundry detergent (1/2 cup dry measure) dissolved in one gallon of water.

12.2 ACIDIC CLEANER

Manufacturer's standard strength general purpose cleaner designed for new masonry surfaces of type indicated; composed of blended organic and inorganic acids combined with special wetting systems and inhibitors; expressly approved for intended use by manufacturer of masonry units being cleaned.

- A. Available Products: Subject to compliance with requirements, a product which may be used to clean unit masonry surfaces includes, but is not limited to, the following:

"Sure Klean" No. 600 Detergent; ProSoCo, Inc.
"Euco Murex"; Euclid Chemical Co.

13.0 MORTAR AND GROUT MIXES

13.1 GENERAL

Do not add admixtures including coloring pigments, air-entraining agents, accelerators, retarders, water repellent agents, antifreeze compounds or other admixtures, unless otherwise indicated.

- A. Do not use calcium chloride in mortar or grout.

13.2 MIXING

Combine and thoroughly mix cementitious, water and aggregates in a mechanical batch mixer; comply with referenced ASTM standards for mixing time and water content.

13.3 MORTAR FOR UNIT MASONRY

Comply with ASTM C 270, Proportion Specification, for types of mortar required, unless otherwise indicated.

- A. Limit cementitious materials in mortar to portland cement-lime.
- B. Use Type M mortar for masonry below grade and in contact with earth, and where indicated, and at loadbearing and reinforced masonry walls.
- C. Use Type N mortar for non-loadbearing walls for other applications where another type is not indicated.

13.4 COLORED PIGMENTED MORTAR

Select and proportion pigments with other ingredients to produce color required. Do not exceed pigment-to-cement ratio of 1-to-10, by weight.

13.5 COLORED AGGREGATE MORTAR

Produce mortar of color required by use of colored aggregates in combination with selected cementitious materials.

- A. Mix to match Architect's sample.

13.6 GROUT FOR UNIT MASONRY

Comply with ASTM C 476 for grout for use in construction of reinforced and non-reinforced unit masonry. Use grout of consistency indicated or if not otherwise indicated, of consistency (fine or course) at time of placement which will completely fill all spaces intended to receive grout. Grout shall have the following properties:

- A. Minimum 28 day compressive strength = 2,500 psi.
- B. Slump: 8" for low absorption units and 10" for high absorption units.
- C. Maximum size of large aggregate shall not exceed 3/8" diameter.

14.0 **INSTALLATION, GENERAL**

Before placing, remove loose rust, ice and other coatings from reinforcing.

Build cavity and composite walls, floors and other masonry construction to the full thickness shown. Build single-wythe walls (if any) to the actual thickness of the masonry units, using units of nominal thickness indicated.

Build chases and recesses as shown or required for the work of other trades. Provide not less than 8" of masonry between chase or recess and jamb of openings, and between adjacent chases and recesses.

Leave openings for equipment to be installed before completion of masonry work. After installation of equipment, complete masonry work to match work immediately adjacent to the opening.

Cut masonry units using motor-driven saws to provide clean, sharp, unchipped edges. Cut units as required to provide continuous pattern and to fit adjoining work. Use full-size units without cutting where possible. Use dry cutting saws to cut concrete masonry units.

15.0 **CONSTRUCTION TOLERANCES**

15.1 VARIATION FROM PLUMB

For vertical lines and surfaces of columns, walls and arrises do not exceed 1/4" in 10 ft. or 3/8" in a story height not to exceed 20 ft., nor 1/2" in 40 ft. or more. For external corners, expansion joints, control joints and other conspicuous lines, do not exceed 1/4" in any story or 20 ft. maximum, nor 1/2" in 40 ft. or more. For

vertical alignment of head joints do not exceed plus or minus 1/4" in 10 ft., 1/2" maximum.

15.2 VARIATION FROM LEVEL

For bed joints and lines of exposed lintels, sills, parapets, horizontal grooves and other conspicuous lines, do not exceed 1/4" in any bay or 20 ft. maximum, nor 1/2" in 40 ft. or more.

For top surface of bearing walls to not exceed 1/8" between adjacent floor elements in 10 ft. or 1/16" within width of a single unit.

15.3 VARIATION OF LINEAR BUILDING LINE

For position shown in plan and related portion of columns, walls and partitions, do not exceed 1/2" in any bay or 20 ft. maximum, nor 3/4" in 40 ft. or more.

15.4 VARIATION IN CROSS-SECTIONAL DIMENSIONS

For columns and thickness of walls, from dimensions shown, do not exceed minus 1/4" nor plus 1/2".

15.5 VARIATION IN MORTAR JOINT THICKNESS

Do not exceed bed joint thickness indicated by more than plus or minus 1/8", with a maximum thickness limited to 1/2". Do not exceed head joint thickness indicated by more than plus or minus 1/8".

16.0 LAYING MASONRY WALLS

16.1 GENERAL

Layout walls in advance for accurate spacing of surface bond patterns with uniform joint widths and to accurately locate openings, movement-type joints, returns and offsets. Avoid the use of less-than-half-size units at corners, jambs and wherever possible at other locations.

Lay-up walls to comply with specified construction tolerances with courses accurately spaced and coordinated with other work.

Lay exposed masonry in the bond pattern shown or, if not shown, lay in running bond with vertical joint in each course centered on units in courses above and below. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 2". Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4" horizontal face dimensions at corners or jambs.

16.2 STOPPING AND RESUMING WORK

Rack back 1/2-unit length in each course; do not tooth. Clean exposed surfaces of set masonry, wet units lightly (if required) and remove loose masonry units and mortar prior to laying fresh masonry.

16.3 BUILT-IN WORK

As the work progresses, build-in items specified under this and other sections of these specifications. Fill in solidly with masonry around built-in items.

- A. Fill space between hollow metal frames and masonry solidly with mortar, unless otherwise indicated.
- B. At exterior frames insert extruded polystyrene board insulation around perimeter of frame in thickness indicated but not less than 3/4" to act as a thermal break between frame and masonry.
- C. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath in the joint below and rod mortar or grout with core.
- D. Fill cores in hollow concrete masonry units with grout 3 courses (24") under bearing plates, beams, lintels, posts and similar items, unless otherwise indicated.

17.0 **MORTAR BEDDING AND JOINTING**

17.1 GENERAL

Lay solid concrete masonry units with completely filled bed and head joint; butter ends with sufficient mortar to fill head joints and shove into place. Do not slush head joints.

Lay hollow concrete masonry units with full mortar coverage on horizontal and vertical face shells. Bed webs in mortar in starting course on footings and in all courses of piers, columns and pilasters, and where adjacent to cells or cavities to be reinforced or filled with concrete or grout. For starting course on footings where cells are not grouted, spread out full mortar bed including areas under cells.

Maintain joint widths shown, except for minor variations required to maintain bond alignment. If not shown, lay walls with 3/8" joints.

Cut joints flush for masonry walls which are to be concealed or to be covered by other materials, unless otherwise indicated.

Tool exposed joints slightly concave using a jointer larger than joint thickness, unless otherwise indicated. Rake out mortar in preparation for application of caulking or sealants.

Remove masonry units disturbed after laying; clean and reset in fresh mortar. Do not pound corners or jambs to shift adjacent stretcher units which have been set in position. If adjustments are required, remove units, clean off mortar and reset in fresh mortar.

18.0 HORIZONTAL JOINT REINFORCEMENT

18.1 GENERAL

Provide continuous horizontal joint reinforcement as indicated. Install longitudinal side rods in mortar for their entire length with a minimum cover of 5/8" on exterior side of walls, 1/2" elsewhere. Lap reinforcing minimum of 6".

Cut or interrupt joint reinforcement at control and expansion joints, unless otherwise indicated.

Reinforce walls with continuous horizontal joint reinforcing unless specifically to be omitted.

Provide continuity at corners and wall intersection by use of prefabricated "L" and "T" sections. Cut and bend reinforcement units as directed by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures and other special conditions.

Space continuous horizontal reinforcement as follows:

For single-wythe walls, space reinforcement at 16" o.c. vertically, unless otherwise indicated.

Reinforce masonry openings greater than 1'-0" wide, with horizontal joint reinforcement placed in 2 horizontal joints approximately 8" apart, immediately above the lintel and immediately below the sill. Extend reinforcement a minimum of 2'-0" beyond jambs of the opening except at control joints.

A. In addition to wall reinforcement, provide additional reinforcement at openings
as required to comply with the above.

19.0 ANCHORING MASONRY WORK

19.1 GENERAL

Provide anchor devices of type indicated.

19.2 ANCHOR MASONRY TO STRUCTURAL MEMBERS where masonry abuts or faces structural members to comply with the following:

- A. Provide an open space not less than 1" in width between masonry and structural member, unless otherwise indicated. Keep open space free of mortar or other rigid materials.
- B. Anchor masonry to structural members with flexible anchors embedded in masonry joints and attached to structure.
- C. Embed a minimum of the masonry wythe minus two (2) inches. At such anchorages the masonry wall shall be grouted solid. Weld to the perimeter steel framing.
- D. Space anchors as indicated, but not more than 24" o.c. vertically and 36" o.c. horizontally.

20.0 CONTROL AND EXPANSION JOINTS

20.1 GENERAL

Provide vertical and horizontal expansion, control and isolation joints in masonry where shown. Build-in related items as the masonry work progresses.

Build flanges of metal expansion strips into masonry. Lap each joint 4" in direction of water flow. Seal joints below grade and at junctures with horizontal expansion joints, if any.

Build flanges of factory-fabricated expansion joint units into masonry. See Division-7 section "Elastic Expansion Joints".

Build-in non-metallic joint fillers where indicated.

Build in horizontal pressure relieving joints where indicated; construct joints by either leaving an air space or inserting non-metallic compressible joint filler of width required to permit installation of sealant and backer rod.

Locate horizontal pressure relieving joints beneath shelf angles supporting masonry veneer and attached to structure behind masonry veneer.

21.0 LINTELS

Install steel lintels where indicated.

Provide masonry lintels where shown and wherever openings of more than 1'-0" for brick size units and 2'-0" for block size units are shown without structural steel or other supporting lintels. Provide precast or formed-in-place masonry lintels. Cure precast lintels before handling and installation. Temporarily support formed-in-place lintels.

For hollow concrete masonry unit walls, use specially formed U-shaped lintel units with reinforcement bars placed as shown filled with coarse grout.

Provide minimum bearing of 8" at each jamb, unless otherwise indicated.

22.0 FLASHING OF MASONRY WORK

22.1 GENERAL

Provide concealed flashing in masonry work at, or above, shelf angles, lintels, ledges and other obstructions to the downward flow of water in the wall so as to divert such water to the exterior. Prepare masonry surfaces smooth and free from projections which could puncture flashing. Place through-wall flashing on sloping bed of mortar and cover with mortar. Seal penetrations in flashing with mastic before covering with mortar. Extend flashings through exterior face of masonry and turn down to form drip.

Extend flashing the full length of lintels and shelf angles and minimum of 4" into masonry each end. Extend flashing from exterior face of outer wythe of masonry, through the outer wythe, turned up a minimum of 4", and through the inner wythe to within 1/2" of the interior face of the wall in exposed work. Where interior surface of inner wythe is concealed by furring, carry flashing completely through the inner wythe and turn up approximately 2". At heads and sills turn up ends not less than 2" to form a pan.

Install flashing to comply with manufacturer's instructions. Provide weep holes in the head joints of the first course of masonry immediately above concealed flashings. Space 24" o.c., unless otherwise indicated.

Install reglets and nailers for flashing and other related work where shown to be built into masonry work.

23.0 INSTALLATION OF REINFORCED UNIT MASONRY

Provide vertical wall reinforcing as shown and specified.

Fully embed reinforcement in concrete fill (grout). Provide all required metal accessories to insure accurate alignment of reinforcement during grout filling operation.

Place grout in cells by either the low-lift or high-lift grouting technique in accordance to NCMA TED Bulletin #23A, "Grouting for Concrete Masonry Walls."

24.0 REPAIR, POINTING AND CLEANING

24.1 GENERAL

Remove and replace masonry units which are loose, chipped, broken, stained or otherwise damaged, or if units do not match adjoining units as intended. Provide new units to match adjoining units and install in fresh mortar or grout, pointed to eliminate evidence of replacement.

24.2 POINTING

During the tooling of joints, enlarge any voids or holes, except weep holes, and completely fill with mortar. Point-up all joints including corners, openings and adjacent work to provide a neat, uniform appearance, prepared for application of sealants.

24.3 FINAL CLEANING

After mortar is thoroughly set and cured, clean masonry as follows:

- A. Remove large mortar particles by hand with wooden paddles and non-metallic scrape hoes or chisels.
- B. Test cleaning methods on sample wall panel; leave 1/2 panel unclean for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
- C. Protect adjacent stone and non-masonry surfaces from contact with cleaner by covering them with liquid strippable masking agent, polyethylene film or waterproof masking tape.
- D. Saturate wall surfaces with water prior to application of cleaners' remove cleaners promptly by rinsing thoroughly with clear water.
- E. Clean concrete unit masonry to comply with masonry manufacturer's directions and applicable NCMA "Tek" bulletins.

24.4 PROTECTION

Provide final protection and maintain conditions in a manner acceptable to Installer, which ensures unit masonry work being without damage and deterioration at time of substantial completion.

25.0 PAYMENT

25.1 MEASUREMENT AND PAYMENT

Payment will be based on one of the following criteria as specified in the Contract Bid Item Descriptions and/or on the Drawings:

- a) Cost shall be included in the work to which it is subsidiary and no separate measurement and payment will be made.
- b) Payment will be based on Plan Quantities or a percentage installed to complete the structure as computed by the Engineer or as shown on the Drawings.

Payment as specified above shall be considered as full compensation for all labor, materials, equipment and incidentals necessary to perform the work as required.



SECTION 05002

ANCHOR BOLTS AND EXPANSION ANCHORS

1. SCOPE. This section covers cast-in-place anchor bolts and expansion anchors to be installed in hardened concrete.

The General Equipment Stipulations set forth additional requirements for anchor bolts for equipment.

2. GENERAL. Unless otherwise specified or indicated on the drawings, all anchor bolts shall be cast-in-place bolts and shall have a minimum 3/4 inch diameter. Anchor bolts and expansion anchors for buried and immersion service and in splash zones shall be galvanized or zinc plated. All other anchor bolts and expansion anchors shall be carbon steel unless otherwise specified or indicated on the drawings.

3. MATERIALS.

Bolts and Nuts

Carbon Steel ASTM A307.

Stainless Steel IFI-104, Grade 303 or 305.

Galvanized Steel Carbon steel bolts and nuts; hot-dip galvanized ASTM A153 and A385, or zinc plated ASTM A164 Type GS.

Flat Washers ANSI B18.22.1; of the same material as bolts and nuts.

Expansion Anchors

For Concrete Fed Spec FF-S-325; wedge type, Group II, Type 4, Class 1 or 2; self-drilling type, Group III, Type 1; or nondrilling type, Group VIII, Type 1 or 2; Phillips, Hilti, Rawlplug, USM< or Wej-It.

4. ANCHOR BOLTS. Anchor bolts shall be delivered in time to permit setting when structural concrete is placed. Anchor bolts which are cast-in-place in concrete shall be provided with sufficient threads to permit a nut to be installed on the concrete side of the concrete form or supporting template.

Two nuts, a jam nut, and washer shall be furnished for anchor bolts indicated on the drawings to have lock nuts; two nuts and a washer shall be furnished for all other anchor bolts.

5. EXPANSION ANCHORS. Expansion anchors shall be installed in conformity with the manufacturer's recommendations for maximum holding power, but in no case shall the depth of hole be less than four bolt hole diameters. Minimum distance between the center of any expansion anchor and an edge or exterior corner of concrete shall be at least 4-1/2 times the diameter of the hole in which the anchor is installed. Unless otherwise indicated on the drawings, the minimum distance between the centers of expansion anchors shall be at least 8 times the diameter of the hole in which the anchors are installed.

Nuts and washers for expansion anchors shall be as specified for anchor bolts.

6. PAYMENT

No separate payment will be made for any anchors. Cost for these items shall be included in the items to which they are subsidiary in the Bid Schedule and no measurement of the quantities will be made.

SECTION 05003

MISCELLANEOUS METALS

1.0 GENERAL

The Contractor shall furnish all labor, materials, equipment and services necessary for fabrication and erection of all miscellaneous steel angles, beams, plates and channels as shown on the Drawings and specified herein and not specifically included under other sections of these Specifications.

1.1 QUALITY ASSURANCE STANDARDS

A. Codes and Standards: All work shall comply with provisions of following, except as otherwise indicated:

1. AISC "Code of Standard Practice for Steel Buildings and Bridges".
2. Paragraph 4.2.1 of the above code is hereby modified by deletion of the following sentence: "This approval constitutes the owner's acceptance of all responsibility for the design adequacy of any connections designed by the fabricator as a part of his preparation of these shop drawings."
3. AISC "Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings", including "Commentary" and Supplements thereto as issued.
4. AISC "Specifications for Structural Joints using ASTM A 325 or A 490 Bolts" approved by the Research Council on Riveted and Bolted Structural Joints of the Engineering Foundation.
5. AWS D1.1 "Structural Welding Code".
6. ASTM A 6 "General Requirements for Delivery of Rolled Steel Plates, Shapes, Sheet Piling and Bars for Structural Use".

B. Qualifications for Welding Work: Qualify welding processes and welding operators in accordance with AWS "Standard Qualification Procedure".

1. Provide certification that welders to be employed in work have satisfactorily passed AWS qualification tests.
 - a) If recertification of welders is required, retesting will be Contractor's responsibility.

1.2 SUBMITTALS

Shop drawings, giving complete information necessary for fabrication, layout and installation of all metal work, shall be submitted to the Engineer for approval prior to fabrication.

The preparation of shop drawings for fabricated metal items shall be coordinated by the Contractor with the manufacturers of various equipment in order to comply with details, locations, openings, etc. required by the manufacturers.

Field measurements shall be made to verify all dimensions in the field, which may affect installation of work before shop drawings are made and/or fabrication is performed.

2.0 MATERIALS

2.1 STRUCTURAL METALS

2.1.1 Steel wide flange shapes shall conform to the requirements of ASTM A 992, grade 50. All other shapes, plates and bars shall be ASTM A36, or ASTM A 572, grade 50. (Non-exposed and interior)

2.1.2 Aluminum shall conform to the requirements of ASTM B209, alloy 6061-T6.

2.2 ANCHORAGE ITEMS

The Contractor shall furnish all bolts, nuts, shims, pins, screws, straps, nails and other anchors, which may be required by the Drawings or job conditions, to secure all items permanently in place, whether or not specifically called for or shown on the Drawings.

3.0 EXECUTION

3.1 FABRICATION AND INSTALLATION OF METAL WORK

All metal items shall be accurately fabricated and erected with exposed joints close fitting. All joints shall be of such character and so assembled that they will be as strong and rigid as adjoining sections. Joints shall be located where least conspicuous. Items shall have smooth finished surfaces except where otherwise shown or specified.

Where welding is required or permitted, it shall conform to the requirements for shielding metal arc welding of the Standard Code for Arc and Gas Welding in Building Construction of the American Welding Society. Shop drawings shall show welding and shall indicate the size, length, spacing and type of welds.

Joints required to be welded shall be continuously welded or spot-welded as specified and face of welds dressed flush and smooth where exposed to view.

Members or parts to be built in with masonry or concrete shall be in a form affording a suitable anchorage or shall be provided with approved anchors, expansion shields or other approved means of securing members.

Ferrous and non-ferrous metals shall be insulated at all contacts with felt washers, strips or sheets, bitumastic paints, or other approved means.

3.1.1 All required anchors, couplings, bolts, and nuts required to support miscellaneous metal work shall be furnished and installed as required.

3.1.2 Weights of connections and accessories shall be adequate to safely sustain and withstand stresses and strains to which they will be normally subjected.

3.1.3 Connections shall be bolted except where welding is called for in the Drawings. Bolts shall have a minimum of 1/2-inch diameter unless noted or required otherwise.

3.1.4 Accurately place all miscellaneous metal items in the locations and to the required elevations.

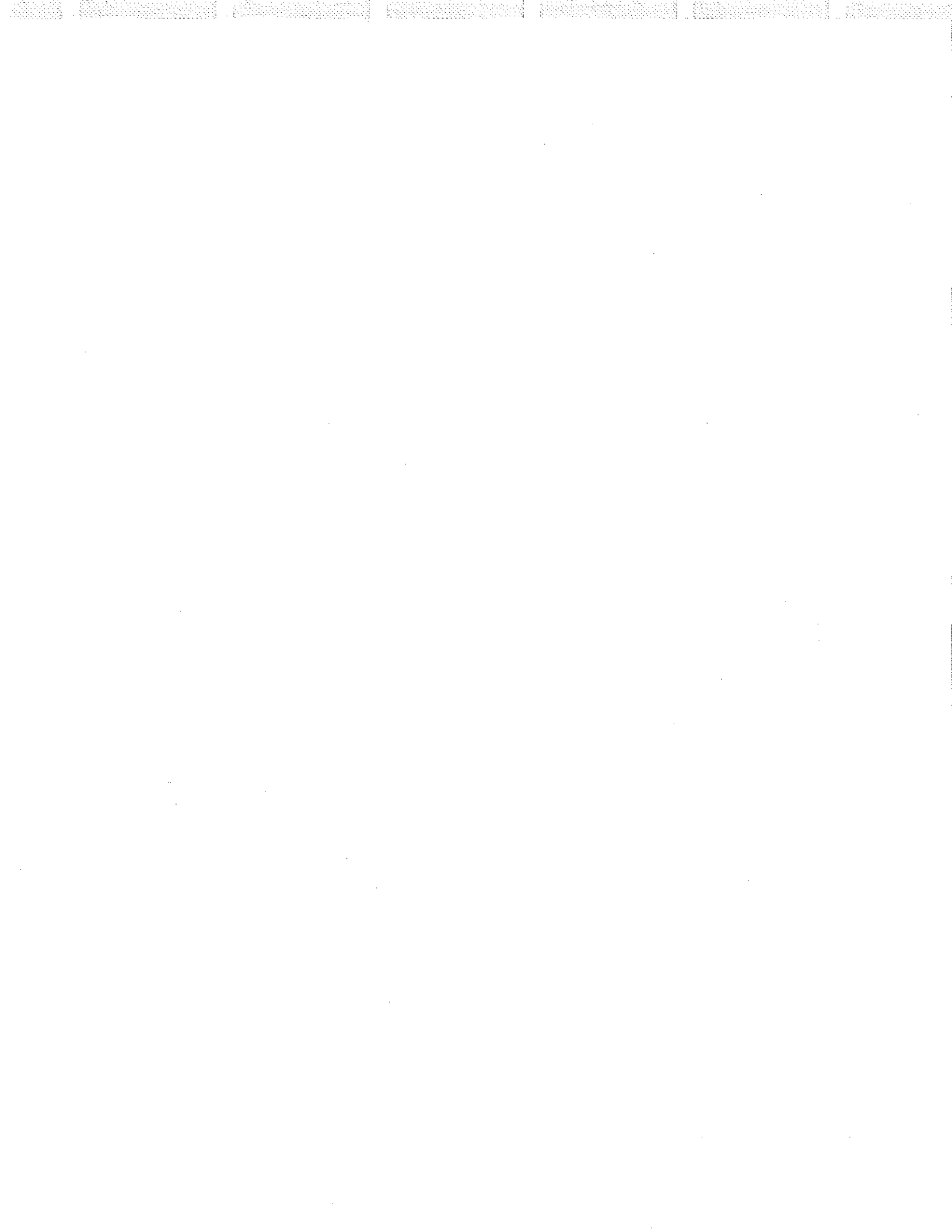
3.1.5 Adequately brace any items which are cast in concrete masonry work.

3.1.6 Use concealed anchors wherever possible.

3.2 CLEANING

Remove and properly dispose of all debris and litter; leave the work area in a clean condition.

END OF SECTION 05003



SECTION 05120

STRUCTURAL STEEL

1.0 GENERAL

1.1 REFERENCES

A. The following is a list of standards, which may be referenced in this Section:

1. American Institute of Steel Construction (AISC):
 - a. Specification for Structural Steel Buildings-Allowable Stress Design and Plastic Design.
 - b. Allowable Stress Design Specification for Structural Joints using ASTM A325 or A490 Bolts.
 - c. Code of Standard Practice for Steel Buildings and Bridges.
 - d. AISC Quality Certification Program.
2. American Society for Testing and Materials (ASTM):
 - a. A36 or A992, Standard Specification for Structural Steel.
 - b. A53, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
 - c. A242, High-strength Low-alloy Structural Steel.
 - d. A325, Standard Specification for High-Strength Bolts for Structural Steel Joints.
 - e. A490, Standard Specification for Heat-Treated Steel Structural bolts, 150 ksi Minimum Tensile Strength.
 - f. A500, Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
 - g. A501, Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
 - h. A563, Standard Specification for Carbon and Alloy Steel Nuts.
 - i. F436, Standard Specification for Hardened Steel Washers.
 - j. F959, Standard Specification for Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners.
3. American Society of Nondestructive Testing (ASNT): SNT-TC- I A, Recommended Practice.
4. American Welding Society (AWS):
 - a. B2.1, Standard for Welding Procedure and Performance Qualification.
 - b. D1.1, Structural Welding Code-Steel.
 - c. QC I, Standard and Guide for Qualification and Certification of Welding Inspectors.

1.2 SUBMITTALS

A. Shop Drawings:

1. Provide details showing:
 - a. Erection plans.
 - b. Members and their connections.
 - c. Anchor bolt layouts.
 - d. Hardened washer details.
 - e. Joint details for complete penetration welds.
 - f. Schedules for fabrication procedures.
2. Name and address of manufacturer(s).
3. Product specifications.
4. Manufacturers' testing procedures and standards.
5. Preparation and installation or application instructions, as appropriate.

B. Quality Control Submittals:

1. Mill Certificates.
2. High-Strength Bolts (Zinc-Coated):
 - a. Certificates of Compliance that products meet chemical and mechanical requirements of standards specified.
 - b. Manufacturer's inspection test report results for production lot(s) furnished, to include:
 1. Tensile strength.
 2. Yield strength.
 3. Reduction of area.
 4. Elongation and hardness.
 - c. Certified Mill Test Reports for Bolts and Nuts:
 1. Name and address of manufacturer.
 2. Bolts correctly marked.
 3. Marked bolts and nuts used in required mill tests and manufacturer's inspection tests.
3. Direct Tension Indicators: Furnish manufacturer's test report meeting requirements of ASTM F959.
4. Methods proposed to resolve misalignment between anchor bolts and bolt holes in steel members.

C. Fabricator Certification :

1. The structural steel fabrication shop shall be certified by the American Institute of Steel Construction in the categories of Conventional Steel Structures and Complex Steel Structures as minimum and endorsed for Sophisticated Paint Category. Submit a copy of the current certification for

ENGINEER's review and approval. At the completion of fabrication, the fabricator shall submit to the ENGINEER a certificate of compliance addressed to the building official stating that the work was performed in accordance with the approved construction documents and Change/Field Orders.

D. Erector Certification:

1. The structural steel erector shall be certified by the American Institute of Steel Construction in the categories of Certified Steel Erector as minimum. Submit a copy of the current certification for ENGINEER's review and approval. At the completion of erection of structural steel, the erector shall submit to the ENGINEER, a certificate of compliance addressed to the building official stating that the work was performed in accordance with the approved construction documents and Change/Field Orders.

1.3 QUALITY ASSURANCE

A. Qualifications:

1. Welder/Welding Operator: In accordance with AWS D1.1.1

B. Special Inspection (Kentucky Building Code 2007, Section 1704) :

1. Special Inspections to be performed under this contract is listed under General Provisions of Structural Drawings. If special inspection is required, Owner will retain the services of a Special Inspector and this Contractor is responsible for providing safe access to all areas of His/Her work for inspection at no additional cost to the Owner or His/Her Agents.
2. The extent of special inspection to be performed is listed in Table 1704.3 of the Kentucky Building Code 2007 (KBC 2007).

C. Fabricator Certification :

1. The structural steel fabrication shop shall be certified by the American Institute of Steel Construction (AISC) in the categories of Conventional Steel Structures and Complex Steel Structures as minimum and endorsed for Sophisticated Paint Category. At the completion of fabrication, the fabricator shall submit a certificate of compliance addressed to the building official stating that the work was performed in accordance with the approved construction documents and Change/Field Orders.
2. If the Fabricator is not certified by the AISC, Special Inspection of the fabrication of the structural steel shall be performed, by the ENGINEER approved Special Inspector according to Article 1704.2 of the KBC 2007

and the cost of Special Inspection shall be back-charged to the Steel Fabricator.

D. Erector Certification :

1. The structural steel erector shall be certified by the American Institute of Steel Construction in the categories of Certified Steel Erector as minimum. At the completion of erection of the structural steel, the erector shall submit a certificate of compliance addressed to the building official stating that the work was performed in accordance with the approved construction documents and Change/Field Orders.
2. If the Erector is not certified by the AISC, Special Inspection of the erection of the structural steel shall be performed, by the ENGINEER approved Special Inspector according to Article 1704.3 of the KBC 2007 and the cost of Special Inspection shall be back-charged to the Steel Erector.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Delivery: Load structural members in such a manner that they will be transported and unloaded without damage to coatings and without being excessively stressed, deformed, or otherwise damaged.
- B. Storage:
1. Protect structural steel members and packaged materials from corrosion and deterioration.
 2. Store in dry area and not in direct contact with ground.
 3. Protect fasteners from dirt and moisture. Do not remove lubricant from bolts and nuts.
- C. Handle materials to avoid distortion or damage to members or supporting structures.

2.0 **PRODUCTS**

2.1 MATERIALS

- A. Steel wide flange shapes: ASTM A992, Grade 50, unless otherwise shown.
- B. Rolled Plates, Shapes, and Bars: ASTM A36, Grade 36, unless otherwise shown.
- C. Structural Steel Pipe: ASTM A501 or ASTM A53, Type E or S, Grade B.

D. Structural Tubing: ASTM A500, Grade B (fy equals 46 ksi); provide full-length members without splices unless otherwise noted or approved.

E. Welding Materials: AWS D1.1.1, E70XX

2.2 FASTENERS

A. Anchor Bolts: ASTM A-36 or ASTM A-307

B. High-Strength Bolts: ASTM A325 or ASTM A490, bolt type 1, zinc coated. Bolt length and thread length shall be as required for the connection type shown, with hardened washers as required.

C. Direction Tension Indicators (DTIs or Load Indicator Washers):

1. ASTM F959, coating type to match bolt finish.
2. Manufacturer: J&M Turner, Southampton, PA.

D. Tension-Control Bolts:

1. High-strength, ASTM A325 or ASTM 490.
2. Manufacturers:
 - a. LeJeune Bolt Company, Lakeville, MN.
 - b. Nucor Fasteners, Saint Joe, IN.
 - c. Bristol Machine Co., Walnut, CA.

E. Nuts: ASTM A563, type to match bolt type and finish.

F. Hardened Washers: ASTM F436, type to match bolt finish.

G. Welded Anchor Studs:

1. Headed concrete anchor studs (HAS), deformed bar anchors (DBA), or threaded anchor studs (TAS), as shown.
2. Manufacturer: Nelson Stud Welding Co., Loraine, OH.

2.3 ANCILLARY MATERIALS

A. Surface Preparation and Primer: As specified in Section 9900, PAINTING

B. Grout: Non-shrink grout as specified in Section 03310.

2.4 FABRICATION

A. General:

1. Fabricate as shown and in accordance with AISC Specifications.

2. Mark and match mark materials for field assembly.
3. Complete assembly, including bolting and welding of units, before start of finishing operations.
4. Fabricate to agree with field measurements.

B. Connections:

1. Shop Connections: Weld or bolt, as shown.
2. Develop full strength of members joined and meet requirements of AISC Manual of Steel Construction tables for bolted double-angle shear connections, unless otherwise shown.

C. Welded Construction:

1. Comply with AWS D1.1 for procedures, appearance, and quality of welds, and methods used in correcting welding.
2. Groove and Butt Welds: Complete penetration unless otherwise specified.

D. Interface with Other Work:

1. Holes:
 - a. As necessary or as indicated for securing other Work to structural steel framing, and for passage of other Work through steel framing members.
 - b. No flame-cut holes will be permitted without prior approval of the ENGINEER.
2. Weld threaded nuts to framing, and other specialty items as shown to receive other Work.

E. Shop Paint Primer:

1. Surface Preparation: Clean and remove slag from welds before painting.
2. Coat members with primer except at future field welds, bolt-ups, and concrete embedment.
3. Apply primer in accordance with Section 9, PAINTING within 8 hours after surface preparation.

F. Slip-Critical Bolted Connections:

1. Mask faying surfaces of slip-critical bolted connections to be shop painted, or blast clean and coat with a Class A paint as specified in Section 9, PAINTING.
2. Roughen galvanized faying surfaces with hand wire brushing.

3.0 EXECUTION

3.1 ERECTION

- A. Meet requirements of AISC Code of Standard Practice for Steel Buildings and Bridges.
- B. Install CONTRACTOR-designed temporary construction bracing to provide necessary support until all components are in place and construction is complete.
- C. High-Strength Bolted Connections:
 - 1. Tighten in accordance with AISC Specification for Structural Joints Using ASTM A325 or A490 Bolts.
 - 2. Hardened Washers:
 - a. Provide at locations required by Washer Requirements section of AISC Specification for Structural Joints Using ASTM A325 or A490 Bolts, to include all slip-critical connections using slotted or oversized holes or A490 bolts.
 - b. Use beveled style and extra thickness where required by AISC Specification.
 - c. Do not substitute Direct Tension Indicators (DTI) for hardened flat washers required at slotted and oversize holes.
 - 3. For bearing-type connections not fully tensioned, tighten to snug-tight condition. Use a hardened washer over slotted or oversize holes in outer plies.
 - 4. Tension-control bolts may be used in snug-tight bearing connections only.
- D. Fully Tensioned Bolted Connections:
 - 1. Use DTIs at all slip-critical and fully tensioned bearing-type connections.
 - 2. Position within bolted assembly in accordance with ASTM F959.
 - 3. Install bolts, with DTIs plus hardened washers as required, in all holes of an assembly and tighten until all plies are in firm contact and fasteners are uniformly snug tight.
 - 4. Final tighten all bolts, beginning at the most rigid part of the bolted connection and progressing toward the free edges, until the DTI's have been compressed to an average gap equal to or less than shown in Table 2, ASTM F959.

3.2 ANCHOR BOLTS

- A. Coordinate installation of anchor bolts and other connectors required for securing structural steel to in-place work.

- B. Provide templates and other devices for presetting bolts and other anchors to accurate locations.

3.3 SETTING BASES AND BEARING PLATES

- A. Clean concrete and masonry bearing surfaces of bond reducing materials and roughen to improve bond to surfaces.
- B. Clean bottom surface of base and bearing plates.
- C. Set loose and attached baseplates and bearing plates for structural members on wedges, leveling nuts, or other adjustable devices.
- D. Tighten anchor bolts after supported members have been positioned and plumbed.
- E. Grout Under Baseplates: As specified in Section 03310, prior to placing loads on structure.

3.4 FIELD ASSEMBLY

- A. Set structural frames accurately to lines and elevations shown.
- B. Align and adjust various members forming a part of a complete frame or structure before permanently fastening.
- C. Clean bearing surfaces and other surfaces that will be in permanent contact before assembly.
- D. Perform necessary adjustments to compensate for minor discrepancies in elevations and alignment.
- E. Level and plumb individual members of structure within tolerances shown in AISC Code of Standard Practice for Steel Buildings and Bridges.
- F. Establish required leveling and plumbing measurements on mean operating temperature of structure.
- G. Provide additional field connection material as required by AISC Code of Standard Practice for Steel and Bridges.

3.5 MISFITS AT BOLTED CONNECTIONS

- A. Where misfits in erection bolting are encountered, immediately notify ENGINEER for approval of one of the following methods of correction:
 - 1. Ream holes that must be enlarged to admit bolts and use oversized bolts.

2. Plug weld misaligned holes and re-drill 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 members containing misfit, incorrect sized or misaligned holes and fabricate a new member to ensure proper fit.
5. Do not enlarge incorrectly sized or misaligned holes in members by burning or by use of drift pins.

3.6 MISFITS AT ANCHOR BOLTS

- A. Resolve misalignments between anchor bolts and bolt holes in steel members in accordance with approved submittal.
- B. Do not flame cut to enlarge holes.

3.7 GAS CUTTING

- A. Do not use gas cutting torches in field for correcting fabrication errors in structural framing.
- B. Secondary members not under stress and concealed in finished structure may be corrected by gas cutting torches, if approved by ENGINEER.
- C. Finish flame-cut sections equivalent to sheared and punched appearance.

3.8 PAINTING TOUCHUP

- A. Immediately after erection, clean field welds, bolted connections, and abraded areas of slag and shop paint primer.
- B. Apply touchup paint primer by brush or spray of same thickness and material as that used in shop application and as specified in Section 9, PAINTING.

3.9 FIELD QUALITY CONTROL-BOLTED CONNECTIONS

- A. High-Strength Bolted Connections: All high-strength bolted connections will be inspected by an independent testing agency, retained by the Owner in accordance with the AISC Specification for Structural Joints Using ASTM A325 or A490 Bolts and per KBC 2007 and 2003 Supplements as follows:
 1. Marking identification and conformance to ASTM standards.
 2. Alignment of bolt holes.
 3. Placement, type, and thickness of hardened washers.
 4. Tightening of bolts.
- B. Bearing-Type Connections Not Fully Tensioned: Snug-tight condition with all plies of the joint in firm contact.

C. Fully Tensioned Bearing and Slip-Critical Connections:

1. Conduct Pre-Installation Test.
2. Monitor installation and tightening of DTI's.
3. Monitor condition of faying surfaces for slip-critical connections.

D. Pre-Installation Test:

1. Conduct jobsite test prior to start of work using a bolt tension measuring device.
2. Select representative sample of not less than three bolts of each diameter, length, and grade.
3. Include DTI's and flat hardened washers as required to match actual connection assembly.
4. Conduct test in accordance with the Specification for Structural Joints Using ASTM A325 or A490 Bolts.

E. Nondestructive Testing (NDT) Report: Prepare and submit a written NDT report identifying location of inspected bolted connections and summary of corrections as required to meet code acceptance criteria.

F. Defective Connections: All defective and improperly tightened high-strength bolted connections shall be corrected.

3.10 FIELD QUALITY CONTROL -- WELDED CONNECTIONS

A. All welded connections for structural steel shall be inspected and tested by an independent testing agency, retained by the Owner in accordance with the AWS D1.1 Structural Welding Code.

B. Selection of Welds to be Tested: As per Special Inspection requirements of the KBC 2007.

C. Unless otherwise specified, the Special Inspector retained by the Owner will perform nondestructive testing (NDT) of welds in accordance with Chapter 6 of AWS D1.1 and per the Section 1704 of the Kentucky Building Code 2007.

1. Butt Joint Welds: 10 percent randomly radiographically tested and repaired.
2. Groove Welds: 10 percent randomly ultrasonically tested and repaired.
3. Fillet Welds: 10 percent randomly examined and repaired, using either dye penetrant or magnetic particle inspection methods.
4. All Welds: 100 percent visually inspected.

D. The certified welding Special Inspector shall be present whenever field welding is performed and shall:

1. Verify conformance of specified job material and proper storage.
 2. Monitor conformance with approved welding procedure specifications.
 3. Monitor conformance of welder/welding operator qualification.
 4. Provide 100 percent visual inspection of all welds.
 5. Supervise nondestructive testing personnel and evaluate test results.
 6. Maintain records and prepare report confirming results of inspection and testing.
- E. Defective Connections: All defective welds shall be repaired and retested until certified acceptable in accordance with AWS D1.1.1

END OF SECTION 05120

SECTION 07214

FOAMED-IN-PLACE MASONRY WALL INSULATION

1.0 GENERAL

1.1 SUMMARY

- A. Extent of insulation work is shown on drawings and indicated by provisions of this section.
- B. Applications of insulation specified in this section include the following:
 - 1. Foamed-in-Place masonry insulation for thermal, sound and fire resistance values.

1.2 SUBMITTALS

- A. Product and technical presentation as provided by the manufacturer.
- B. Certified Test Reports: With product data, submit copies of certified test reports showing compliance with specified performance values, including R-values, fire performance and sound abatement characteristics.
- C. Material Safety Data Sheet: Submit Material Safety Data Sheet complying with OSHA Hazard Communication Standard, 29 CFR 1910 1200.

1.3 QUALITY ASSURANCE

- A. Manufacturing Standards: Provide insulation produced by a single and approved manufacturer. The product must come from the manufacturer pre-mixed to ensure consistency.
- B. Installer Qualifications for Foamed-in-Place Masonry Insulation: Engage an experienced dealer/applicator who has been trained and licensed by the product manufacturer and which has not less than ten (10) years direct experience in the installation of the product used.
- C. Warranty: Upon request, a one year product and installation warranty will be issued by both the manufacturer and installer.

- D. Fire Performance Characteristics: Provide insulation materials which are identical to those whose fire performance characteristics, as listed for each material or assembly of which insulation is a part, have been determined by testing, per methods indicated below, by a testing agency acceptable to authorities having jurisdiction.
- E. Insurance: Insulation Subcontractor shall carry Products and Completed Operations Insurance with minimum liability limits of \$5,000,000.

Product must be classified by Underwriters Laboratory^R (“UL”) as to Surface Burning Characteristics

Fire Resistance Ratings:	ASTM E-119
Surface Burning Characteristics:	ASTM E-84
Combustion Characteristics:	ASTM E-136

2.0 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Manufacturers of Foamed-in-Place Masonry Insulation: Subject to compliance with requirements, provide products from the following:
1. **“Core-Fill 500TM”** – Tailored Chemical Products, P.O. Drawer 4186, Hickory, NC 28663, 800-627-1687.
 2. Air Krete, Inc.
P.O. Box 380
Weedsport, NY 13166
 3. CP Chemical Co. (Tripolymer)
White Plains, NY

2.2 INSULATING MATERIALS

- A. General: Provide insulating materials which comply with requirements indicated for materials, compliance with referenced standards, and other characteristics.
- B. Foamed-in-Place Masonry Insulation: Two (2) component thermal insulation produced by combining a plastic resin and catalyst foaming agent surfactant which, when properly ratioed and mixed, together with compressed air produce a cold-setting foam insulation in the hollow cores of hollow unit masonry walls.

1. Fire-Resistance Ratings: Minimum four (4) hour fire resistance wall rating (ASTM E-1 19) for 8-inch (8") and 12-inch (12") concrete masonry units when used in standard two (2) hour rated CMUs.
2. Surface Burning Characteristics: Maximum flame spread, smoke developed and fuel contributed of 0, 5 and 0 respectively.
3. Combustion Characteristics: Must be noncombustible, Class A building material.
4. Thermal Values: "R" Value of 4.91/inch @ 32 degrees F mean; ASTM C-177.
5. Sound Abatement: Minimum Sound Transmission Class ("STC") rating of 53 and a minimum Outdoor Indoor Transmission Class ("OITC") rating of 44 for 8-inch (8") wall assembly (ASTM E 90-90).

3.0 EXECUTION

3.1 INSPECTION AND PREPARATION

A. Application Assemblies:

1. Block Walls: 6", 8", 10" or 12" concrete masonry units
2. Cavity Walls: 2" cavity of greater

3.2 INSTALLATION OF FOAMED-IN-PLACE INSULATION

- A. General: Install foamed-in-place insulation from interior, or as specified, prior to installation of interior finish work and after all masonry and structural concrete work is in place; comply with manufacturer's instructions.
- B. Installation: Fill all open cells and voids in hollow concrete masonry walls where shown on drawings. The foam insulation shall be pressure injected through a series of 5/8" to 7/8" holes drilled into every vertical column of block cells (every 8" on center) beginning at an approximate height of four (4) feet from finished floor level. Repeat this procedure at an approximate height of ten (10) feet above the first horizontal row of holes (or as needed) until the void is completely filled. Patch holes with mortar and score to resemble existing surface.

4. MEASUREMENT AND PAYMENT

Payment shall be included in the work to which it is subsidiary unless otherwise shown in the Bid Schedule.

- End of Section -

SECTION 08110

STEEL DOORS AND FRAMES

1.0 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specifications, apply to this Section.

1.2 SUMMARY

A. Section Includes:

- 1. Standard hollow metal doors and frames.

B. Related Sections

- 1. Division 4 Section "Unit Masonry Assemblies" for embedding anchors for hollow metal work into masonry construction.
- 2. Division 8 Section "Fiberglass Reinforced Plastic (FRP) Doors and Frames" for doors and frames manufactured from Fiberglass Reinforced Plastic (FRP).
- 3. Division 8 Section "Door Hardware" for door hardware for hollow metal doors.
- 4. Division 9 Sections "Exterior Painting" and "Interior Painting" for field painting hollow metal doors and frames.

1.3 DEFINITIONS

- A. Minimum Thickness: Minimum thickness of base metal without coatings.
- B. Standard Hollow Metal Work: Hollow metal work fabricated according to ANSI/SDI A250.8.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions and finishes.

B. Shop Drawings: Include the following:

1. Elevations of each door design.
2. Details of doors, including vertical and horizontal edge details and metal thickness.
3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
4. Locations of reinforcement and preparations for hardware.
5. Details of each different wall opening condition.
6. Details of anchorages, joints, field splices and connections.
7. Details of accessories.
8. Details of moldings, removable stops and glazing.

C. Other Action Submittals:

1. Schedule: Provide a schedule of hollow metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with door hardware schedule.

D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each type of hollow metal door and frame assembly.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain hollow metal work from single source from single manufacturer.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Deliver hollow metal work palletized, wrapped or crated to provide protection during transit and Project site storage. Do not use nonvented plastic.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch (102 mm) high wood blocking. Do not store in a manner that traps excess humidity.
 - 1. Provide minimum ¼ inch (6 mm) space between each stacked door to permit air circulation.

1.7 PROJECT CONDITIONS

- A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.8 COORDINATION

- A. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts and items with integral anchors. Deliver such items to Project site in time for installation.

2.0 **PRODUCTS**

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Ceco Door Products; an Assa Abloy Group company.
 - 2. Curries Company; an Assa Abloy Group company.
 - 3. Security Metal Products Corp.
 - 4. Steelcraft; an Ingersoll-Rand company.

2.2 MATERIALS

- A. Cold Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

- B. Hot Rolled Steel Sheet: ASTM A 1011-A 1011M, Commercial Steel (CS), Type B; free of scale, pitting or surface defects; pickled and oiled.
- C. Metallic Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.
- D. Frame Anchors: ASTM A 591/A 591M, Commercial Steel (CS), 40Z (12G) coating designation; mill phosphatized.
 - 1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot dip galvanized according to ASTM A 153/A 153M, Class B.
- E. Inserts, Bolts and Fasteners: Hot dip galvanized according to ASTM A 153/A 153M.
- F. Powder Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion resistant materials, with clips or other accessory devices for attaching hollow metal frames of type indicated.
- G. Grout: ASTM C 476, except with a maximum slump of 4 inches (102 mm), as measured according to ASTM C 143/C 143.
- H. Mineral Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool with 6 to 12 lb/cu ft. (96 to 192 kg/cu m) density; with maximum flame spread and smoke development indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.
- I. Glazing: Comply with requirements in Division 8 Section "Glazing".
- J. Bituminous Coating: Cold applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil (0.4 mm) dry film thickness per coat. Provide inert type noncorrosive compound free of asbestos fibers, sulfur components and other deleterious impurities.

2.3 STANDARD HOLLOW METAL DOORS

- A. General: Provide doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces unless otherwise indicated. Comply with ANSI/SDI A250.8.

1. Design: Flush panel.
 2. Core Construction: Manufacturer's standard kraft paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral board or vertical steel stiffener core.
 3. Vertical Edges for Single Acting Doors: Beveled edge.
 - a. Beveled Edge: 1/8 inch in 2 inches (3 mm in 50 mm).
 4. Top and Bottom Edges: Closed with flush or inverted 0.042 inch (1.0 mm) thick, end closures or channels of same material as face sheets.
 5. Tolerances: Comply with SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames".
- B. Exterior Doors: Face sheets fabricated from metallic coated steel sheet. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:
1. Level 3 and Physical Performance Level A (Extra Heavy Duty), Model 2 (Seamless).
 - a. Width: 1 3/4 inches (44.5 mm).
- C. Interior Doors: Face sheets fabricated from cold rolled steel sheet unless metallic coated sheet is indicated. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:
1. Level 3 and Physical Performance Level A (Extra Heavy Duty), Model 2 (Seamless).
 - a. Width: 1 3/4 inches (44.5 mm).
- D. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.
- E. Fabricate concealed stiffeners and hardware reinforcement from either cold or hot rolled steel sheet.

2.4 STANDARD HOLLOW METAL FRAMES

- A. General: Comply with ANSI/SDI A250.8 and with details indicated for type and profile.
- B. Exterior Frames: Fabricated from metallic coated steel sheet.
 - 1. Fabricate frames with mitered or coped corners.
 - 2. Fabricate frames as full profiled welded unless otherwise indicated.
 - 3. Frames for Level 3 Steel Doors: 0.053 inch (1.3 mm) thick steel sheet.
- C. Interior Frames: Fabricated from cold rolled steel sheet.
 - 1. Fabricate frames with mitered or coped corners.
 - 2. Fabricate frames as full profile welded unless otherwise indicated.
 - 3. Fabricate knocked down, drywall slip-on frames for in place gypsum board partitions.
 - 4. Frames for Level 3 Steel Doors: 0.053 inch (1.3 mm) thick steel sheet.
 - 5. Frames for Wood Doors: 0.053 inch (1.3 mm) thick steel sheet.
 - 6. Frames for Borrowed Lights: 0.053 inch (1.3 mm) thick steel sheet.
- D. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforced plates from same material as frames.

2.5 FRAME ANCHORS

- A. Jamb Anchors:
 - 1. Masonry Type: Adjustable strap and stirrup or T shaped anchors to suit frame size, not less than 0.042 inch (1.0 mm) thick, with corrugated or perforated straps not less than 2 inches (50 mm) wide by 10 inches (250 mm) long; or wire anchors not less than 0.177 inch (4.5 mm) thick.
 - 2. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch (1.0 mm) thick.

3. Compression Type for Drywall Slip-On Frames: Adjustable compression anchors.
 4. Postinstalled Expansion Type for In Place Concrete or Masonry: Minimum 3/8 inch (9.5 mm) diameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.
- B. Floor Anchors: Formed from same material as frames, not less than 0.042 inch (1.0 mm) thick, and as follows:
1. Monolithic Concrete Slabs: Clip type anchors, with two holes to receive fasteners.
 2. Separate Topping Concrete Slabs: Adjustable type anchors with extension clips, allowing not less than 2-inch (50 mm) height adjustment. Terminate bottom of frames at finish floor surface.

2.6 HOLLOW METAL PANELS

- A. Provide hollow metal panels of same materials, construction and finish as specified for adjoining hollow metal work.

2.7 STOPS AND MOLDINGS

- A. Moldings for Glazed Lites in Doors: Minimum 0.032 inch (0.8 mm) thick, fabricated from same material as door face sheet in which they are installed.
- B. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch (16 mm) high unless otherwise indicated.
- C. Loose Stops for Glazed Lites in Frames: Minimum 0.032 inch (0.8 mm) thick, fabricated from same material as frames in which they are installed.

2.8 ACCESSORIES

- A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.
- B. Ceiling Struts: Minimum 1/4 inch thick by 1 inch (6.4 mm thick by 25.4 mm) wide steel.
- C. Grout Guards: Formed from same material as frames, not less than 0.016 inch (0.4 mm) thick.

2.9 FABRICATION

- A. Fabricate hollow metal work to be rigid and free of defects, warp or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.
- B. Tolerances: Fabricate hollow metal work to tolerances indicated in ANSI/NAAMM-HMMA 861.
- C. Hollow Metal Doors:
 - 1. Exterior Doors: Provide weep hole openings in bottom of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
 - 2. Glazed Lites: Factory cut openings in doors.
- D. Hollow Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
 - 1. Welded Frames: Weld flush face joints continuously; grind, fill, dress and make smooth, flush and invisible.
 - 2. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
 - 3. Provide countersunk, flat or oval head exposed screws and bolts for exposed fasteners unless otherwise indicated.
 - 4. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
 - 5. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
 - 6. Jamb Anchors: Provide number and spacing of anchors as follows:

a. Masonry Type: Locate anchors not more than 18 inches (457 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c. and as follows:

1. Two anchors per jamb up to 60 inches (1524 mm) high.
2. Three anchors per jamb from 60 to 90 inches (1524 to 2286 mm) high.
3. Four anchors per jamb from 90 to 120 inches (2286 to 3048 mm) high.
4. Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches (610 mm) or fraction thereof above 120 inches (3048 mm) high.

b. Stud Wall Type: Locate anchors not more than 18 inches (457 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c. and as follows:

1. Three anchors per jamb up to 60 inches (1524 mm) high.
2. Four anchors per jamb from 60 to 90 inches (1524 to 2286 mm) high.
3. Five anchors per jamb from 90 to 96 inches (2286 to 2438 mm) high.
4. Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches (610 mm) or fraction thereof above 96 inches (2438 mm) high.
5. Two anchors per head for frames above 42 inches (1066 mm) wide and mounted in metal stud partitions.

c. Compression Type: Not less than two anchors in each jamb.

d. Postinstalled Expansion Type: Locate anchors not more than 6 inches (152 mm) from top and bottom of frame. Space anchors not more than 26 inches (660 mm) o.c.

7. Door Silencers: Except on weather stripped doors, drill stops to receive door silencers as follows. Keep holes clear during construction.

- a. Single Door Frames: Drill stop in strike jamb to receive three door silencers.
 - b. Double Door Frames: Drill stop in head jamb to receive two door silencers.
- E. Fabricate concealed stiffeners, edge channels and hardware reinforcement from either cold or hot rolled steel sheet.
- F. Hardware Preparation: Factory prepare hollow metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 8 Section "Door Hardware".
- 1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
 - 2. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
- G. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with buttered or mitered hairline joints.
- 1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow metal work.
 - 2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
 - 3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
 - 4. Provide loose stops and moldings on inside of hollow metal work.
 - 5. Coordinate rabbet width between fixed and removable stops with type of glazing and type of installation indicated.

2.10 STEEL FINISHES

- A. Prime Finish: Apply manufacturer's standard primer immediately after cleaning and pretreating.

1. Shop Primer: Manufacturer's standard, fast curing, lead and chromate free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field applied coatings despite prolonged exposure.

3.0 EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas and conditions with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing in for embedded and built in anchors to verify actual locations before frame installation.
- C. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove welded in shipping spreaders installed at factory. Restore exposed finish by grinding, filling and dressing, as required to make repaired area smooth, flush and invisible on exposed faces.
- B. Prior to installation, adjust and securely brace welded hollow metal frames for squareness, alignment, twist and plumbness to the following tolerances:
 1. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 2. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
 3. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 4. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a perpendicular line from head to floor.

- C. Drill and tap doors and frames to receive nontemplated, mortised and surface mounted door hardware.

3.3 INSTALLATION

- A. General: Install hollow metal work plumb, rigid, properly aligned and securely fastened in place; comply with Drawings and manufacturer's written instructions.

- B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11.

- 1. Set frames accurately in position, plumbed, aligned and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.

- a. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress and make splice smooth, flush and invisible on exposed faces.

- b. Install frames with removable glazing stops located on secure side of opening.

- c. Install door silencers in frames before grouting.

- d. Remove temporary braces necessary for installation only after frames have been properly set and secured.

- e. Check plumbness, squareness and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.

- f. Field apply bituminous coating to backs of frames that are filled with grout containing antifreezing agents.

- 2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.

- a. Floor anchors may be set with powder actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.

3. Metal Stud Partitions: Solidly pack mineral fiber insulation behind frames.
 4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
 5. Concrete Walls: Solidly fill space between frames and concrete with grout. Take precautions, including bracing frames, to ensure that frames are not deformed or damaged by grout forces.
 6. In Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors and fill and make smooth, flush and invisible on exposed faces.
 7. In Place Gypsum Board Partitions: Secure frames in place with postinstalled expansion anchors through floor anchors at each jamb. Countersink anchors and fill and make smooth, flush and invisible on exposed faces.
 8. Ceiling Struts: Extend struts vertically from top of frame at each jamb to overhead structural supports or substrates above frame unless frame is anchored to masonry or to other structural support at each jamb. Bend top of struts to provide flush contact for securing to supporting construction. Provide adjustable wedged or bolted anchorage to frame jamb members.
 9. Installation Tolerances: Adjust hollow metal door frames for squareness, alignment, twist and plumb to the following tolerances:
 - a. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - b. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
 - c. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines and perpendicular to plane of wall.
 - d. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs at floor.
- C. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.

1. Non Fire Rated Standard Steel Doors:
 - a. Jambs and Head: 1/8 inch (3 mm) plus or minus 1/16 inch (1.6 mm).
 - b. Between Edges of Pairs of Doors: 1/8 inch (3 mm) plus or minus 1/16 inch (1.6 mm).
 - c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch (9.5 mm).
 - d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch (19 mm).
- D. Glazing: Comply with installation requirements in Division 8 Section "Glazing" and with hollow metal manufacturer's written instructions.
 1. Secure stops with countersunk flat or oval head machine screws spaced uniformly not more than 9 inches (230 mm) o.c. and not more than 2-inches (50 mm) o.c. from each corner.

3.4 ADJUSTING AND CLEANING

- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed or otherwise unacceptable.
- B. Remove grout and other bonding material from hollow metal work immediately after installation.
- C. Prime Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air drying, rust inhibitive primer.
- D. Metallic Coated Surfaces: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

- END OF SECTION -

SECTION 11210

BOOSTER PUMP STATION

1.0 GENERAL

The contractor shall furnish and install the water booster pump station, with all the necessary piping, controls, and appurtenances as shown on the plans and as specified herein. Each water booster pump station shall be complete with all necessary equipment installed in a concrete block building. Also all tie-ins, access entrance, yard piping etc. shall be considered part of the lump sum bid for each pump station.

1.01 REFERENCE STANDARDS

The Work in this Section is subject to the requirements of applicable portions of the following standards:

- A. Hydraulic Institute
- B. ANSI – American National Standards Institute
- C. ASTM – American Society for Testing and Materials
- D. IEEE - Institute of Electrical and Electronics Engineers
- E. NEMA – National Electrical Manufacturers Association
- F. NEC – National Electrical Code
- G. ISO – International Standards Organization

1.02 RELATED WORK

- A. Section 11100 – INTEGRATION OF TELEMETRY CONTROLS
- B. Section 16000 – ELECTRICAL GENERAL PROVISIONS
- C. Section 16157 – ADJUSTABLE FREQUENCY DRIVES (VFD'S)
- D. Section 16915 - TELEMETRY

2.0 DEFINITIONS

When the term "pumping unit" is used it shall be deemed to mean a pump or pumps, complete with, but not limited to, drive motor, accessories, appurtenances and all associated equipment.

3.0 CONTRACT DRAWINGS

The contract drawings are intended to show a general arrangement of pump equipment, drives, structural supports, foundations, connected piping and valves.

The pump suction and discharge nozzles shown shall be considered minimum sizes unless otherwise specified.

4.0 MANUFACTURER

4.1 QUALITY ASSURANCE

All pumping units shall be of approved design and make and products of manufacturers who have built equipment of similar type, size and capacity.

4.2 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.

4.3 REPLACEMENT PARTS CAPABILITY AND SERVICE

Pumping units 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 pumps. Upon request, the Contractor certify and shall submit full details of the proposed manufacturer's ability to promptly fill replacement orders. The manufacturer shall have a fully staffed factory trained service center within three (3) hours of the installation.

4.4 MANUFACTURE 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.

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.

Approval of the manufacturers or suppliers will not be given until all information required by the specifications or requested by the Engineer has been submitted and found acceptable.

4.5 DISQUALIFICATION OF MANUFACTURER

- A. Failure to successfully comply with the provisions of sub-paragraphs 4.1 through 4.4, inclusive, will constitute grounds for disqualification of pump manufacturer.
- B. Poor performance of similar pumping equipment now in operation under the specified conditions of service and pump rating constitute grounds for disqualification of the pump manufacturer, supplier, or both, unless such poor performance has been corrected.

5.0 **SUBMITTALS (SHOP DRAWINGS)**

5.1 GENERAL

The Contractor shall comply with the provisions in the specifications regarding submittals, unless otherwise specified herein.

5.2 CONTENT OF SUBMITTALS

The following shall be included in submittals as a minimum. However, any additional information or data shall be added if and whenever requested by the Owner or Engineer. Where applicable, submit separate data for each pump.

5.3 DESCRIPTIVE LITERATURE

- A. Dimensions
- B. Materials of construction (including required coatings)
- C. Performance data
 - 1. Size of pump
 - 2. GPM
 - 3. TDH
 - 4. BHP
 - 5. Overall pump efficiency (inlet through discharge head)
 - 6. RPM
 - 7. Performance curves showing overall pump efficiencies

8. NPSH curve (if applicable)
9. Shutoff head
10. Weight of pump
11. Head
12. Rated HP of motor
13. Weight of motor

5.4 INSTALLATION INFORMATION

Submit drawings and information necessary for final design of foundations, connecting piping and valves, pump drip and drainage piping, electrical connections, starting, speed regulating and protective equipment, and auxiliary equipment.

Submit drawings showing location, size and full details of foundation bolts for all components for all pumping units.

For all pumping units, a dimensioned and scaled assembly outline drawing or drawings of the complete pump, drive, and all associated equipment furnished shall be submitted for approval. Such drawing or drawings shall show plan, elevation, and any other views or sections requested.

For all pumping units, a scaled cross-sectional drawing of the assembled pump showing full details and materials of construction shall be submitted for approval.

The Contractor shall submit all other drawings, material lists and other information specified, requested and/or necessary to show complete compliance with all details of the contract documents.

5.5 MAINTENANCE AND OPERATIONS MANUAL

Manual shall contain all information necessary for proper operation and maintenance of pumping units, as well as the location of the nearest permanent service headquarters. Three (3) bound copies of the pump station operation and maintenance manual shall be provided.

6.0 **TIME OF DELIVERY**

Since time is of the essence on all work under this contract, manufacturers or suppliers are hereby notified that they will be required through the Contractor to state and guarantee a firm delivery date for all equipment specified under this section which they offer to furnish.

7.0 MANUFACTURER'S REPRESENTATIVE

For all pumping units the Contractor shall furnish the services of accredited representatives of the pump manufacturer who shall supervise the installation, adjustment, and testing of each pumping unit and give instructions to operating personnel. Pumping equipment shall be tested for performance according to curves and other approved data as soon as practical after installation. Failure of the equipment to perform as curves indicate and with other approved data shall be sufficient cause for rejection. As one condition necessary to acceptance of any pumping unit, the Contractor shall submit a certificate from the manufacturer, stating that the installation of the pumping unit is satisfactory, that the unit is ready for operation, and that the operating personnel have been suitably instructed in the operation, lubrication, and care of the unit.

8.0 IDENTIFICATION - NAMEPLATE

Each piece of equipment shall be provided with a substantial nameplate, securely fastened in place and clearly inscribed with the manufacturer's name, year of manufacture, serial number, and principal rating data.

9.0 TOOLS AND ACCESSORIES

The Contractor shall furnish with each type, kind, or size of pumping unit, two sets of any special suitable marked high grade tools, gauges and fixtures which may be needed to adjust, operate, maintain, or repair the equipment. Such tools and appliances shall be furnished in neat special steel cases fitted with locks and keys, and delivered to the Engineer prior to the initial operation of the equipment.

10.0 GUARANTEE PERIOD

After successful completion of tests and trials under operating conditions on all equipment, the Contractor shall guarantee all equipment and materials from undue wear and tear, from mechanical and electrical defects, and from any failure whatever except those resulting from proven carelessness or deliberate actions of the Owner, for a minimum of one year. This one-year minimum shall not replace a standard manufacturer's guarantee if it exceeds one year.

11.0 PUMP WARRANTY

The Contractor guarantees and warrants that during the first year of operation, the pumps will operate satisfactorily and continuously according to the pump schedule specified herein, and that after due notice has been given by the Owner, he or the pump manufacturer will proceed, within a reasonable time, to adjust, regulate, repair and renew at his own expense such part or parts, equipment, auxiliaries, appurtenances or perform such work as is necessary to maintain the guaranteed capacities, efficiencies and performances.

12.0 EQUIPMENT

12.1 BOOSTER PUMPS

12.1.1 General. The booster pumps shall meet the hydraulic and driver data as set forth in the specification section titled, "OPERATING CONDITIONS".

1. A data sheet covering each pump completely filled in.
2. Performance Curve showing expected performance at points other than the design conditions. Curve shall show head, capacity, efficiency and horsepower based on performance and shall cover the complete operating range of the pump from zero capacity to the maximum capacity. The curve is to also include a net positive suction head required curve.
3. Drawings of the proposed equipment giving general dimensions sufficient to determine how the equipment is to be supported and if it will fit within the space available.

12.2 APPLE ORCHARD BOOSTER PUMP STATION

Operating Conditions. The pump stations shall be capable of delivering the fluid medium at the following capacities and heads.

Minimum	0 gpm @ 125' TDH
Design	400 gpm @ 110' TDH
Maximum	600gpm @ 90' TDH
Efficiency at Design	85%
Horsepower	20
Electric	3 phase 460 volt
Speed	1770 rpm

NPSH requirements shall not exceed 10 feet at Design GPM.

Pumps for Apple Orchard Booster Pump Station shall be Pentair Model 3800 – 3 x 4 x 11 or approved equal.

KY 80 BOOSTER PUMP STATION

Operating Conditions. The pump stations shall be capable of delivering the fluid medium at the following capacities and heads.

Minimum	0 gpm @ 85' TDH
Design	400 gpm @ 70' TDH
Maximum	550 gpm @ 55' TDH
Efficiency at Design	85%
Horsepower	15
Electric	3 phase 460 volt
Speed	1770 rpm

NPSH requirements shall not exceed 10 feet at Design GPM.

Pumps for KY 80 Booster Pump Station shall be Pentair Model 3800 – 3 x 4 x 11 or approved equal.

12.3 GENERAL DESCRIPTION

The pumps shall be a Horizontal Close-Coupled End Suction Centrifugal Pump, Pentair Model 3800 or pre-approved equal.

12.4 MATERIALS OF CONSTRUCTION

Casing	Cast Iron (ASTM A48)
Impeller	316 Stainless Steel (ASTM A276)
Shaft	Steel (AISI C1045)
Shaft Sleeve	316 Stainless Steel (ASTM A276)

12.5 CASING

The casing will be of the end suction design with tangential discharge outlet. For suction piping diameters of 2" or less and discharge piping diameters of 1.5" or less, the suction and discharge connections shall be NPT threaded. For suction piping diameters of 2" or greater, the suction inlet and the discharge outlet shall be a bolt through flange connection, and tapped for pressure gages. Flange connections shall be ANSI 125# rated. The casing shall have tapped and plugged holes for priming and draining. The casing bore shall be large enough to

allow "back pullout" of the impeller without disturbing the casing or suction and discharge piping. The casing shall have integral cast feet.

12.6 IMPELLER

The impeller shall be of the enclosed type, and investment cast. It shall be have a smooth finish all over, the exterior being turned or from a casting process that provides a smooth finish and the interior being finished smooth and cleaned of all burrs, trimmings, and irregularities. The impeller shall be dynamically balanced. The impeller will be keyed to the shaft, and fastened with a washer, gasket and capscrew.

12.7 SHAFT

The motor shaft shall be machined to provide a keyway, and drilled and tapped to accept the impeller fastener. Stub shafts are not acceptable. The outboard shaft extension shall be machined with a keyway to accept a coupling to the driving unit. Lip seals shall be furnished on both the inboard and outboard shaft extensions and a water slinger shall be furnished on the inboard shaft extension closest to the mechanical seal.

12.8 MECHANICAL SEAL

Shaft sealing shall be accomplished by means of a mechanical seal with a Ceramic seat, carbon washer, Buna-N elastomers, and stainless steel metal parts.

12.9 MOTOR BRACKET AND SEAL PLATE

The seal plate and motor bracket shall be of a two piece design, and shall provide an adequate area for internal recirculation of the pumped fluid around the sealing medium.

12.10 SHAFT SLEEVE

The pump shaft shall be fitted with a shaft sleeve to minimize shaft wear. The sleeve shall be sealed to the impeller hub by an O-ring, and shall be positively driven by a pin to the keyway. The use of adhesive compounds to fasten the sleeve to the shaft shall not be accepted.

12.11 FOOT SUPPORTS

The pump unit shall be supported from feet cast into the casing and the feet on the motor.

12.12 PUMP PRESSURE GAUGES

Each pump shall be provided with pressure gauges according to the schedule. All pressure gauges within the booster pumping station shall have 4-1/2" minimum diameter faces. The case shall be black, cast aluminum, flanged back type with close type ring and clear glass face. The gauge connections shall be at the bottom of the gauge and will be 1/4" N.P.T. The gauge internal construction shall include phosphor bronze bourdon tube with a brass movement, bronze bushed independently mounted. Pressure gauge range and scale graduations shall be in feet of water and psi as follows:

INLET PRESSURE - 0 to 300 psi, 20 psi figure intervals,
with graduating marks every 5 psi.

OUTLET PRESSURE - 0 to 300 psi, 20 psi figure intervals,
with graduating marks every 5 psi.

12.13 NON-METALLIC EXPANSION JOINTS

Connections to pumps shall be made with spherical rubber connectors to eliminate the transmission of vibration and noise through the piping system. Rubber connectors shall incorporate flow conditioning devices when specified.

Expansion joints when required or indicated on contract documents shall be a spherical rubber connector to accommodate pipe thermal movement.

Rubber connector shall be of the molded spherical type. Rubber connector shall be of EPDM and nylon construction for water systems. A different elastomeric may be required for other systems.

Rubber connector shall be manufactured with internal steel wire, molded within the raised face ends, for added strength.

Pressure rated for 150 PSI at 200°F for sizes up to 12", with a minimum safety factor of 4 to 1.

Rubber connectors shall comply with ASTM F1123.

Flanges shall be one-piece, free-floating, class 150 galvanized plate steel type with tapped or drilled holes as required. Connectors shall be "Metrasphere" as manufactured by The Metraflex Company®, Chicago, IL.

Control units must be furnished in unanchored applications, or as recommended by the manufacturer. Factory installed limiting cables to be included.

Rubber joints shall be installed per manufacturer's instructions and in accordance to Rubber joints FSA's "Technical Handbook: Non-Metallic Expansion Joints and Flexible Pipe Connectors."

12.14 GLOBE STYLE SILENT CHECK VALVE

Globe style silent check valves shall be of silent operating type which reduce or eliminate water hammer shock.

The valve design shall incorporate a center guided, spring loaded poppet, guided at opposite ends and having a short linear stroke that generates a flow area equal to that of the pipe size.

The valve shall operate equally well in the vertical or horizontal position with the flow up or down.

All component parts shall be field replaceable and without the need of special tools. A replaceable guide bushing shall be provided and held in position by the valves spring.

The valve disc shall be convex in sizes up to 6" and concave in 8" and larger to the flow direction providing for disc stabilization, maximum strength and minimal flow velocity to open the valve.

When specified, a rubber seal shall be furnished to provide zero leakage. The rubber seal shall be glued or chemically adhered.

The valve shall be equal in all respects to the Model 402BT/BTR as manufactured by the Flomatic Corporation.

12.15 ELECTROMAGNETIC FLOW METER

The meter shall be equal in all respects to the Badger Model M-2000.

OPERATING CONDITIONS

A. System Components

1. Metering Tube (Detector)

- a. Consists of stainless steel tube lined with a non-conductive material. Energized detector coils around tube create a magnetic field across the diameter of the pipe. As a conductive fluid flows through the magnetic field, a voltage is

induced across two electrodes; this voltage is proportional to the average flow velocity of the fluid.

2. Signal Amplifier

- a. Consists of unit which receives, amplifies, and processes the detector's analog signal. Signal is converted to both analog and digital signals that are used to display rate of flow and totalization. Processor controls zero-flow stability, analog and frequency outputs, serial communications and a variety of other parameters. Integrated LCD display indicates rate of flow, forward and reverse totalizers and diagnostic messages. Display guides user through programmable routines.

B. Operational Requirements

1. Electromagnetic Flow Meter

- a. The flow meter system shall operate with a pulsed DC excitation frequency, and shall produce a signal output that is directly proportional and linear with the volumetric flow rate of the liquid flowing through the metering tube. The metering system shall include a metering sensor tube (detector), a signal amplifier, and the necessary connecting wiring. The metering system shall have the ability to incorporate a meter mounted or remote mounted amplifier.
- b. Engineering Units:
 - 1) The signal amplifier shall be program selectable to display the following units of measure: U.S. gallons, imperial gallons, million gallons (U.S.), cubic feet, cubic meters, liters, hector-liters, oil barrels, pounds, ounces or acre feet.
- c. Operating Principle: Electromagnetic Induction
- d. Metering Tube (Detector)
 - 1) The metering tube (detector) shall be constructed of 316 stainless steel, and rated for a maximum allowable non-shock pressure and temperature for steel pipe flanges, according to ANSI B16.5.
 - 2) The metering tube (detector) shall be available in line size from ¼" [6 mm] to 54" [1400 mm].
 - 3) The metering tube (detector) end connections shall be carbon steel or 316 stainless steel flanged, according to ANSI B16, Class 150 and AWWA Class B standards.

- 4) The insulating liner material of the metering tube (detector) shall be made of a hard rubber elastomer and NSF-listed for meter sizes 4" and above, in conformance with manufacturer's recommendation for the intended service or an NSF-listed meter option with PTFE liner.
- 5) The metering tube (detector) shall include two self-cleaning measuring electrodes. The electrode material shall be corrosion resistant and available in Alloy C or 316 stainless steel.
- 6) The metering tube (detector) shall include a third "empty pipe detection" electrode located in the upper portion of the inside diameter of the flow tube in order to detect an empty pipe condition when the flow tube is running partially empty. Empty pipe detection that is not activated until the pipe is 50% empty is not acceptable.
- 7) The metering tube (detector) housing shall be constructed of carbon steel, welded at all joints, and rated to meet NEMA 4X/6P (IP66/IP67) ratings.
- 8) For remote amplifier applications, the metering tube (detector) junction box enclosure shall be constructed of cast aluminum (powder-coated paint) and shall meet NEMA 4X/6P (IP66/IP67) ratings.
- 9) When installed in non-metallic or internally lined piping, the metering tube (detector) shall be provided with a pair of corrosion resistant grounding rings. The grounding ring material shall be 316 stainless steel.
- 10) Fluid Temperature Range
 - i. For remote amplifier applications, the fluid temperature range shall be 32°F to 178°F [0°C to 80°C] at a maximum ambient temperature of 122°F [50°C] for the hard rubber liner material.
 - ii. For meter-mounted amplifier applications, the fluid temperature range shall be 32°F to 178°F [0°C to 80°C] at a maximum ambient temperature of 122°F [50°C] for the hard rubber liner material.
 - iii.

e. Signal Amplifier

- 1) The signal amplifier shall be microprocessor based, and shall energize the detector coils with a digitally controlled pulsed DC. The excitation frequency shall be program selectable for the following: 1Hz, 3.75Hz, 7.5Hz, or 15Hz. (factory optimized to pipe size and application)
- 2) The signal amplifier electrical power requirement shall be 85-265VAC, 45-65Hz. The power consumption shall not exceed 15W.
- 3) The signal amplifier shall have an ambient temperature rating of -4°F to 140°F [-20°C to 60°C].
- 4) The signal amplifier shall include non-volatile memory capable of storing all programmable data and accumulated totalizer values in the event of a power interruption.
- 5) Automatic zero stability, low flow cut-off, empty pipe detection and bi-directional flow measurement shall be inherent capabilities of the signal amplifier.
- 6) All signal amplifier outputs shall be galvanically isolated to 250 volts.
- 7) The signal amplifier and remote junction enclosures shall be constructed of cast aluminum (powder-coated paint) and shall meet NEMA 4X/6P (IP66/IP67) ratings.
- 8) Outputs:

The signal amplifier shall provide a total of four digital outputs, one analog output and one digital input.

 - i. Up to four open collector digital outputs, program selectable from the following: Forward pulse, reverse pulse, AMR pulse, flow set point, empty pipe alarm, flow direction, reset output, error alarm and 24V supply.
 - ii. Up to two active digital (24 Volt) outputs, program selectable from the following: Forward pulse, reverse pulse, AMR pulse, flow set point, empty pipe alarm, flow direction, preset output, error alarm and 24V supply.
 - iii. Up to two AC solid-state relay outputs, program selectable from the following: Frequency output, flow set point, empty pipe alarm, flow direction, preset amount and error alarm.

- iv. One digital input, program selectable from the following: Remote reset, batch reset and positive return to zero.
 - v. Advanced protocol support using Modbus/RTU.
 - vi. One analog output programmable and scalable from the following: 0-10mA, 0-20mA, 2-10mA or 4-20mA. Voltage sourced and isolated. Max. loop resistance = 800 ohms.
- f. Control and Programming
- 1) The signal amplifier shall be programmed via three function buttons. The programming functions shall be available in a user-friendly, menu driven software through the four-line LCD interface. The signal amplifier shall accommodate the following languages: English, German, Czech, French or Spanish.
 - 2) Programmable parameters of the amplifier include, but are not limited to: calibration factors, totalizer resets, unit of measure, analog and pulse output scaling, flow-alarm functions, language selection, low-flow cutoff, noise dampening factor and excitation frequency selection.
 - 3) The signal amplifier shall have a programming option allowing entry of a selected numeric password value for tamper protection.
- g. System Performance
- 1) The metering system shall operate over a flow range of 0.10 to 39.4 ft/s [0.03 to 12.0 m/s].
 - 2) The metering system shall perform to an accuracy \pm 0.25 percent of rate for velocities greater than 1.64 ft/s [0.50 m/s], \pm 0.004 ft/s [\pm 1 mm/s] for velocities less than 1.64 ft/s [0.50 m/s].
 - 3) The metering system shall be capable of measuring the volumetric flow rate of liquids having an electrical conductivity as low as 5.0 micromhos per centimeter.
 - 4) The system measuring repeatability shall be $<0.10\%$ of full scale.
- h. Indication
- 1) The signal amplifier shall include a four-line, 20-character, backlit LCD interface to display the following values:
 - i. Flow rate in selectable rate units
 - ii. Forward totalizer in selectable volume units

- iii. Reverse totalizer in selectable volume units
- iv. Net totalizer in selectable volume units
- v. Error or alarm messages
- vi. Software revision level

Meter to be installed per manufactures recommendation.

13.0 PUMP STATION BUILDING

The building shall be of concrete block and shall have the dimensions as shown on the plans. All concrete shall be Class "A" in accordance with KTC Specification 601. All reinforcing steel shall conform to KTC Specification 811.

Construct 1-3/4" thickness doors of 6063-T5 aluminum alloy rails and stiles minimum 5/16" depth. Provide joinery of 3/8" diameter full width tie rods through extruded splines top and bottom integral to standard tubular shaped rails and stiles reinforced to accept hardware as specified. Provide hex type aircraft nuts for joinery without welds, glues or other methods for securing internal door extrusions. Furnish integral reglets to accept the face sheet to permit a flush appearance. Rail caps or other face sheet capture methods are not acceptable.

Nameplates and other dataplates shall be stainless steel, suitably secured to the pump.

All interior piping, valves, pumps and metal surfaces to receive two coats of Themec 66 HB Epoxoline or approved equal. Also, one coat of primer if needed. Finish coat shall be gray in color.

Parts shall be completely identified with a numerical system (no alphabetical letters) to facilitate parts inventory control. Each part shall be properly identified by a separate number, and those parts which are identical shall have the same number to effect minimum spare parts inventory.

Two (2) plate strainers, aka suction diffusers, shall be a part of the station assembly. Strainers shall be Mueller Model 56940, or equal.

14.0 ACCEPTANCE

Any defects in the equipment or failure to meet the guaranteed requirements of these specifications shall be promptly corrected by the Contractor by replacement or otherwise. The decision of the Engineer as to whether or not the Contractor has fulfilled his obligation shall be final and binding on all parties.

15.0 MEASUREMENT AND PAYMENT

Payment will be based on one of the following criteria as specified in the Contract Bid Item Descriptions and/or on the Drawings:

- A. Cost shall be included in the work to which it is subsidiary and no separate measurement and payment will be made.
- B. Payment will be based on Plan Quantities or a percentage of the work installed to complete the item as computed by the Engineer or as shown on the Drawings.

Payment as specified above shall be considered as full compensation for all labor, materials, equipment and incidentals necessary to perform the work as required. Owner shall provide the power and meter to the site.

SECTION 11900

INTEGRATION OF TELEMETRY CONTROLS

1.0 GENERAL

This specification section is for information purposes only to clarify the Contractor's responsibility regarding the telemetry controls.

2.0 INTEGRATION OF TELEMETRY CONTROLS

The East Laurel Water District in concert with MicroComm, the supplier of the existing SCADA system, will be responsible for providing the fully wired panel for the telemetry facilities required for the operational control of the pump station, alarms, data acquisition and integration within the current SCADA system.

The pump station Contractor shall be responsible for mounting the telemetry panel, furnishing and installing the conduit, wiring and incidentals for connections from the data collection elements in the pump station to the telemetry panel and continuing as necessary, to the Motor Control Center and other end locations as necessary for a fully operational system.

The Contractor shall coordinate the integration of the telemetry facilities with the Water District and telemetry provider as stipulated in Specification Section 16915.

See **Appendix B** for the materials supplied by MicroComm for each pump station.

3.0 PUMP STATION START-UP

The Water District and the telemetry provider will be present during pump station start-up to coordinate the telemetry equipment operation with the operational elements of the pump station.

END OF SECTION



SECTION 15100

WATERLINES

1.0 GENERAL

The Contractor shall furnish all labor, materials and equipment to install the water lines as shown on the plans and as specified herein.

The water lines may either be pressure-rated plastic pipe (PVC), municipal plastic pipe (MPVC) or ductile iron (DI), all as specified hereinafter. The bid documents and plans shall show the amounts of each type and class of pipe to be provided by the Contractor.

The Owner will obtain all rights-of-way for operations through private property. It will also secure building permits and the permits for all pipe laid in highway rights-of-way. Any charges for inspections or other fees required will be the responsibility of the Contractor since the amounts of these are dependent upon the operation of the Contractor.

1.1 TRANSPORTATION CABINET BONDING

The Kentucky Transportation Cabinet will require that the Owner post a bond for all work accomplished on their right-of-way. Each contract on which work is to be performed will be a separate application and will require a separate bond. Each permit will have conditions attached and these conditions will vary depending on the area where work is to be performed. In areas where traffic control may pose a problem, working hours may be limited. A copy of the encroachment permit will be provided to the Contractor. The Contractor will be responsible for knowledge of the permit's content and conditions in order that the construction may be accomplished in accordance with the specified requirements.

Should any additional bonds or requirements be imposed by the Kentucky Transportation Cabinet, the Owner shall also be responsible for the bonding of the additional requirements.

2.0 PIPE AND FITTINGS

2.1 POLYVINYL CHLORIDE RIGID PIPE AND FITTINGS

This specification covers rigid, pressure-rated, polyvinyl chloride pipe and fittings, hereinafter called PVC pipe and PVC fittings, for sizes 1/2 inch through 12-inch.

Pipe shall be as manufactured by North American, Diamond, J-M or approved equal.

2.1.1 PVC Pipe. PVC pipe shall be extruded from Type 1, Grade 1, polyvinyl chloride material with a hydrostatic design stress of 2,000 psi for water at 73.4°F, designated as PVC 1120, meeting ASTM Specifications D-1784 for material and D- 2241 for pipe, latest revisions. Pipe shall also meet all applicable provisions of the Product Standards and shall bear the National Sanitation Foundation (NSF) seal of approval in compliance with NSF Standard No. 14. PVC pipe having a maximum hydrostatic working pressure of 160 psi (SDR26), 200 psi (SDR21), 250 psi (SDR17), or 315 psi (SDR13.5) shall be used as shown in the Bid Documents and Plans.

Samples of pipe and physical and chemical data sheets shall be submitted to the Engineer for review and determination of compliance with these specifications before pipe is delivered to job. The pipe shall be homogeneous throughout and free from cracks, holes, foreign inclusions or other defects.

The workmanship, pipe dimensions and tolerances, outside diameters, wall thickness, eccentricity, sustained pressures (ASTM D-1598), burst pressures (ASTM D-1599), flattening, extrusion quality (ASTM D-2152), marking and all other requirements of the Product Standard PS 22-70 shall be with in all respects. No pipe, 2 inches in diameter or larger, with a wall thickness less than 0.090 inches may be used.

Pipe shall be furnished in 20 feet or 40 feet lengths. The pipe shall be bell on one end. Male ends of pipe must be beveled on the outside. Pipe shall have a ring painted around the male end or ends in such a manner as to allow field checking of setting depth of pipe in the socket. This requirement is made to assist construction superintendents and inspectors in visual inspection of pipe installation.

Pipe must be delivered to job site by means which will adequately support it, and not subject it to undue stresses. In particular, the load shall be so supported that the bottom rows of pipe are not damaged by crushing. Pipe shall be unloaded carefully and strung or stored as close to the final point of placement as is practical. Pipe must not be exposed to the direct rays of the sun for an extended period of time. If pipe is not to be installed shortly after delivery to the job site, it must be stored in a shaded location and strung as needed.

2.1.2 PVC Pipe Jointing. Pipe shall be joined with slip-type joints with rubber gaskets. Pipes with bells shall have all parts of the bell, including the gasket groove, made from the same extruded piece, integral with the pipe, and shall be thickened to meet standard dimension ratios of wall thickness to outside diameter. This manufacturing procedure shall be the normal practice of the pipe manufacturer and proven by past performance of pipe in service. The gasket

groove shall be constructed such that gasket rollout will not occur. Rubber gasketing shall conform to ASTM 3139.

The pipe manufacturer shall have an experienced representative on the job for a minimum of one day at the commencement of joining and laying operations. Joint lubricant shall be of a type recommended by the manufacturer for their pipe subject to the Engineer's approval. Lubricant shall be water soluble, non-toxic and have no objectionable properties.

2.1.3 PVC Couplings. Where PVC couplings are used, they shall be of the same material as the pipe and may be of the molded, or extruded type. PVC couplings shall have a minimum rating of 200 psi for continuous operation at 73.4 degrees F.

2.1.4 Fittings Ductile iron mechanical joint type fittings with appropriate adaptors as manufactured by Romac or approved equal, shall be used with PVC pipe. All such fittings shall be approved by the pipe manufacturer, and complete data sent to the Engineer, including the manufacturer's approval, for review. Fittings shall comply with AWWA C-110 or C-153 and shall be manufactured for the size and pressure class of the line on which they are used. Use of transition gaskets will not be allowed unless specifically approved by the pipe manufacturer. Coatings and lining shall be in accordance with 2.3.7.F of this section of the Specifications.

2.1.5 Service Connections. All service connections on PVC lines shall be made by means of tees, factory tapped couplings, or bronze service clamps manufactured specifically for use with PVC pipe as manufactured by Ford or approved equal. Whenever possible, corporation stops shall be installed in plastic lines before conducting hydrostatic tests.

2.2 MUNICIPAL POLYVINYL CHLORIDE (MPVC) PRESSURE PIPE

This specification covers the requirements for AWWA approved Polyvinyl Chloride Pressure Pipe for water supply and distribution systems.

2.2.1 MPVC Pipe. MPVC pipe shall meet the requirements of AWWA C900, latest revision, "Standard for Polyvinyl Chloride (PVC) Pressure Pipe, 4" through 12" for water" and shall be furnished in cast-iron pipe equivalent outside diameters with rubber-gasketed separate couplings. Pipe shall be as manufactured by Certainteed or approved equal.

MPVC pipe and couplings shall be made from Class 12454-A or Class 12454-B virgin compounds as defined in ASTM D-1784. The standard code designation shall be PVC 1120. The PVC compounds shall be tested and certified as suitable for potable water products by the NSF Testing Laboratory and shall carry the NSF approval marking.

Solvent-cement couplings or joints shall not be used. PVC joints using elastomeric gaskets shall be tested as assembled joints and shall meet the laboratory performance requirements specified in ASTM D-3139.

Pipe and couplings shall be pressure Class 100, DR 25 (Dimension Ratio), pressure Class 150, DR 18, or pressure Class 200, DR 14 as shown on the plans or the bid form.

Pipe and couplings shall be marked as follows:

- a. Nominal size and OD base.
- b. Material code designation (PVC 1120).
- c. Dimension ratio number.
- d. AWWA pressure class.
- e. AWWA designation number (AWWA C900).
- f. Manufacturers name or trade-mark and production record code.
- g. Seal of the NSF Laboratory.

Pipe and couplings shall meet or exceed the following test requirements:

<u>Sustained Pressure</u>	=	<u>ASTM D-1598 (1000 Hrs.)</u>
<u>DR</u>		<u>Sustained Pressure</u>
14		650 psi
18		500
25		350

<u>Burst Pressure</u>	=	<u>ASTM D-1599 (60-70 seconds)</u>
<u>DR</u>		<u>Minimum Burst Pressure</u>
14		985
18		755
25		535

Hydrostatic Integrity - Each standard and random length of pipe shall be proof-tested at four times its rated class pressure for a minimum of 5 seconds. Bells or couplings shall be tested with pipe.

Flattening - The pipe shall not split, crack, or break when tested by the parallel-plato method as specified by ASTM D- 2241.

Extrusion quality - The pipe shall not flake or disintegrate when tested by the acetone-immersion method as specified in ASTM D-2241.

Standard length - Pipe shall be furnished in standard laying lengths of 20 ft. \pm 1 in. A maximum of 15 percent of each pipe size may be furnished in random lengths of not less than 10 ft. each.

2.2.2 MPVC Pipe Jointing. Pipe shall be joined with slip-type joints with rubber gaskets. Manufacturing and installation procedures shall be as recommended by the manufacturer and as described for PVC pipe in Section 2.1.2 of this specification.

2.2.3 Fittings. Fittings for municipal PVC shall be ductile iron only. Fittings shall be mechanical joint. Fittings shall be manufactured for the size and pressure class of the line on which they are used and shall comply with AWWA C-110 or C-153. Coatings and lining shall be in accordance with subsection 2.3.7.F of this section of the Specifications. Fittings shall be as manufactured by Tyler, Clow, U.S. Pipe, Union Foundry or approved equal.

2.2.4 Service Connections. Service connections shall be made by means of bronze service clamps manufactured specifically for use with municipal PVC pipe. Clamps shall be Mueller Catalog No. H-161 or approved equal.

2.2.5 Underground Marking for PVC Pipe. Underground marking for PVC pipe shall be both of the following types. The type required for this project is specified in the notes on the Drawings.

2.2.5.1 Underground Marking Wire. At all locations where PVC pipe is utilized, a detectable underground marking wire shall be placed in the trench as shown on the miscellaneous drawings. The wire used shall be No. 12 insulated copper wire. Copper split bolt screw connectors shall be used for splice connections, see miscellaneous drawings. Extreme care shall be exercised in connecting and taping splices and joints to assure continuity. At each valve box the wire shall be looped to the surface extending 12-inches above the concrete valve box pad (see Std. Dwg. for valve). When the entire project or pipeline segment is complete, including meter installation and leak repairs, the locating wire system shall be checked for continuity.

2.2.5.2 Underground Marking Tape. At all locations where PVC pipe is utilized, a detectable underground marking tape shall be placed in the trench approximately twelve inches below the finished grade. The tape used shall be mylar encased aluminum foil with the printing "CAUTION - Buried Water Line Below". Printing shall be readable through the clear mylar and surface printing is not acceptable. Tape size shall be 2 inch width as provided by Lifeguard, Inc. or approved equal. Color of the tape shall be blue.

2.3 DUCTILE IRON PIPE

These specifications cover ductile iron pipe (3-inch diameter and greater) to be used in water transmission systems with mechanical joints, rubber ring slip type joints or flanged joints.

2.3.1 General. Ductile iron pipe shall be designed in accordance with AWWA H3 (ASA A21.50) and for pressures and conditions as stated in these
15100-5

specifications or called for on the plans. Ductile iron pipe shall conform to AWWA C-151 (ASA A21.51.).

2.3.2 Minimum Nominal Thickness. The specified thickness will be determined for the given internal and external loading requirements in accordance with ASA A21.50. The class of pipe, wall thickness, and coatings required will be shown on the plans or the bid form for all ductile iron pipe installation.

2.3.3 River Crossing Pipe. River crossing pipe shall be ductile iron, Flex-Lok as manufactured by the American Cast Iron Pipe company or equal conforming to the appropriate requirements of ANSI/AWWA C150/A21.50 and ANSI/AWWA C151/A21.5 with a thickness class of 54.

2.3.4 Lengths. Pipe may be furnished in 12, 16, 16 1/2, 18 or 20 feet nominal laying lengths.

2.3.5 Tests. Hydrostatic and acceptance tests shall be in accordance with AWWA Specification C-106 for "Cast Iron Pipe Centrifugally Cast In Metal Molds" or C-108 for sand molds. The Engineer shall be provided with five (5) copies of each of the following tests for each contract involved:

- a. Talbot strip test.
- b. Ring and full length bursting tests.
- c. Chemical analysis of pipe.
- d. Certification that pipe was hydrostatically tested.

Any pipe not meeting the AWWA Specifications quoted above shall be rejected in accordance with the procedure outlined in the particular specifications.

2.3.6 Marking. The net weight, class or nominal thickness and sampling period shall be marked on each pipe.

2.3.7 Pipe Joints for Ductile Iron Pipe. Pipe joints shall be mechanical joint, rubber ring slip joint, flanged, or locked mechanical joint as shown on the plans.

A. Mechanical Joint

Mechanical joints are to be furnished according to AWWA Specifications C-111. All pipe joints must be furnished complete with all accessories. Mechanical joint bolts and nuts shall be of alloy cast iron or alloy steel (Corten type such as U.S. Alloy) or approved equal. Rubber gaskets shall be made of plain first grade rubber, free of imperfections and porosity. Hardness shall be 70 to 75 durometer.

B. Rubber Ring Slip Joint

Rubber ring slip joint shall be equal to AWWA C-111 or latest revision. The joints shall be of the following materials:

- a. Rubber ring gasket compressed in groove in bell of pipe.
- b. Beveled spigot end of pipe for initial centering into rubber gasket in bell.

C. Locked Mechanical Joint

Locked mechanical joints shall be equal to Clow Corporation's "Locked Mechanical Joint".

D. Ductile Iron Flanged Pipe and Special Coupling

a. Flanged Pipe. All ductile iron flanged pipe shall have flanges faced and drilled, 125 pound in accordance with ASA A21.10 (AWWA C-110) unless otherwise specified on the Drawings. Flanges may be cast integrally with the pipe or they may be screwed on specially designed long hub flanges, refaced across both face of flange and end of pipe. Flanged pipe shall be in accordance with ASA A21.6 (AWWA C-106) Specifications, latest revision, and be the class called for on the plans or bid forms. Where plain ends of flanged and plain end pipe fit into mechanical joint bells, centrifugally cast pipe shall be used. Flanged pipe for water service shall be cement lined and bituminous coated the same as written herein for bell-joint pipe.

b. Special Coupling. Flexible couplings for flanged pipe shall be a mechanical joint cast to a special flanged joint using a neoprene O-ring in place of the usual 1/16 inch rubber ring gasket. The mechanical bell and special flanged joint piece shall be of high grade gray cast iron (ASTM A48-56, AWWA C-100) with bolt circle, bolt size and spacing according to ASA Specifications. Mechanical joint follower flange shall be of ductile iron ASTM A399 or malleable iron ASTM A47, Grade 35018 or 32510, latest revision with high strength/weight ratio design.

Bolts shall be fine grained high tensile malleable iron with malleable iron hexagon nut. Stainless steel nuts shall be used in vaults and wet wells. Where pressures may exceed 20 pounds, anchor studs shall be included with spigots of pipes connected drilled to receive ends of studs.

- E. All items used for jointing pipe shall be furnished with the pipe and tested before shipment. The joints shall be made with tools and lubricant in strict conformity with the manufacturer's instructions.

Three (3) copies of such instruction shall be delivered to the Engineer at start of construction.

- F. Coatings and Lining. All buried ductile iron pipe shall have manufacturers outside coal tar or asphaltic base coating and a cement lining and bituminous seal coat on the inside. Cement mortar lining and a bituminous seal coat inside shall conform to ANSI A21.4 (AWWA C-104) latest revision.

All pipe and fittings housed and in vaults shall be lined and coated on the inside as specified herein for buried ductile iron pipe and fittings, but shall be left uncoated on the outside so that it may be painted without the use of tar stop.

- G. Fittings for Ductile Iron Pipe. Ductile iron mechanical, rubber ring slip and flanged joints shall conform to ASA Specifications A21.10 (AWWA C-110) for centrifugally cast iron water pipe. Mechanical joints shall also conform in all respects to ASA 21.11 (AWWA C-111). All fittings shall be manufactured for the size and pressure class of the pipeline in which they are to be used. Mechanical joint type fittings with appropriate adaptors as manufactured by Megalug or approved equal, shall be used. All fittings shall be furnished complete with all joint accessories. All ductile iron pipe fittings for water, sewer, air, gas and force main service shall be bituminous coated outside and lined on the inside same as the line on which they are installed.

- H. Underground Marking Tape. At all locations where Ductile Iron pipe is utilized, a detectable underground marking tape shall be placed in the trench approximately twelve inches below the finished grade. The tape used shall be mylar encased aluminum foil with the printing "CAUTION - Buried Water Line Below". Printing shall be readable through the clear mylar and surface printing is not acceptable. Tape size shall be 2 inch width as provided by Lifeguard, Inc. or approved equal. Color of the tape shall be blue.

2.4 POLYETHYLENE PIPE

This pipe is used primarily for stream crossings and other special applications in locations indicated on the Drawings. The required pressure class shall be as shown on the Drawings.

The pipe shall be PE 3408 high density, high molecular weight polyethylene pipe equal to DRISCOPIPE 1000 as manufactured by Phillips Driscopipe, Inc. The pipe shall meet or exceed the following specifications:

- a. ASTM 3350 having a cell classification of PE34534C
- b. ASTM F714 - Dimensions and Workmanship
15100-8

- c. AWWA C901 - Potable Water Pipe
- d. ASTM D1248 - Type III, Class C, Category 5, Grade P34
- e. ASTM D3261 - Fittings Standard
- f. NSF - Listed, Standard #14

The pipe shall be joined by the butt fusion technique utilizing controlled temperatures and pressures to produce a fused, leak-free joint that has equal or greater strength than the pipe itself in both tension and hydrostatic loading. The joining system shall be equal to Phillips butt fusion joint system.

Transitions to the continuing pipeline shall be made with the appropriate fittings to maintain the integrity of the piping system as recommended by the pipe manufacturer.

Drawings showing details of the installation shall be submitted to the Engineer for approval prior to installation.

3.0 HAULING AND STORAGE

The Contractor shall notify the Engineer when pipe will be received on the job so that proper arrangements may be made for inspecting the unloading and stringing, as well as inspecting and examining the pipe materials.

All pipes shall be covered with tarpaulin during hauling from the manufacturer to the job site. It is acceptable for the front end only to be covered. The intent is to prevent diesel exhaust residue from coating the pipe and/or contaminating the gaskets.

The Contractor will be required to deliver all equipment and other materials and place same as and where required for installation. Care must be exercised in the handling of all materials and equipment and the Contractor will be held responsible for all breakage or damage to same caused by his workmen, agents, or appliances for handling or moving. Pipes and other castings shall in no case be thrown or dropped from cars, trucks, or wagons to the ground, but same shall be lowered gently and not allowed to roll against or strike other castings and unyielding objects violently. Pipe and other castings may be distributed at places that will not interfere with other building operations and unloaded, or yarded and distributed as required, as the Contractor may elect.

Valves, castings, fabricated metal, reinforcing steel, etc. shall be yarded or housed in some convenient location by the Contractor and delivered on the ground as required. All equipment and materials subject to damage from the weather, dampness, changes in temperature, or exposure shall be protected by a dry, weatherproof enclosure until ready for installation or use. The cost of all hauling, handling, and storage shall be included in the prices bid for equipment and materials in place. The Owner takes no risk or responsibility for fire, flood, theft, or damage until after the final acceptance of the work.

4.0 LINES AND GRADES

The Contractor will be required to accomplish any detailed layout, including that required for establishing the grade of the pipe line.

5.0 TRENCH EXCAVATION

5.1 GENERAL

This section describes the acceptable methods of trenching for the installation of pressure pipe and casing pipe in an open trench.

Trenching may be accomplished by means of a backhoe, trenching machine or by hand depending on the construction area.

At the Contractor's option, trenching, by a trenching machine or by backhoe is acceptable except as noted below:

Where the pipe line is being constructed close to other utilities, structures, building, or large trees, and it is reasonable to anticipate possible damage from the use of a backhoe, then trenching shall be made by hand methods.

The Contractor shall include in his unit price bid, all trenching necessary for installation of all pipelines as planned and specified. Trenching shall include all clearing and grubbing, including all weeds, briars, small trees, stumps, etc. encountered in the trenching. The Contractor shall dispose of any such material by burning, burial, or hauling away (or as noted on the drawings), at no extra cost to the Owner. It shall be the Contractor's responsibility to notify the appropriate State and local Air Pollution Control agencies when he conducts open burning of refuse. Ornamental shrubs shall be removed, protected, and replanted. Trenching also includes such items as minor street, road, sidewalk, pipe and small creek crossings; cutting, moving or repairing damage to fences, poles, or gates and other surface structures regardless of whether shown on the plans.

The Contractor shall protect existing facilities against danger or damage while pipeline is being constructed and backfilled, or from damage due to settlement of this backfill. In case of damage to any existing structures, repair and restoration shall be made at once and backfill shall not be replaced until this is done. In all cases, restoration and repair shall be such that the damaged structures will be in as good condition and serve its purpose as completely as before and such restoration and repair shall be done without extra cost to the Owner. The use of trench-digging machinery will be permitted except where its operations will cause damage to trees, buildings or existing structures above or below the ground. At such locations hand methods shall be employed to avoid such damage. All excavated material shall be piled in a manner that will not endanger the work and will avoid obstructing sidewalks and driveways. Gutters shall be kept clear or other satisfactory provisions made for street drainage.

All excavation shall be open trenches, except where the drawings call for tunneling, boring, or jacking under structures, railroads, sidewalks and roads. The construction procedure for these types of excavation is described elsewhere in these specifications.

All trench excavation shall be termed unclassified and costs shall be included in the unit price bid for the pipe.

5.2 CLEARING

The Contractor shall accomplish all clearing and/or grubbing as required for the construction under this contract. Clearing and grubbing shall include the cutting and removal of trees, stumps, brush, roots, logs, fences and other loose or projecting material and natural obstructions which, in the opinion of the Engineer, must be removed to properly prosecute the construction and operate the facilities upon completion of construction. Trees, unless designated otherwise on the plans, shall remain and be properly protected. Ornamental shrubs, plantings, fences, walls, etc. shall be removed and replanted or replaced or protected from the construction activity. Clearing and/or grubbing shall be incidental to the various bid items and no additional compensation will be paid for same.

5.3 TRENCH DEPTH

Trenches shall be excavated to the line and grade required for the installation of pipe at the elevations indicated on the plans. The minimum depth of cover shall be 30 inches above the top of the pipe, unless shown otherwise on the plans or on the Standard Details. When the pipe is laying in or on solid rock, the minimum depth of cover shall also be 30 inches above the top of the pipe. No additional compensation will be made for extra depth where required by the plans or due to Contractor error. Excavation, except as required for exploration, shall not begin until the proposed work has been staked out. Materials which are not required for backfill and site grading shall be removed and disposed of as directed by the Engineer. Hauling, bedding, and backfilling shall be considered incidental to the various bid items and will not be paid for directly. Excavation shall be of sufficient depth to allow the piping to be laid on the standard pipe bedding in accordance with the Section 6 of this section. The trenches shall be excavated to a minimum of six inches (6") below the bottom of the pipe barrel in rock. In all cases where lines are under traffic a minimum cover of forty-two (42") inches shall be provided. Should it be necessary to avoid existing utilities, culverts, outlets, or other structures, the water line shall be carried deeper at no additional expense to the Owner.

Where the plans call for extra trench depth, this extra depth shall be provided at no extra cost.

5.4 TRENCH WIDTH

Trench widths shall exceed the minimum width that will provide free working space on each side of the pipe and to permit proper backfilling around the pipe as shown in the accompanying table and unless specifically authorized by the Engineer, shall not be excavated to wider than two feet (2') plus the nominal diameter of the pipe at the top of the trench. Before laying the pipe, the trench shall be opened far enough ahead to reveal any obstruction that may necessitate changing the line and grade of the pipe. Should the Contractor fail to accomplish this, and changes are required, they shall be at his sole expense. In rock, all ledge rocks, boulders and large stones shall be removed to provide six inches (6") of clearance on each side and below all pipe and fittings.

MINIMUM TRENCH WIDTH

<u>Size</u>	<u>Width</u>	<u>Size</u>	<u>Width</u>
Up to 4" Pipe	2'-0"	15" Pipe	2'-8"
6" Pipe	2'-0"	16" Pipe	2'-8"
8" Pipe	2'-0"	18" Pipe	3'-0"
10" Pipe	2'-4"	20" Pipe	3'-2"
12" Pipe	2'-6"	21" Pipe	3'-4"
14" Pipe	2'-6"	24" Pipe	3'-8"

5.5 SHORING, SHEETING AND BRACING OF EXCAVATION

Where unstable material is encountered, or where the depth of the excavation in earth exceeds five feet (5'), the sides of the trench or excavation shall be supported by substantial sheeting, bracing, or shoring. The design and installation of all sheeting, sheet piling, bracing or shoring shall be based on computations of pressure exerted by the materials to be retained under retaining conditions. Adequate and proper shoring of all excavations will be the entire responsibility of the Contractor. The Standards of the Federal Occupational Safety and Health Act and the Kentucky Department of Labor shall be followed.

The Engineer will not be responsible for determining requirements for bracing or sheeting.

5.6 REMOVAL OF WATER

The Contractor shall provide for adequate removal of all water and the prevention of surface water from entering the excavation. The Contractor shall maintain dry conditions within the excavations until the backfill is placed. No additional compensation will be paid for replacement and/or stabilization of prepared excavations due to flooding and/or deterioration from extended exposure. All water pumped or drained from the excavation shall be disposed of

in a suitable manner without damage to adjacent property or to other work under construction.

5.7 PAVEMENT REMOVAL

Pavement removal shall be as indicated on the plans or directed by the Engineer. When so required, or when directed by the Engineer, only one-half (1/2) of the street crossings or road crossings shall be excavated before placing temporary bridges over the side excavated, for the convenience of the traveling public. All backfilled ditches shall be maintained in such a manner that they will offer no hazard to the passage of traffic. The convenience of the traveling public and the property Owners abutting the improvements shall be taken into consideration. All public or private drives shall be promptly backfilled or bridged at the direction of the Engineer. Pavement replacement shall be in accordance with Section 15102 of these specifications. Excavated materials shall be disposed of so as to cause the least interference and in every case the disposition of excavated materials shall be satisfactory to the Engineer.

5.8 TRAFFIC MAINTENANCE

The Contractor must "red light" and guard all open trenches or obstructions placed on the streets or sidewalks. The lights must be burning from sunset to sunrise in order to effectually warn and safeguard the public against dangers connected with open trenches, excavations and other obstructions. The Contractor shall be held responsible for any damage that may occur to persons or property by reason of the failure of the Contractor to properly "red light" and guard all open trenches or obstructions along the routes of the water lines. This Contractor at his own expense shall also maintain warning signs, barricades and a watchmen or flagmen to control traffic at such times as his work would interfere with the flow of traffic. No excavation shall begin that may present a safety hazard unless the signs, barricades, lights, etc. are available to protect the open excavation at the conclusion of the day. The Contractor will comply with all Federal and State Occupational Safety and Health requirements for this type of construction. The Contractor shall also comply with all local and Kentucky Department of Highways requirements for signing and traffic control.

5.9 LINE LOCATION

The location of pipelines and their appurtenances as shown are those intended for the final construction. However, conditions may present themselves before construction on any line is started that would indicate desirable changes in location. In such cases, the Owner reserves the right to make reasonable changes in line and structure locations without extra cost, except as may be determined by extra units of materials and construction actually involved. The Owner is under no obligation to locate pipelines so they can be excavated by machine.

6.0 BEDDING OF PIPELINE

In all cases the foundation for pipe shall be prepared so that the entire load of the backfill on top of the pipe will be carried uniformly on the barrel of the pipe. The bells of the pipe shall not carry any of the loads of the backfill. The Contractor should refer to the Standard Details for pipe bedding shown in the plans. The bedding specifications shall govern the backfill from the bottom of the trench up to the centerline or spring line of the pipe.

6.1 STABLE EARTH FOUNDATION

On all PVC pipelines, the trench bottoms shall be smooth and free of frozen material, clodded dirt and stones over 1/2" diameter. Bottom dirt left by trenching equipment will usually provide adequate material to level the trench bottom and provide bedding support for the pipe barrel. If the trench bottom is free of dirt, soft material may be shoveled off the side walls or shoveled under the pipe to insure proper pipe barrel bedding. In areas where the trench bottom is hard, a layer of soft backfill must be provided to insure the pipe barrel is properly cushioned. See the plans for proper bedding material depth.

If the foundation is good firm earth the pipe may be laid directly on the undisturbed earth provided the pipe barrel is supported for its full length.

Bedding of No. 9 stone, fine gravel, sand or compacted finely graded select earth shall be used to correct irregularities in the subgrade. Where bell and spigot is involved, bell holes shall be excavated to prevent the bells from being supported on undisturbed earth.

As an alternative to the above method, excavation in earth may be undercut to a depth below the required invert elevation that will permit laying the pipe on a bed of granular material or finely graded select earth to provide continuous support for the pipe barrel. Bedding depth shall be as shown on the plans.

The bedding is not a separate pay item and shall be included as incidental expense in the unit price for the pipe bid per foot of pipe.

6.2 TRENCHES IN ROCK

All installation in rock will utilize the undercutting method. Bedding will be with 6 inches crushed stone as shown in the Standard Details.

6.3 UNSTABLE TRENCHES

If unstable material is encountered which may not provide a suitable foundation for the pipe, the unstable material will be removed and an adequate layer of encasement concrete or other special bedding shall be placed for the pipe foundation in accordance with the Standard Details in the plans. Such "special

pipe foundation" shall only be installed if directed by the Engineer in writing or on the plans.

All ductile iron pipes shall be installed in accordance with Standard ANSI/AWWA C150/A21.50 Laying Condition Type 3 unless otherwise noted.

7.0 PIPE LAYING

7.1 GENERAL

Proper instruments, tools and facilities satisfactory to the Engineer shall be provided and used by the Contractor for the safe and convenient prosecution of the work. Each pipe manufacturer shall have an experienced representative on the job for at least one day at the commencement of jointing and laying operations.

Before any length of pipe is placed in the trench, a careful inspection shall be made of the interior of the pipe to see that no foreign material is in the pipe. In order to properly remove any foreign materials, a swab of necessary length is to be available at all times.

All pipes shall be lowered carefully into the trench, properly aligned and properly jointed by use of suitable tools and equipment, in such a manner as to prevent damage to water line materials and protective coatings and linings. Excessive scratching of the exterior surface of the pipe will be cause for rejection of the pipe.

Under no circumstances shall pipeline materials be dropped or dumped into the trench. The pipe and fittings shall also be inspected for the purpose of determining if they are sound and free from cracks. Laying of pipe shall be commenced immediately after excavation is started. Pipe shall be laid with bell ends facing in the direction of laying.

When pipe laying is not in progress, the open ends of pipe shall be closed by approved means to prevent entrance of trench water into the line. Whenever water is excluded from the interior of the pipe, adequate backfill shall be deposited on the pipe to prevent floating. Any pipe which has floated shall be removed from the trench and relaid as directed by the Engineer. No pipe shall be laid in water or on frozen trench bottom, or whenever the trench conditions or the weather are unsuitable for such work.

If any defective pipe and fittings shall be discovered after the pipeline is laid, they shall be removed and replaced with a satisfactory pipe or fitting without additional charge to the Owner. Open ends of unfinished pipe lines shall be securely plugged or closed at the end of each day's work or when the line is left temporarily at any other time.

7.2 LAYING DUCTILE IRON PIPE

Ductile iron bolted joint, rubber ring slip joint, and ball and socket river crossing pipe shall first be thoroughly cleaned at joints, then joined according to instructions and with tools recommended by the manufacturer. Three (3) copies of instructions shall be furnished the Engineer and one (1) copy shall be available at all times at the site of the work. The lining inside ductile iron pipe must not be damaged by handling.

All pipes must be forced and held together, or "homed" at the joints, before sealing or bolting. Pipe must be aligned as each joint is placed, so as to present as nearly true, straight lines and grades as is practical, and all curves and changes in grades must be laid in such a manner that the manufacturer's recommended maximum deflection is not exceeded at any joint.

Cutting of pipe may be done by wheeled pipe cutters or saws, or by hammer and chisel, as the Contractor may elect, but the Contractor will be held responsible for breakage or damage caused by careless cutting or handling.

All ductile iron pipes shall be installed with Standard ANSI/AWWA C150/A21.50 Laying Condition Type 3 unless otherwise noted, six inches (6") crushed stone bedding shall be used in rock. Sufficient space (limited to 2 feet longitudinally) shall be left out of 4 or 6 inch cushion for tightening of bolts where bolted joints are used. No pipe shall be laid resting on rock, blocking, or other unyielding objects. Jointing before placing in trench, and subsequent lowering of more than one section jointed together may be allowed, subject to the Engineer's approval and direction.

When using pipe with push-on joints care must be exercised to make certain that the correct gasket is being used for the type of joint installed and that the gasket faces the proper direction. Before inserting the gasket, the groove and bell socket should be carefully cleaned of all dirt. If sand or dirt is permitted to remain in the groove, leaks may occur. Lubricant must be applied to bell socket, gasket and plain- end of pipe as required by manufacturer. Plain-end must be beveled before joint is made. Deflection required at the joint shall be obtained after the joint is made.

Cut pieces of ductile iron pipe 18 inches or more in length, shall be used in fitting to special conditions, and valves and fitting changes in grade and alignment, provided cutting is even enough to make first class joints and no cracks are evident.

7.3 LAYING PLASTIC PIPE

The trench bottom must be smooth and uniform and the alignment must conform to the plans. Bedding and cover as specified herein and shown in the Standard Details is required.

To make a clean and unobstructed joint, it is necessary to wipe the ring, groove and pipe spigot free from all foreign materials at the time of assembly (welded joints will be allowed only in special cases and will be required as shown on the plans). The ring must be positioned properly in the fitting to receive the pipe by a worker who is not in contact with the lubricant. In general, the lubricant is applied to the spigot (not the ring or groove). However, the manufacturer's instructions are to be followed in all cases. Only an approved lubricant may be used in accordance with the manufacturer's recommendations. All plastic pipes shall be joined by hand.

Where good bedding conditions are attained PVC pipe smaller than 4 inches may be assembled outside the trench in longer sections (as conditions allow) and then lowered into the trench. At any time when improper bedding is discovered or the pipe is severely deflected the pipe will be removed from the trench and the condition corrected. Pipe in sizes 4 inch and above may be assembled outside the trench but must be lowered into the trench as each joint is assembled. Regardless of installation methods all couplings must be inspected after laying in trench for proper insertion and alignment. Field cuts and bevels will be allowed in accordance with the manufacturer's recommendations for these operations. A new reference mark shall be installed before joining any field cut pipe. The same requirements for clearance from rock or other objects, thrust blocking and deflections shall apply to PVC pipe as for other pipe materials.

Municipal PVC pipe of all sizes must be assembled in the trench in strict accordance with the manufacturer's requirements.

7.4 INSTALLATION OF RIVER CROSSING PIPE

The ball joint pipe shall be assembled and installed in accordance with manufacturer's recommendations. Installation shall be made at time of low flow, using cofferdams as necessary to divert stream flow. The ball joint pipe shall be laid and allowed to settle before joining to the pipe on each side of the stream. The ball and joint pipes shall be tested separately once in place to detect any leaks or bad joints. After connecting to the land pipe, it shall be tested the same as specified for the other water mains. See the Drawings for additional installation requirements.

8.0 **BACKFILLING**

Backfilling must be started as soon as practicable after pipe has been laid and joints hardened sufficiently, and jointing and alignment approved. Spading of crushed rock, sand, or mechanical tamping of earth, around pipe (as specifically required) between joints shall be the usual procedure as the laying progresses. This is in order to avoid danger or misalignment from slides, flooding or other causes. The Engineer shall be given a minimum of 24 hours for inspection before backfilling. The backfill shall be crushed rock, sand, or finely divided

earth free from debris, organic material and stones, places simultaneously on both sides of pipe to the same level by hand.

In backfilling of the lower part of the trench beginning at the top of the bedding, the backfill material shall be carefully and solidly tamped by hand or approved mechanical methods in 6" layers around the pipe and up to a point 8 inches higher than the top of the pipe. For PVC only the backfill shall be select material and may be walked-in. Walking or working on the completed pipe line, except as necessary in tamping or backfilling, shall not be permitted until the trench has been backfilled to a point one diameter higher than the top of the pipe. The filling of the trench and the tamping of the backfill shall be carried on simultaneously on both sides of the pipe in such a manner that the completed pipe line will not be disturbed and injurious side pressures do not occur.

After the above specified backfill is hand placed, rock may be used in the backfill in pieces no larger than 18 inches in any dimension and to an extent not greater than one-half (1/2) the backfill materials used. If additional earth is required, it must be obtained and placed by the Contractor. Filling with rock and earth shall proceed simultaneously, in order that all voids between rocks may be filled with earth. Above the hand placed backfill, machine backfilling may be employed without tamping, (if not contrary to specified conditions for the location) provided caution is used in quantity per dump and uniformity of level of backfilling. Backfill material must be uniformly ridged over trench and excess hauled away, with no excavated rock over 1-1/2 inch in diameter or pockets of crushed rock or gravel in top 6 inches of backfill. Ridged backfill shall be confined to the width of the trench and not allowed to overlap onto firm original earth and its height shall not be in excess of needs for replacement of settlement of backfill. All rock, including crushed rock or gravel from construction, must be removed from yards and fields. Streets, roadways and walks shall be swept to remove all earth and loose rock immediately following backfilling.

In the case of street, highway, railroad, sidewalk and driveway crossings or within any roadway paving or about manholes, valve and meter boxes, the backfill must be machine tamped in not over 4-inch layers, measured loose in accordance with the standard details. Where backfill is under paved driveways, streets, highways, railroads, sidewalks, paved parking areas and other areas where settlement is not allowed, crushed stone or coarse sand backfill only shall be used up to the paving surface. Crushed stone shall be Kentucky Department of Highways Standard Specification No. 78 or finer. Coarse sand backfill shall be spread in layers not over 4 inches thick and thoroughly compacted. Sand may be moistened to aide compaction. Tunnels shall be backfilled in not over 3-inch layers, measured loose, with selected material suitable for mechanically tamping. If material suitable for tamping cannot be obtained, sand, gravel or crushed rock (No. 78) shall be blown, packed or sluiced to complete fill all void spaces.

Where local conditions permit, pavement shall not be placed until 30 days have passed since placing backfill. Crushed stone is specified for roads and parking

areas and sidewalks or their bases, shall be placed and compacted to the top of trench. Backfills shall be maintained easily passable to traffic at original ground level, until acceptance of project or replacement of paving or sidewalks.

Where the final surfacing is to be crushed stone, compacted earth backfill may be used in the trench to within 6 inches of the top as shown in the Standard Details.

Railroad Company and Highway Department requirements in regard to backfilling will take precedence over the above general specification where they are involved.

Excavated materials from trenches and tunnels in excess of quantity required for trench backfill shall be disposed as shown on the plans or as directed by the Engineer.

The Contractor shall protect all sewer, gas, electric, telephone, water and drain pipes or conduits, power and telephone poles and guy wires from danger of damage while pipelines are being constructed and backfilled, or from danger due to settlement of his backfill.

In case of damage to any such existing structures, repair and restoration shall be made at once and backfill shall not be replaced until this is done. In all cases, restoration and repair shall be such that the damaged structure will be in as good condition and serve its purpose as completely as before uncovering and such restoration and repair shall be done without extra charge.

No extra charge shall be made for backfilling of any kind, except as provided in the Bid. Backfilling shall be included as a part of the unit price bid for which it is subsidiary. No extra charge shall be made for supplying outside materials for backfill.

Before completion of contract, all backfills shall be reshaped, holes filled and surplus material hauled away, and all permanent walks, street, driveway and highway paving, and sod, replaced (if such surface replacement items are included in the contract) and reseeding performed.

The line Contractor shall be responsible for clean-up, grading, seeding, sodding or otherwise restoring all areas that he disturbs within the work limits of other Contractors on this project.

Any deficiency in the quantity of material for backfilling the trenches or for filling depressions caused by settlement, shall be supplied by the Contractor.

9.0 TIE-INS TO EXISTING PIPELINES

This work shall consist of connecting new water pipes to the existing system where shown on the plans and shall include the necessary fittings, tapping sleeves, valves and necessary equipment and material required to complete the connection.

Knowledge of pipe sizes in the existing system may not be accurate; therefore, it is recommended that the Contractor check outside diameters of existing pipe and types of pipe prior to ordering the required accessories. No additional payment will be allowed for matching pipe and/or accessories when the proper size is not ordered.

Neither the Owner nor the Engineer can guarantee the location of the existing lines. The Contractor shall verify the location of all existing water mains and valves pertaining to the proposed improvements before excavation is started.

The necessary regulation or operation of the valves on existing mains, to allow for the connections being made, shall be supervised by the Engineer. Before shutting down an existing water main or branch main for a proposed connection, prior approval for a specific time interval shall be obtained from a representative of the Owner. At no time shall an existing main be shut down without the Owner's knowledge and permission.

Excavation to existing water mains shall be carefully made, care being exercised not to damage the pipe. The excavation shall not be of excessive size or depth beneath the pipe. The sides of the excavation shall be as nearly vertical as possible.

The Contractor shall be responsible for any damage to the existing system and any such damage shall be repaired to the satisfaction of the Engineer at the Contractor's expense.

The Contractor shall verify, by field inspection, the necessary sizes, lengths and the types of fittings needed for each inter-connection. Typical connections are shown on the plans and any modifications or changes shall be subject to the approval of the Engineer. The exact length of the proposed water main needed for this work shall also be determined by field measurement as required.

The probing required to locate existing mains is not a separate pay item.

10.0 PIPE ENTERING STRUCTURES

Ductile iron, steel or PVC pressure pipe, 4-inch diameter or larger, entering structure below original earth level, unsupported by original earth for a distance of more than six feet (6'), shall be supported by Class B concrete, where depth of such support does not exceed three feet (3'), and by Class B Concrete piers

15100-20

where depth exceeds three feet (3') in accordance with the Standard Details. All other pressure pipe entering buildings or basins below original earth level, which have more than 3 feet span between wall and original earth and having a cover of more than 24 inches of earth, or under roadway, shall be supported as shown on Standard Detail drawings, in order to prevent breakage from settlement of backfill about the structure. Concrete and reinforcing steel for such supports are to be included in the unit price of work to which it is subsidiary, and not as extra concrete, in order to discourage excessive excavation outside the limits of structures. Pipe entering structures shall have flexible joint within 16 inches of exterior of structure.

11.0 OWNERSHIP OF OLD MATERIALS

Pipe - Unless otherwise indicated, all existing pipe that is to be abandoned that interferes with construction or is easily removed shall become the property of the Contractor. All pipe that is not easily removed or not required to be removed as a result of the new construction, shall be abandoned in place by this Contractor.

Pipe Line Fittings and Appurtenances - All pipe line fittings, valves, hydrants and other like appurtenances that are removed as a result of new construction shall be removed by this Contractor but shall become the property of the Owner. All such fittings and appurtenances shall be delivered to a point by the Contractor. Said point shall be on the Owner's property and shall be designated by the Engineer.

Other Materials - All other materials or items that are to be removed, demolished, or abandoned as a part of this contract shall become the property of the Contractor and shall be disposed of by him.

12.0 THRUST BLOCKS AND ANCHORAGE

Thrust blocks shall be installed whenever the pipe line changes direction, as at tees, bends, crosses, stops, as at a dead end; or at valves. The locations of thrust blocks depend on the direction of thrust and type of fitting. Their size and type depends on pressure, pipe size, kind of soil, and the type of fitting. Where thrusts act upward (as at vertical curves) the weight of the pipe, the water in the pipe and the weight of the soil over the pipe should be determined to make certain that the total weight is sufficient to resist upward movement. If there is not enough soil or if it will not compact over the pipe or it is too soft and mushy to resist movement, then ballast or concrete may be placed around the pipe in sufficient weight and volume to counteract the thrust. Where a fitting is used to make a vertical bend, the fitting may be anchored to a concrete thrust block designed to key in to undisturbed soil and to have enough weight to resist upward and outward thrust, since the newplaced backfill may not have sufficient holding power.

Thrust blocks shall be constructed of not less than Class B concrete conforming to KTC Specification 601 and placed between the fitting and the trench wall. It is important to place the concrete so it extends to undisturbed (freshly cut) trench wall.

13.0 MAINTENANCE OF FLOW OF DRAINS AND SEWERS

Adequate provision shall be made for the flow of sewers, drains and water courses encountered during construction. Any structures which are disturbed shall be satisfactorily restored by the Contractor.

14.0 INTERRUPTION OF UTILITY SERVICES

No valve, switch or other control on any existing utility system shall be operated for any purpose by the Contractor without approval of the Engineer and the Utility. All consumers affected by such operations shall be notified by the Contractor as directed by the Engineer and utility before the operation and advised of the probable time when service will be restored.

15.0 FENCING

Where water supply line is being constructed in fields where stock is being grazed, Contractor shall provide temporary fence as approved by the Engineer around open trenches to prevent stock from falling in trenches. Where trenching operations should isolate grazing stock from their source of water, Contractor will either provide temporary bridging over trench or else provide water for such stock.

Where trench crosses near sound existing corner posts and existing fence is in good condition, fence may be taken loose, rolled back and stored until pipe line is completed at this point, then replaced by stretching tightly and thoroughly stapling. Additional posts will be provided and additional new fence shall be provided when it is necessary to place the fence crossed by the water line in a condition equal to existing fence before water line was constructed.

Where it is necessary to cut existing fence, new end posts shall be installed on each side of the water line and the old fence thoroughly stapled to these new posts before cutting. After pipe line is completed at this point, a new fence of galvanized wire (No. 9 gauge with No. 11 filler wires) shall be stretched between these new end posts and thoroughly stapled to existing posts and any new intermediate posts necessary to provide a good fence. Replacement of fences shall be on a replacement in-kind basis, and shall be considered incidental to laying of the lines and any additional cost shall be included in the unit price bid per lineal foot of pipe. Contractor shall notify property Owner prior to cutting fence.

16.0 PROTECTION OF ADJACENT LANDSCAPE

Reasonable care shall be taken during construction of the water lines to avoid damage to vegetation. Ornamental shrubbery and tree branches shall be temporarily tied back, where appropriate, to minimize damage. Trees which receive damage to branches shall be trimmed of those branches to improve the appearance of the tree. Tree trunks receiving damage from equipment shall be treated with a tree dressing.

In the course of construction, the Contractor may deflect horizontal alignment of the water line to avoid trees and to keep from damaging their roots. The Contractor shall be fully responsible for settling all claims by private property Owners concerning damage to trees and shrubs.

17.0 COORDINATION WITH UTILITIES

The Plans show the general location of existing utilities, such information having been determined from the utilities. However, such information shall be considered general and is not guaranteed by Owner, Engineer or the Utility.

Prior to construction, the Contractor shall arrange to meet with representatives of all utilities, and provide them with his anticipated work schedule. The Contractor shall have the utilities make their best determination of utility locations in the areas in which he is working. Throughout the progress of the work, such field markings of utilities shall be kept current.

Repairs to any utilities damaged by the Contractor shall normally be performed by the utility at the Contractor's expense, unless the Contractor and the utility negotiate other understandings and/or procedures.

18.0 BLASTING AND ROCK EXCAVATION

The Contractor shall make his own investigation as he deems necessary to ascertain the sub-surface conditions to be encountered in the work.

All blasting operations shall be conducted in accordance with municipal ordinances, state and federal laws and Section 9, Explosives, of the "Manual of Accident Prevention in Construction", published by the Associated General Contractors of America, Inc. Soil particle velocity shall not exceed limit set by Kentucky law. All explosives shall be stored in conformity with said ordinances, laws and safety regulations. No blasting shall be done within five feet of any water mains, sewer lines, natural or manufactured gas lines, liquid petroleum product lines or other utilities. Any damage done by blasting is the responsibility of the Contractor and shall be promptly and satisfactorily repaired by him.

The Contractor shall use delay caps or other approved methods to reduce earth vibrations and noise. Mud capping, as defined in the above manual, will not be permitted as a method of breaking boulders. No blasting shall be permitted on Sundays or after dark.

Prior to commencing with the work, the Contractor shall, during a preconstruction conference with the Owner and Engineer, state clearly his approach to performing the excavations on the project. He shall be familiar with the laws and ordinances covering blasting and shall also give consideration to the use of hydraulically operated rock breaking devices in lieu of blasting where considered necessary. If blasting is not handled in an expert manner at all times, the Engineer reserves the right to suspend blasting and require the work to proceed without it.

Prior to blasting, the Contractor shall make his own detailed preblast survey of adjacent walks, curbs, retaining walls, house foundations, etc. to determine conditions prior to the work. Such a file of information, including photographs, may be certified in such a manner as the Contractor believes necessary since this information that may stand in his defense.

19.0 MEASUREMENT AND PAYMENT

Payment for supplying, transporting and storing pipe, trenching, standard bedding, pipe installation, fittings, thrust- blocking, pipe locating wire or tape, testing, backfilling, disinfection, seeding, crop damage, regular stream crossings, clean-up, tie-ins to other structures and other incidental items in this section shall be made on the basis of the unit price bid for the pump station.

SECTION 15101

WATERLINE ACCESSORIES

1.0 GENERAL

The Contractor is to supply and install all valves, hydrants, blowoffs and other equipment at the locations shown on the plans in complete accordance with these specifications.

2.0 GATE VALVES

All gate valves shall be the resilient seat-type, iron body, non-rising stem, fully bronze mounted, and suitable for working water pressures of not less than 200 psi for installations on PVC pipe and not less than 250 psi for installations on DI pipe. Valves shall be of standard manufacture and of the highest quality both of materials and workmanship and shall conform to the latest revision of AWWA C-509 Standard. Valves shall be furnished with flanged connections for exposed piping and push-on or mechanical joint connections for buried service. Gate valves shall have a clear water way equal to the nominal diameter, and shall be opened by turning counter-clockwise. The operating nut or wheel shall have an arrow cast in the middle, indicating the direction of opening. Each valve shall have the maker's initials, pressure rating and the year in which manufactured, cast on the body. Prior to shipment from the factory each valve shall be tested by hydraulic pressure of at least 300 pounds per square inch.

Underground valves shall be nut operated, unless otherwise shown on the plans. Valve supplier shall furnish two standard stem iron wrenches for turning nut operated valves. All underground valves which have nuts deeper than thirty inches (30") below the top of valve box shall have extended stems with nuts located within two feet (2') of valve box cap. Buried service valves shall have either epoxy-coated or tar-coated exteriors.

The valve maker is to supply the Engineer, through the bidder, within one week after award is made, complete catalogs or other material giving complete details and dimensions of valves and accessories.

Gate valves installed in underground piping systems may be installed in the vertical position for sizes to 12-inch. Gate valves 14-inch and larger shall be installed in the horizontal position with bevel gear operators unless otherwise noted on the drawings. Gear operators shall be the totally enclosed type, oil filled and designed for buried and submerged service. Gear housing shall be ductile iron. Gears shall be steel. Pinion shafts shall be stainless steel. Shaft bearings shall be Teflon with "O"-Ring bearings.

3.0 FIRE HYDRANTS

3.1 WORK INCLUDED

Under this Item, the Contractor shall provide all labor, tools, equipment and materials to furnish and install hydrants with gate valves as shown on the drawing and as directed by the Engineer.

3.2 MATERIALS

All fire hydrants shall have a six inch bell connection, shall have two hose outlets and one pumper connection, shall be designed for 250 pounds working pressure or 300 pounds hydrostatic pressure and shall conform to the latest specifications of the AWWA C502. All working parts shall be bronze. Both hose outlets shall be 2 1/2 inch with NST threads and the pumper outlet shall be 4 1/2 inch with NST thread. Hydrants shall be designed so that no water will be lost when they are broken off and so they can be repaired with a repair kit. Design, materials, and workmanship shall be similar and equal to the latest stock pattern ordinarily produced by the manufacturer. Length of barrel shall be such to provide a 3 1/2 foot bury depth. Working drawings and full description of hydrants shall be submitted to the Engineer before ordering. All hydrants shall have a 5 1/4 inch valve opening against pressure. The hydrants shall be Mueller or Kennedy brand or approved equal. All hydrant extensions will be the responsibility of the Contractor.

3.3 PAINT

Hydrants shall be painted one coat of red paint and two finish coats of approved paint of color directed by the Engineer. All hydrants are to receive the final coat of paint after field installation.

3.4 INSTALLATION

Hydrants shall be set at such elevations that the connecting pipe will have the same depth of cover as the distribution main. The back of the hydrant opposite the pipe connection shall be firmly wedged against one and one-half square feet or enough of the vertical face of the trench with concrete to prevent the hydrants from blowing off the line. In addition, all fittings, valves and hydrants shall be joined by the use of all-thread rods, nuts and "DUC-LUG" offsets as shown on the attached drawing to prevent movement of the hydrant. If the character of the soil is such, in the opinion of the Engineer, that the hydrant cannot be securely wedged, bridle rod collars shall be used which shall be not less than three-fourths inch stock and shall be protected by a coat of acid resistant paint.

Not less than seven cubic feet of No. 9 stone shall be placed around the base of the hydrant to insure drainage. Before the No. 9 stone is placed and before it is

backfilled the drain hole shall be inspected and thoroughly cleaned if necessary. The backfill around the hydrant shall be thoroughly compacted to the grade line in a manner satisfactory to the Engineer. Hydrants shall have the interior cleaned of all foreign matter before installation.

All hydrants will be installed with the pumper connection facing the main access road or as directed by the Engineer.

Stuffing boxes shall be tightened and the hydrants shall be inspected in open and closed position to see that all parts are in working condition.

4.0 AIR VALVES

4.1 AIR RELEASE VALVES

A valve designed to allow exhaust of small pockets of air from the water main while in use shall be installed where shown on the plans or where directed by the Engineer. The air release valve shall have a 3/4" iron pipe thread inlet, cast iron body construction, bronze trim, with all internal parts of stainless steel. The valve shall have a minimum orifice size of 3/32". Valves shall be suitable for a working water pressure of 150 PSIG. The air release valve shall be mounted on 3/4" bronze riser pipe. The riser pipe shall be connected to the water main by use of a service clamp and a corporation stop. The riser shall also have a 3/4" bronze ball valve with stainless steel handle and be suitable for a 150 PSIG working water pressure. Air release valves shall be as manufactured by APCO Models 65 or 50, or approved equal.

Air release valves will be installed in the same type of box used for meter installation. The box must allow for adequate cover over the pipe at the installation.

In locations where the air release valve can not be placed directly above the water main, such as roadway drainage ditches, then a section of service tubing shall be used to locate the valve as directed by the Engineer. The service tubing shall be installed with a continuous upward slope to eliminate air pockets. Additional payment for the tubing shall be made based on the linear foot bid for service tubing. Tubing shall also be rodded through the box to support the valve. No additional payment will be made for the tubing supports.

5.0 VALVE BOXES

All valves (gate, air release, check, etc.) installed underground shall be installed in an approved valve box. Each gate valve shall be installed in a vertical position with a valve box. Valve boxes shall be of a cast iron, two or three-piece, slip-type consisting of a base, a center section and a top section with a cover marked "water". Where valve box is constructed in a paved area the box

shall be a screw type box. The entire assembly shall be adjustable for elevation and shall be set vertically and be properly adjusted so that the cover will be in the same plane as the finished street surface (no more than 1/2" above ground in yards or pastures or 2" in unsodded areas). The assembly must provide for the required cover over the pipe at the installation site and shall rest on concrete pads as shown in the Standard Details. The Contractor shall furnish two valve wrenches for the project.

6.0 BLOW-OFF ASSEMBLY

Blow-off assembly shall be installed in accordance with the details and the specifications at locations shown on the plans and in other locations as directed by the Engineer. The gate valve is included in the unit bid price for blow-off assembly. The Contractor should refer to the Standard Details for blow-off installation.

The blowoff pipe from the main to the flush valve shall be connected to the main by means of a tee. Do not use a corporation stop for this connection. The gate valve included in the blow-off connection shall be a resilient seat gate valves in conformance with AWWA C509.

7.0 TAPPING SLEEVE AND VALVE

Tapping sleeves shall be as manufactured by Mueller or approved equal, and shall be rated for a minimum working water pressure of 150 psi. Contractor shall ascertain the type and size of pipe to which the connection is to be made prior to selection. The valve shall be as specified under section 2.0 of this specification.

8.0 TIE IN CONNECTIONS

All tie in connections shall include any fittings suitable to make the required connection. The fittings shall be mechanical joint, ductile iron type as specified in other sections.

9.0 STUB-OUT

A stub-out shall consist of a gate valve restrained with all-thread to the main line. The valve shall be the same size as the main line and be as close to the main line as practical. The valve shall be as specified under section 2.0 of this specification. A minimum of one joint of pipe shall be laid past the valve with the bell end away from the valve. A cap matching the material and size of the pipe shall be placed at the end of the line.

10.0 SOLENOID CONTROL VALVE

The valve shall have ANSI Class 150 flanges drilled to pressure rating/ flange standard, globe, style valve. Solenoid valve shall be four-way de-energized to close valve, with a 120VAC/ 60Hz solenoid coil. The valve shall open and close fully in response to energizing and de-energizing of the solenoid pilot

Valve shall be a hydraulically operated globe valve. The inner valve assembly shall be guided in two locations by means of easily replaceable bearing bushings. The inner valve assembly shall be the only moving part and shall be securely mounted on a 316 stainless steel stem with all stainless steel internal components. The two operating chambers shall be separated from each other by the diaphragm and from the flowing media by an adapter plate. All pressure containing components shall be constructed of ASTM A536-65/45/12 ductile iron. The flanges shall be designed to ANSI Class 150 standards.

Valve 4" and smaller shall provide smooth "frictionless" motion with actuation being achieved by the use of a flat style EPDM diaphragm. They shall be constructed of nylon fabric bonded with synthetic rubber. The diaphragms shall not be used as a seating surface. No lip seals or packing may be used to seal the actuator.

Valve 6" and larger shall provide smooth "frictionless" motion and maximum low flow stability with actuation being achieved by the use of a rolling diaphragm technology. The diaphragms shall be fully supported through their full stroke and not be used as a seating surface. No lip seals or packing may be used to seal the actuator.

The valve cover shall have a separate stem cap giving access to the stem for alignment check, spring installation and ease of assembly. On valves 3" and larger, bonnets shall be accurately located to bodies utilizing locating pins. Locating pins shall eliminate corrosion resulting from the use of uncoated ductile iron to ductile iron surfaces. Valve(s) 3" and larger shall have the 316 stainless steel seat bolted in place. The 316 stainless steel seat ring shall be easily replaceable without special tools. The valve shall form a drip tight seal between the stationary stainless steel seat ring and the resilient disc. The resilient disc shall be constructed of Buna or EPDM for normal service conditions. All external fasteners shall be 18/8 stainless steel with 18/8 washers. All repairs and maintenance shall be possible without removing the valve from the line.

Each valve shall be tested prior to shipment. The standard test shall include a pressure test and a full functional, operational test when pilots and accessories are fitted to suit a particular application. The valve shall be covered by a minimum three year (3) warranty against defects in materials and workmanship. The stainless steel seat ring shall be covered by a lifetime replacement warranty.

The valve shall be a Singer Model S106-PT-SC-X129 or approved equal.

Pilots & Accessories:

Micrometer Flow Control Valve

- Maximum Fluid Temperature: 140 F
- Maximum Pressure Rating: 250 psi
- X129 Limit Switch Assembly
- (2) 2 ½" L/F Gauges (Inlet & Outlet)
- Stainless Steel Pilot Tubing & Fittings

11.0 MEASUREMENT AND PAYMENT

Payment for the solenoid control valve shall include all work and materials necessary for a complete and working installation. Payment will be made at the unit price bid for the type and size of valve installation. Tapping sleeve and valve tie-in connections and fire hydrants or blow-off assemblies shall be included in the unit price bid for the pump station.

SECTION 15102

SPECIAL ITEMS OF CONSTRUCTION

1.0 GENERAL

These specifications govern special crossings, installations and construction procedures required to deal with unusual construction items or special requirements of governing agencies.

2.0 STATE HIGHWAY CROSSINGS

In all cases, these crossings will be made in compliance with the requirements of the State Highway Department. Such requirements will normally be described by the appropriate District Highway Office. In general, unless otherwise shown on the plans or directed otherwise by the ENGINEER, the crossing of all State Highways shall be accomplished by boring under the roadway. In addition, the crossing of service lines 1-1/2 inches and greater under rigid and flexible surfaced paved roads shall be accomplished by boring and jacking a casing pipe under said roadway. In certain cases, as shown on the plans, service lines of all sizes will require casing pipe installed with the crossing.

2.1 OPEN TRENCH CROSSINGS

The trench shall be excavated to a minimum width that will allow the pipe installation. The trench walls shall be kept as nearly vertical as possible. The minimum specified cover above the pipe shall be maintained. The Miscellaneous Detail Drawings show the requirements for open trench crossings.

The backfill in the trench under any roads, driveways, or parking areas where the open trench method is used shall be of the type shown in the Miscellaneous Details and shall be deposited and compacted in uniform layers not to exceed the depth shown in the Miscellaneous Details.

The surface of the road, driveway, or parking area shall be replaced with the same type of material as specified under pavement replacement.

2.2 BORING AND JACKING

The work is herein defined as the operations in which both the boring by auger and the jacking of the casing pipe are done mechanically and in which the diameter of the casing pipe is too small to permit hand working at the heading of the casing pipe. Two basic methods are; (1) pushing the casing pipe into the fill or earth simultaneously as the boring auger drills out the ground; and (2) drilling

the hole through the fill or earth and pushing the casing or carrying pipe into the hole after the drill auger has completed the bore.

A suitable approach trench shall be opened adjacent to the slope of the embankment, or adjacent to point of bored and jacked section as shown on the plans. The approach trench shall be long enough to accommodate the selected working room. Guide timbers or rails for keeping the casing pipe on line and grade shall be accurately set and maintained in the bottom of the approach trench and with heavy timber back-stop supports installed at the rear of the approach trench to adequately take thrust of the jacks without any movement or distortion. It is paramount to the securing of acceptable tolerance limits of workmanship in the boring and jacking operation that extreme care be taken in the setting of all guides, rails and jacks to the end that the casing pipe in final position be within the limits of acceptability for the placing and laying of the carrier pipe. The minimum cover of forty-two inches (42") under the roadway must be maintained. Additional depth may be required as shown on the plans.

In general, the diameter, thickness, style, joints and materials selected for casing pipe shall be as shown on the plans and shall be considered as "minimum" requirements, all subject to prior approval of the Engineer. In all cases, the approval for construction by agreement with the private company and/or construction permit issued by the State, County, or Municipal agency will be required before construction starts.

Steel casing pipe for road and railroad crossings using the boring and jacking method shall be steel, plain end, uncoated and unwrapped, and shall be furnished in at least 18-foot lengths. Steel pipe shall meet the requirements of ASTM Specification A-120 and AWWA C200. Pipes up to and including 4 inches in diameter shall be Schedule 40. Pipe larger than 4 inches shall have a wall thickness equal to or greater than 0.312 inches under railroads and 0.250 for all other uses. The inside diameter of all casing pipes shall be a minimum of four (4") inches greater than the largest outside diameter of the carrier pipe, joint or coupling.

The steel casing pipe shall be bored and/or jacked in place at the locations as shown on the plans or as directed by the Engineer. All joints between lengths shall be solidly welded with a smooth nonobstructing joint inside. Any field welding shall be performed by a certified welder and shall be in accordance with AWWA C206. The casing pipe may be extended beyond the boring limits by open trenching as shown in the Standard Details. This would apply when the casing is required from right-of-way to right-of-way or ditch line to ditch line. Open trenching at jacked or bored locations will be allowed no closer than 3 feet from edge of pavement.

Positioning guides (insulators) shall be utilized on all carrier pipe which is within the casing pipe. Positioning shall be accomplished by the use of prebuilt

spacers such as those manufactured by CALPICO or an approved equal. The Contractor shall submit the type of position guide proposed for use for the approval of the Engineer. Spacing of the positioning guides shall be in accordance with the Standard Drawings.

The ends of the casing pipe shall be plugged and made watertight in a manner acceptable to the Engineer prior to backfilling. Casing seals as manufactured by Pipeline Seal & Insulator, Inc. (PSI), Advance Products & Systems, Inc. (APS) or equal shall be used.

Where road crossings are made using plastic pipe or copper, the location of joints under the roadway should be avoided by using lengths of adequate dimension for the crossing. This principle also applies to other types of pipe where sufficiently long lengths are available.

3.0 RAILROAD CROSSINGS

At all railroad crossings, cover pipe (casing) for water lines (carrier pipe) shall be jacked or pushed beneath tracks and the carrier pipe jointed and pushed through the cover pipe. Detailed drawings of railroad crossings including the length of casing and depth below track are shown in the plans. Contractor shall obtain and pay for services of a representative of the railroad to direct the Contractor's operations while on the railroad property when required by the railroad.

4.0 STREAM CROSSINGS

4.1 NO-FLOW CONDITION

Where required on the plans or instructed by the Engineer, the Contractor shall construct a special creek crossing as shown in the Miscellaneous Detail Drawings. Crossings shall be scheduled for construction in times of no flow or very low flow, if practicable, otherwise the stream shall be directional bored. Concrete shall not be placed under water and Contractor shall provide suitable pumps to keep water out of trench excavation during stream crossing construction. Special creek crossings shall be designated as Type A or Type B as contained in the Miscellaneous Detail Drawings.

4.2 NORMAL EARTHEN STREAM CROSSING

Where the stream crossing is made in earth or other beds which are stable (no casing or anchorage required), then the pipe will be laid in a narrow trench at the depth specified in the Miscellaneous Details to maintain the required cover between pipe and stream bed. Initial backfill will be mechanically compacted. Trench backfill in any stream crossing area from one foot (1') above the top of the pipe shall consist of trench excavated rock, if available. No extra payment will be made above normal construction for this type of creek crossing.

4.3 BLUE LINE STREAM CROSSINGS

All crossing of streams that appear as a blue line on a USGS 7.5 minute topographical map shall be accomplished in accordance with:

**GENERAL CERTIFICATION
NATIONWIDE PERMIT #12
UTILITY LINE BACKFILL AND BEDDING**

This document is bound in back of the specifications. The Contractor shall read, understand and comply with the requirements and procedures.

Stream size, for purposes of this specification, is differentiated as large or small. A stream is classified as small when the distance across the stream channel at top of banks is 15 L.F. or less. A stream is classified as large when this measurement is greater than 15 L.F.

It is the intent of the plans to identify a stream crossing at each blue line stream. Small stream crossings may frequently be accomplished by trenching when the stream is in a no-flow condition. If the stream is in a flow condition, irregardless of the size classification, the crossing shall be accomplished by directional boring or other method that complies with the General Certification and is approved by the Engineer. Specific details for stream crossings are contained in the Miscellaneous Detail Drawings.

See Section 15 for Basis of Payment.

4.4 BYPASS TEST METER

At locations as indicated on the plans, where a new creek crossing is installed, a bypass test meter shall be installed. The meter shall be installed as a normal water meter with taps on each side of a valve, as shown in the Miscellaneous Detail Drawings.

5.0 RIVER OR LAKE CROSSINGS

Crossings in rivers or lakes where the pipe cannot be laid in a trench shall normally be made with ductile iron pipe having ball and socket joints or polyethylene pipe or directional bored as indicated on the Drawings. Details for any required installations of this type including pipe required; number, size and location of anchors; and, installation technique are shown in the plans and Miscellaneous Detail Drawings. See Section 15100 for installation requirements.

6.0 BRIDGE CROSSINGS

Wherever possible bridges will not be utilized for stream crossings. However, where it is necessary for the water line to be attached to bridges, the pipe shall

be securely fastened to bridge stringers or beams using supports as dimensioned and located in the plans. The carrier pipe shall be insulated with Vermiculite or other approved material to prevent freezing. Expansion joints to allow for movement of the bridge will be required as shown on the plans.

7.0 FREE BORE

7.1 WORK INCLUDED

Under this item, the Contractor shall provide all labor, tools, equipment and materials to install the free bore at all bituminous and concrete driveways and/or county road unless otherwise directed by the Engineer.

7.2 INSTALLATION

The Contractor shall provide a jacking pit and bore through the earth at the proper line and grade. The augured hole shall be as small as practical to allow the carrier pipe to pass through.

This bid item does not apply to service tubing.

7.3 MEASUREMENT AND PAYMENT

The unit price bid per linear foot for free boring, as measured from edge of pavement to edge of pavement, regardless of size of bore, shall constitute full compensation for the work specified.

8.0 WATER LINE AND SEWER LINE SEPARATION

8.1 GENERAL

Wherever sewer lines cross, or are adjacent to, each other, special precautions shall be taken.

8.2 PARALLEL WATER AND SEWER LINES

Water lines must, if possible, be located a minimum lateral distance of 10 feet from any existing or future sewer lines measured from outside diameters. Where water lines and sewer lines must be placed in the same trench, the water line must be located on a shelf, 2 feet above and 2 feet to the side of the sewer line. Whenever this condition cannot be met, and upon direction from the Engineer, the water line shall be uncovered and encased with concrete per the standard encasement detail.

8.3 CROSSING WATER AND SEWER LINES

Wherever sewer lines and water lines cross, it is desirable, if practical, that the sewer line be at least 24 inches below the water line.

Where it is not practical to provide such a separation, care shall be taken to ascertain that the existing water line or existing sewer line is in good sound condition and that no evidence of joint leakage is known in that vicinity. If any such evidence does exist, the existing line shall be exposed by the Contractor at least 10 feet each side of the new pipe crossing, carefully examined and any defects positively corrected. The Owner will arrange for examining and correcting any defects in the existing lines, but the Contractor shall cooperate in every way possible.

When the water line must be below or less than 2 feet above the sewer line, the Contractor shall encase the water line 5 feet in each direction from the crossing as directed by the Engineer. This encasement should only be accomplished when directed by the Engineer and shall be accomplished in accordance with the details shown on the drawings. The encasement is a separate pay item.

9.0 **CLEANUP, SEEDING AND SODDING**

9.1 GENERAL

Upon completion of the installation of the work, the Contractor shall remove all debris and surplus construction materials resulting from the work. The Contractor shall fine grade all the disturbed surfaces around the area of the work in a uniform and neat manner leaving the construction area in a condition as near as possible to the original ground line or to the lines as directed by the Engineer. The Contractor shall provide effective cleanup of the work as it progresses. Procrastination of cleanup will not be tolerated.

9.2 ROUGH GRADE WORK AND CLEANUP

Rough Grade Work and Cleanup (Rough Cleanup) shall be defined to include the final backfill and windrowing of the ditch line, disposal of excess excavated material, level grading of the disturbed areas adjacent to the ditch line, filling and leveling street and driveway cuts, cleaning up and removal of rubbish, repair of fences and structures, and any other such work that may be required to result in a neat, orderly project area. Rough Cleanup shall be performed as other construction progresses and must be completed within **one week** of the adjacent pipeline construction.

Rough Cleanup is not a separate pay item. The cost for this work shall be included in the unit bid price for water lines. If Rough Cleanup is not performed

as specified, the Owner, after notification to the Contractor, will refuse payment for additional pipeline installation until the Rough Cleanup is accomplished.

9.3 FINAL CLEANUP

Final cleanup, grade work and seeding shall be performed on each line when backfilled trenches have had adequate time to settle, but at least within **30 days** from the date each line is constructed. Final grade work and seeding on Kentucky Transportation Cabinet rights-of-way shall be done in accordance with said Cabinet's specifications and the permit granted to the Owner specifically for this project.

Where work was performed on private property in lawns, earth of good quality, free from rock shall be spread over the disturbed area and graded and compacted to match adjacent ground contours. The graded and seed bed area shall be prepared with a power landscape rake and further hand raked if necessary, until smooth and free from rock, potholes, and bumps. The disturbed area shall then be seeded with the seed variety used on the original lawn (e.g., a bluegrass lawn shall be reseeded with bluegrass seed). In the case of no preference by the Owner, the mixture of grasses shall consist of one-third (1/3) Rye grass, one-third (1/3) Kentucky Fescue and one-third (1/3) Kentucky Bluegrass by weight and shall be applied in accordance with the supplier's recommendations. The area shall be fertilized with 12-12-12 fertilizer applied at a rate of 6 pounds per 1,000 square feet of area. After the seed and fertilizer have been applied, the Contractor shall then lightly cover the seed by use of a drag or other approved device. The seeded area shall then be covered with clean straw to a depth of approximately one (1) inch.

Where work was performed on private property and not in lawns the trench line shall be graded and filled if necessary to match adjacent contours. All rock larger than 1-1/2" in diameter shall be removed from the disturbed area. In general, pasture and fallow land shall be fertilized and seeded with Kentucky 31 Fescue and plowed fields shall be left unseeded, however, the desire of each property owner shall govern regarding seeding. The entire pipeline length that is seeded shall be strawed.

In all cases on private property the rate of seed and fertilizer application shall be that recommended by the material supplier or the University of Kentucky Cooperative Extension Service for new plantings of the variety of grass seed used. If the trench line settles following final grade work or if grass seed fails to germinate within a reasonable time, the Contractor shall regrade or reseed the area in question as specified above and as directed by the Engineer.

Final cleanup will not constitute a separate pay item.

10.0 PAVEMENT AND OTHER STRUCTURE REPLACEMENT

The Contractor shall replace all pavement cut or disturbed, with pavement similar in all respects to existing pavement in accordance with the Standard Details and at those locations approved by the Engineer. Every effort shall be made to avoid cutting the pavement. In restoring pavement, new pavement is required, except that granite paving blocks, sound brick or sound asphalt paving blocks may be reused. No permanent paving shall be placed within thirty (30) days after the backfilling has been completed. All concrete and asphalt paving materials shall be in conformance with the Miscellaneous Details shown in the plans. The pipeline trench through all paved areas (parking lots, driveways, roads, etc.) shall be fully backfilled with crushed stone.

10.1 CLASSIFICATIONS OF PAYMENTS

- A. Concrete Pavement Replacement - This pavement replacement shall be Portland cement concrete construction in accordance with the requirements shown in the Standard Details. It shall include all pavement replacement on concrete surfaced roads, concrete driveways, concrete sidewalks and concrete parking areas, both public and private.
- B. Heavy-Duty Bituminous Pavement Replacement - This type of asphalt pavement replacement shall be bituminous concrete surface over concrete base in accordance with the details. This type of pavement replacement shall be used on all heavily trafficked roads having an existing pavement greater than 2", whether public or private, or in other locations as directed by the Engineer.
- C. Light-Duty Bituminous Pavement Replacement - This type of pavement replacement shall be bituminous concrete constructed in accordance with the details. This item shall include all light-duty bituminous concrete roadways, bituminous driveways and bituminous parking lots, both public and private.
- D. Crushed Stone Surface Replacement - This type of surface replacement shall include all graveled roadways, driveways, parking areas, or other gravel surfaced areas, both private and public. This type of surfacing may also be required as a base course for other pavement replacement.

10.2 MATERIALS

The crushed stone backfill as noted on the drawings shall be dense graded aggregate per Kentucky Department of Highways Specifications or as noted on the Drawings. The Contractor shall continuously be responsible for the

maintenance of the aggregate and the surface of the trenches until the pavement replacement is completed.

Portland cement concrete for pavement replacement shall contain a minimum of 6 sacks of cement per cubic yard, the maximum free water content shall be 6 gallons per sack of cement, the slump shall be between 2 and 4 inches, and the concrete shall have minimum 28-day compression strength of at least 3,500 PSI. Cement, aggregate and water shall be described in these specifications for Class "A" concrete. A set of cylinders shall be made and tested for each 25 cubic yards of concrete placed, or fraction thereof, to supply representative sampling and testing of the concrete, upon the direction of the Engineer. The Contractor shall produce a broomed, or burlaped uniformly smooth and nonskid surface, consistent with the existing pavement.

Bituminous materials and mixes shall be consistent with the recommended practice of the asphalt institute and it shall conform to the requirements of the Kentucky Department of Highways for prime coat and Class 1 bituminous concrete. The bituminous concrete shall consist of a binder or base course and a surface course.

10.3 INSTALLATION OF PAVEMENT REPLACEMENT

The Contractor shall cut back the surfacing adjacent to the trench for 12 inches on both sides of the trench and shall cut down the dense graded aggregate he has placed to a depth required for either type of pavement replacement. The resulting surface shall be rolled to yield a smooth, dense surface and a uniform depth.

The concrete shall be placed in accordance with standard practice, with the welded wire mesh if required in proper position and thoroughly vibrated into place. The Contractor shall produce a surface consistent with the existing pavement. The Contractor shall apply a liquid curing component, sprayed on the surface of the concrete, and shall provide adequate protection to the pavement until it has set.

For bituminous concrete, the Contractor shall clean and broom the prepared surface, then apply the prime coat at the rate of 0.20 to 0.25 gallons per square yard, with a pressure distributor or approved pressure spray method. When the prime coat has become tacky but not dry and hard, the bituminous binder course, or base course, whichever applies, shall be placed and compacted. The Contractor shall then apply the surface course. It is recommended, but not required, that the base course remain in place for approximately one week before placing the surface course. The finished course shall be compacted and the completed surface shall match the grades and slopes of the adjacent existing surfacing and be free of offsets, depressions, raised places and all other irregular surfaces.

10.4 SEASONAL AND WEATHER LIMITATIONS FOR PAVEMENT REPLACEMENT

In the event the progress and scheduling of the work is such that the bituminous pavement replacement would occur in the winter months, during adverse cold weather and/or during such times the asphalt plants are not in operation, then the final pavement replacement shall be postponed until favorable weather occurs in the spring and the asphalt plants resume normal operations. No bituminous concrete shall be laid when the temperature is below 40°F. except by written permission of the Engineer.

Concrete pavement shall not be placed when the temperature is such that the pavement placed will freeze before it has had adequate time to set and shall be placed in conformance with the temperature conditions approved by the Engineer.

The Contractor shall be responsible for replacement of pavement which he has placed which has been damaged by cold weather or freezing without additional compensation.

In the meantime, the Contractor will be required to maintain the temporary surfacing until the permanent pavement is placed. Such labor, materials and equipment as is required for temporary maintenance of the streets, roadways and driveways shall be provided at the Contractor's expense and is not a pay item. The Contractor will be required to use a cold mix asphaltic concrete as a temporary surface for trenches under heavy traffic use.

10.5 GUARANTEE

The one year guarantee as specified in the contract documents is also applicable to trench settlement and pavement replacement.

11.0 SIDEWALK AND DRIVEWAY REPLACEMENT

Sidewalks and driveways will be replaced if damaged by the Contractor in any way. Payment will be made for those pavements necessarily damaged by the line installation in accordance with the Standard Details. No pavements are to be replaced over a backfilled trench for at least 30 days after filling. Pavements damaged otherwise are to be replaced immediately at the Contractor's expense.

Materials and dimensions are to be at least equal to existing pavement and are to conform with the Standard Details.

12.0 PAYMENT FOR WATER

All water used from the Utility shall be metered with meters supplied by the Contractor. The Contractor shall pay for such water monthly at the rates published by the water utility. Unmetered water lost through water line breakage shall also be paid at the rates published by the water utility. The quantity lost shall be computed on the basis of a discharge velocity of 7 feet/second, the diameter of the line, and the estimate duration of free uncontrolled discharge.

13.0 FINAL CLEAN-UP

The Contractor shall provide effective cleanup of the work as it progresses. Procrastination of cleanup will not be tolerated. At the time of final inspection, no trenches shall show any undue evidence of the previous construction. All areas shall be left free of ruts due to construction equipment and shall have a clean and neat appearance without rubble or debris. The areas shall not be mounded up and shall be completely restored, and all yards and fields shall be reseeded so land may be cultivated, mowed, etc. Straw and fertilizer shall accompany the seeding. If necessary to hasten proper restoration of terraces, principally along ditch lines, the Contractor shall sod such areas at the Engineer's direction. For all line segments, final cleanup shall be performed within 30 days from day of installation.

14.0 PROTECTION OF ADJACENT LANDSCAPE

Reasonable care shall be taken during construction of the water lines to avoid damage to vegetation. Ornamental shrubbery and tree branches shall be temporarily tied back, where appropriate, to minimize damage. Trees which receive damage to branches shall be trimmed of those branches to improve the appearance of the tree. Tree trunks receiving damage from equipment shall be treated with a tree dressing.

In the course of construction, the Contractor may deflect horizontal alignment of the water line to avoid trees and to keep from damaging their roots. The Contractor shall be fully responsible for settling all claims by private property owners concerning damage to trees and shrubs.

15.0 PAYMENT

Casing pipe will be paid according to the unit bid price for boring or open cutting, as appropriate. The price shall include, as necessary, the cost of the casing pipe, the cost of boring or cutting, and the cost of special requirements for the road or railroad crossing. Carrier pipe will be paid according to Section 15100.

The unit price bid per linear foot for free boring, as measured from edge of pavement to edge of pavement, regardless of size of bore, shall constitute full compensation for the work specified.

Payment for special creek crossings will be at the unit price bid per linear foot for that item and shall include encasement pipe, crushed stone, concrete, solid rock excavation and all other work necessary for a satisfactory installation. The carrier pipe installed in the casing shall be paid separately under the unit price bid for pipe installed.

Payment for Bypass Test Meter or Leak Detection Test Meter shall include a meter setting (5/8" x 3/4") and taps on both sides of a gate valve. The gate valve, sized for the line, is a separate pay item, covered in Section 15110.

Additional costs for normal earth creek crossings shall be included in the unit price bid for pipe installation and no special payment will be made for these crossings.

Payment for asphalt and concrete pavement replacement will not be based on the quantities purchased by the Contractor. Payment for surfacing will be paid on the basis of linear feet installed in accordance with the Standard Drawings with a maximum width of pipe diameter plus twenty-four inches (24"). Crushed stone sub-grade under paving shall be included in paving price and not paid for separately. Any additional cost estimated by the Contractor must be included in the cost of pipe in place.

Sidewalk /driveway crossings when included as a bid item shall include the extra cost of free-boring or the removal and disposal of existing pavement and replacement with new construction. Payment for pavement replacement will be on the basis of linear feet installed. Width for payment for a standard trench crossing is shown in the Standard Details. When sidewalk/driveway crossings or replacement are not included as a bid item, their costs shall be considered subsidiary to the bid for pipe installation.

Where required by the Special Provisions or the Bid Proposal, the cost of pavement replacement, boring, crossings of all types and other incidental construction shall be included in the unit price bid for pipe line installation and shall comprise total compensation for all such work.

All clean-up associated with installing water lines is incidental to the cost of installing the water lines. There is no separate pay item for clean-up.

SECTION 15103

PRESSURE TESTING AND STERILIZATION

1.0 TESTING

1.1 After the pipe has been laid, all newly laid pipe or any valved section thereof shall be subjected to a hydrostatic pressure test of at least 1.5 times the working pressure at the point of testing, but in no case less than that required by other sections herein. In addition, a leakage test shall be conducted concurrently with the pressure test. **A mandrel/pig shall be used for preliminary cleaning of each section of piping prior to disinfection for all waterlines 3" or greater.**

1.2 PRESSURE TEST

1.2.1 Test pressure shall:

1.2.1.1 Not be less than 1.25 times the working pressure at the highest point along the test section.

1.2.1.2 Not exceed pipe or thrust restraint design pressures at the lowest point along the test section.

1.2.1.3 Be of at least six (6) hour duration unless otherwise stipulated by owner.

1.2.1.4 Not vary by more than plus or minus 5 psi.

1.2.1.5 Not exceed twice the rated pressure of the valves or hydrants when the pressure of the test section includes closed gate valves or hydrants.

1.2.1.6 Not exceed the rated pressure of resilient seat butterfly valves when used.

1.2.2 Each valved section of pipe shall be filled with water slowly and the specified test pressure, based on the elevation of the lowest point of the line or section under test and corrected to the elevation of the test gauge, shall be applied by means of a pump connected to the pipe in a manner satisfactory to the Engineer.

1.2.3 Before applying the specified test pressure, air shall be expelled completely from the pipe, valves, and hydrants. If permanent air vents are not located at all high points, the contractor shall install corporation cocks at such points so that the air can be expelled as the line is filled with water. After all the

air has been expelled, the corporation cocks shall be closed and the test pressure applied. At the conclusion of the pressure test, the corporation cocks shall be removed and plugged, or left in place at the discretion of the Engineer.

1.2.4. All exposed pipe, fittings, valves, hydrants, and joints shall be examined carefully during the test. Any damage or defective pipe, fittings, valves or hydrants that are discovered following the pressure test shall be repaired or replaced with sound material and the test shall be repeated until it is satisfactory to the Engineer.

1.3 LEAKAGE TESTING

1.3.1 Leakage shall be defined as the quantity of water that must be supplied into the newly laid pipe, or any valved section thereof, to maintain pressure within 5 psi of the specified test pressure after the air in the pipeline has been expelled and the pipe has been filled with water.

1.3.2 No pipe installation will be accepted if the leakage is greater than that determined by the following formula:

$$L = ND(P \text{ exp } 1/2)/7400$$

in which L is the allowable leakage, in gallons per hour; N is the number of joints in the length of pipeline tested; D is the nominal diameter of the pipe, in inches; and P is the average test pressure during the leakage test, in pounds per square inch gauge.

1.3.2.1 Allowable leakage at various pressures is shown in TABLE K-1.

1.3.2.2 When testing against closed metal-seated valves, an additional leakage per closed valve of 0.0078 gal/hr/in of nominal valve size shall be allowed.

1.3.2.3 When hydrants are in the test section, the test shall be made against the closed hydrant.

1.3.3 Acceptance shall be determined on the basis of allowable leakage. If any test of pipe laid discloses leakage greater than that specified in Section 2.3.2 the contractor shall, at his own expense, locate and repair the defective material until the leakage is within the specified allowance.

1.3.3.1 All visible leaks are to be repaired regardless of the amount of leakage.

**TABLE K-1
ALLOWABLE LEAKAGE PER 1,000 FT. OF PIPELINE (gph)**

Avg. Test Pressure psi	Nominal Pipe Diameter (Inches)								
	2	3	4	6	8	10	12	14	16
450	0.32	0.48	0.64	0.95	1.27	1.59	1.91	2.23	2.55
400	0.30	0.45	0.60	0.90	1.20	1.50	1.80	2.10	2.40
350	0.28	0.42	0.56	0.84	1.12	1.40	1.69	1.97	2.25
300	0.26	0.39	0.52	0.78	1.04	1.30	1.56	1.82	2.08
275	0.25	0.37	0.50	0.75	1.00	1.24	1.49	1.74	1.99
250	0.24	0.36	0.47	0.71	0.95	1.19	1.42	1.66	1.90
225	0.23	0.34	0.45	0.68	0.90	1.13	1.35	1.58	1.80
200	0.21	0.32	0.43	0.64	0.85	1.06	1.28	1.48	1.70
175	0.20	0.30	0.40	0.59	0.80	0.99	1.19	1.39	1.59
150	0.19	0.28	0.37	0.55	0.74	0.92	1.10	1.29	1.47
125	0.17	0.25	0.34	0.50	0.67	0.84	0.01	1.18	1.34
100	0.15	0.23	0.30	0.45	0.60	0.75	0.90	1.05	1.20

Avg. Test Pres- sure psi	Nominal Pipe Diameter (Inches)							
	18	20	24	30	36	42	48	54
450	2.87	3.18	3.82	4.78	5.73	6.69	7.64	8.60
400	2.70	3.00	3.60	4.50	5.41	6.31	7.21	8.11
350	2.53	2.81	3.37	4.21	5.06	5.90	6.74	7.58
300	2.34	2.60	3.12	3.90	4.68	5.46	6.24	7.02
275	2.24	2.49	2.99	3.73	4.48	5.23	5.98	6.72
250	2.14	2.37	2.85	3.56	4.27	4.99	5.70	6.41
225	2.03	2.35	2.70	3.38	4.05	4.73	5.41	6.03
200	1.91	2.12	2.55	3.19	3.82	4.46	5.09	5.73
175	1.79	1.98	2.38	2.98	3.58	4.17	4.77	5.36
150	1.66	1.84	2.21	2.76	3.31	3.86	4.41	4.97
125	1.51	1.68	2.01	2.52	3.02	3.53	4.03	4.53
100	1.35	1.50	1.80	2.25	2.70	3.15	3.60	4.05

2.0 STERILIZATION

2.1 GENERAL

It is the intent of this section to present essential procedures for disinfecting new and repaired water mains. The section is patterned after AWWA C651. The basic procedure comprises:

2.1.1 Preventing contaminating materials from entering the water mains during construction or repair and removing by flushing materials that may have entered the water main.

2.1.2 Disinfecting any residual contamination that may remain.

2.1.3 Determining the bacteriologic quality by laboratory test after disinfection.

2.2 PREVENTIVE MEASURES DURING CONSTRUCTION

2.2.1 Precautions shall be taken to protect pipe interiors, fittings, and valves against contamination. Pipe delivered for construction shall be strung so as to minimize entrance of foreign material. When pipe laying is not in progress, as, for example, at the close of the day's work, all openings in the pipe line shall be closed by water tight plugs. Joints of all pipe in the trench shall be completed before work is stopped. If water accumulates in the trench, the plugs shall remain in place until the trench is dry.

If dirt, that, in the opinion of the Engineer, will not be removed by the flushing operation (Article 3.3) enters the pipe, the interior of the pipe shall be cleaned and swabbed as necessary, with a five (5%) percent hypochlorite disinfecting solution.

2.2.2 Gaskets and Joints - No contaminated material or any material capable of supporting prolific growth of micro-organisms shall be used for sealing joints. Gaskets shall be handled in such a manner as to avoid contamination. Gasket packing materials must conform to AWWA standards. The lubricant used in the installation of sealing gaskets shall be suitable for use in potable water. It shall be delivered to the job in enclosed containers and shall be kept clean.

2.3 PRELIMINARY FLUSHING

The main shall be flushed prior to disinfection. It is recommended that the flushing velocity be not less than 2.5 ft/sec. The rate of flow required to produce this velocity in various diameters is shown in Table K-2. No site for flushing

should be chosen unless it has been determined that drainage is adequate at the site.

TABLE K-2
REQUIRED OPENINGS TO FLUSH PIPELINES
 (40-psi Residual Pressure)

Pipe Size (in)	Flow Required to Produce	Orifice Size (in)	Number	Hydrant Outlet Nozzles
	2.5 fps Velocity (gpm)			Size (in)
4	100	15/16	1	2 1/2
6	220	1 3/8	1	2 1/2
8	390	1 7/8	1	2 1/2
10	610	2 5/16	1	2 1/2
12	880	2 13/16	1	2 1/2
14	1,200	3 1/4	2	2 1/2
16	1,565	3 5/8	2	2 1/2
18	1,980	4 3/16	2	2 1/2

2.4 FORM OF CHLORINE FOR DISINFECTION

The most common forms of chlorine used in the disinfecting solutions are liquid chlorine (gas at atmospheric pressure), calcium hypochlorite granules, sodium hypochlorite solutions.

2.4.1 Liquid Chlorine

2.4.1.1 Use: Liquid chlorine shall be used only when suitable equipment is available and only under the direct supervision of a person familiar with the physiological, chemical, and physical properties of this element and who is properly trained and equipped to handle any emergency that may arise. Introduction of chlorine-gas directly from the supply cylinder is unsafe and shall not be permitted.

NOTE: The preferred equipment consists of a solution fed chlorinator in combination with a booster pump for injecting the chlorine-gas water mixture into the main to be disinfected. Direct feed chlorinators are not recommended because their use is limited to situations where the water pressure is lower than the chlorine cylinder pressure.

2.4.2 Hypochlorites

2.4.2.1 Calcium Hypochlorite: Calcium hypochlorite contains seventy (70%) percent available chlorine by weight. It is either granular or tabular in form. The

tablets, 6-8 to the ounce, are designed to dissolve slowly in water. Calcium hypochlorite is packaged in containers of various types and sizes ranging from small plastic bottles to one hundred (100) pound drums.

A chlorine-water solution is prepared by dissolving the granules in water in the proportion requisite for the desired concentration.

2.4.2.2 Sodium Hypochlorite: Sodium hypochlorite is supplied in strengths from five and one-quarter (5.25%) to sixteen (16%) percent available chlorine. It is packaged in liquid form in glass, rubber, or plastic containers ranging in size from one (1) quart bottles to five (5) gallon carboys. It may also be purchased in bulk for delivery by tank truck.

The chlorine-water solution is prepared by adding hypochlorite to water. Product deterioration must be reckoned with in computing the quantity of sodium hypochlorite required for the desired concentration.

2.4.2.3 Application: The hypochlorite solutions shall be applied to the water main with a gasoline or electrically powered chemical feed pump designed for feeding chlorine solutions. For small applications, the solutions may be fed with a hand pump, for example, a hydraulic test pump. Feed lines shall be of such material and strength as to withstand safely the maximum pressures that may be created by the pumps. All connections shall be checked for tightness before the hypochlorite solution is applied to the main.

2.5 METHODS OF CHLORINE APPLICATION

2.5.1 Continuous Feed Method: This method is suitable for general application.

2.5.1.1 Water from the existing distribution system or other approved sources of supply shall be made to flow at a constant, measured rate into the newly-laid pipe line. The water shall receive a dose of chlorine, also fed at a constant, measured rate. The two rates shall be proportioned so that the chlorine concentration in the water in the pipe is maintained at a minimum of 50 mg/l available chlorine. To assure that this concentration is maintained, the chlorine residual should be measured at regular intervals in accordance with the procedures described in the current edition of Standard Methods and AWWA M12--Simplified Procedures for Water Examination.

NOTE: In the absence of a meter, the rate may be determined either by placing a pitot gauge at the discharge or by measuring the time to fill a container of known volume.

TABLE K-3 gives the amount of chlorine residual required for each one hundred (100) feet of pipe of various diameters. Solutions of one (1%) percent chlorine may be prepared with sodium hypochlorite or calcium hypochlorite. The latter

solution requires approximately one (1) pound of calcium hypochlorite in eight and five tenths (8.5) gallons of water.

**TABLE K-3
CHLORINE REQUIRED TO PRODUCT 50 Mg/l CONCENTRATION
IN 100 FT. OF PIPE (BY DIAMETER)**

Pipe Size (in)	100 Percent Chlorine (lb)	1 Percent Chlorine Solutions (gal)
4	0.027	0.33
6	0.061	0.73
8	0.108	1.30
10	0.170	2.04
12	0.240	2.88

2.5.1.2 During the application of the chlorine, valves shall be manipulated to prevent the treatment dosage from flowing back into the line supplying the water. Chlorine application shall not cease until the entire main is filled with the chlorine solution. The chlorinated water shall be retained in the main for at least twenty-four (24) hours during which time all valves and hydrants in the section treated shall be operated in order to disinfect the appurtenances. At the end of this twenty-four (24) hour period, the treated water shall contain no less than 25 mg/l chlorine throughout the length of the main.

2.5.2 Slug Method: This method is suitable for use with mains of large diameter for which, because of the volumes of water involved, the continuous feed method is not practical.

2.5.2.1 Water from the existing distribution system or other approved source of supply shall be made to flow at a constant, measured rate (see Article 2.5.1.1) into the newly laid pipe line. The water shall receive a dose of chlorine also fed at a constant, measured rate. The two rates shall be proportioned so that the concentration in the water entering the pipe line is maintained at no less than 300 mg/l. The chlorine shall be applied continuously and for a sufficient period to develop a solid column or "slug" of chlorinated water that will, as it passes along the line, expose all interior surfaces to a concentration of at least 300 mg/l for at least three (3) hours. The application shall be checked at a tap near the upstream end of the line by chlorine residual measurements.

2.5.2.2 As the chlorinated water flows past tees and crosses, related valves and hydrants shall be operated as to disinfect appurtenances.

2.6 FINAL FLUSHING

2.6.1 Clearing the Main of Heavily Chlorinated Water. After the applicable retention period, the heavily chlorinated water shall not remain in prolonged contact with the pipe. This water shall be flushed from the main until the chlorine concentration in the water leaving the main is no higher than that generally prevailing in the system, or less than 1 mg/l. Chlorine residual determination shall be made to ascertain that the heavily chlorinated water has been removed from the pipe line.

2.6.2 Disposing of Heavily Chlorinated Water. The environment into which the chlorinated water is to be discharged shall be inspected. If there is any possibility that the chlorinated discharge will cause damage to the environment, then a neutralizing chemical shall be applied to the water to be wasted to neutralize thoroughly the chlorine residual remaining in the water. (See Appendix B of ANSI/AWWA C651 for neutralizing chemicals.) Federal, state, provincial, and local regulatory agencies should be contacted to determine special provisions for the disposal of heavily chlorinated water.

2.7 BACTERIOLOGIC TESTS

2.7.1 After final flushing, and before the water main is placed in service, a sample or samples shall be collected from the end of the line and tested for bacteriologic quality and shall show the absence of coliform organisms. If the number and frequency of samples is not prescribed by the public health authority having jurisdiction, at least one sample shall be collected from chlorinated supplies where a chlorine residual is maintained throughout the new main. From unchlorinated supplies at least two samples shall be collected at least twenty-four (24) hours apart.

2.7.2 Samples for bacteriologic analysis shall be collected in sterile bottles treated with sodium thiosulphate. No hose or fire hydrant shall be used in collection of samples. A suggested sampling tap consists of a standard corporation cock installed in the main with a copper tube gooseneck assembly. After samples have been collected, the gooseneck assembly may be removed, and retained for future use.

2.8 REPETITION OF PROCEDURE

If the initial disinfection fails to produce satisfactory samples, disinfection shall be repeated until satisfactory samples have been obtained. The tablet method cannot be used in these subsequent disinfections. When the sample tests indicate that disinfection has been effective, the main may be placed in service.

2.9 PROCEDURE AFTER CUTTING INTO OR REPAIRING EXISTING MAINS

The procedures outlined in this Article apply primarily when mains are wholly or partially dewatered. Leaks or breaks that are repaired with clamping devices while the mains remain full of water under pressure present little danger of contamination and require no disinfection.

2.9.1 Trench "Treatment": When an old line is opened, either by accident or by design, the excavation will likely be wet and may be badly contaminated from nearby sewers. Liberal quantities of hypochlorite applied to open trench areas will lessen the danger from such pollution. Tablets have the advantage in such a situation because they dissolve slowly and continue to release hypochlorite as water is pumped from the excavation.

2.9.2 Main Disinfection: The following procedure is considered as a minimum that may be used.

2.9.2.1 Swabbing With Hypochlorite Solution: The interior of all pipe and fittings used in making the repair (particularly couplings and tapping sleeves) shall be swabbed with a five (5%) percent hypochlorite solution before they are installed.

2.9.2.2 Flushing: Thorough flushing is the most practical means of removing contamination introduced during repairs. If valving and hydrant locations permit, flushing from both directions is recommended. Flushing shall be started as soon as the repairs are completed and continued until discolored water is eliminated.

2.9.2.3 Slug Method: Where practicable, in addition to the procedures of Article 3.9.2.1, a section of main in which the break is located shall be isolated, all service connections shut off, and the section flushed and chlorinated as described in Article 3.5.2, except that the dose may be increased to as much as 500 mg/l, and the contact time reduced to as little as one-half (1/2) hour. After chlorination, flushing shall be resumed and continued until discolored water is eliminated.

2.9.3 Sampling: Bacteriologic samples shall be taken after repairs to provide a record by which the effectiveness of the procedures used can be determined. If the direction of flow is unknown, samples shall be taken on each side of the main break.

3.0 PAYMENT

Payment for pressure testing and sterilization of pipelines shall be included in the unit price for the booster pump station unless otherwise itemized on the Bid Schedule.



SECTION 15104

METERS AND SERVICES

1.0 GENERAL

The Contractor shall furnish all labor, tools, equipment and materials for installing water services as shown on the plans and as directed.

2.0 WATER METER SETTINGS

2.1 MATERIALS

Meters shall include meter box and cover, coppersetter (including cut-off valve), four feet of pipe, saddle and corporation stop iron pipe or rod to hold meter plumb, plus two feet of pipe and plug or cap on the customer's side of meter. (This latter item is to prevent the customer or his plumber from disarranging or loosening the meter after the Contractor has already set the meter in its proper position.) Where the main line is in the highway right-of-way, meters shall be set as close to the right-of-way fence as practicable or as directed on the plans. The standard details show the required meter setting.

2.2 CORPORATION STOPS, SETTERS AND SADDLES

The corporation stops shall be equal to Ford F-Series. The meter setter shall be equal to the Ford 170-Series Coppersetter VB-HH-72-7W 44-33 with seven inch rise. A tandem coppersetter to accommodate a pressure reducer and meter shall be used where specified. Saddles shall be equal to Ford S70 Series for PVC and 202 Series for Ductile Iron Pipe.

Service line connections are to be made with compression fittings only.

2.3 METERS

The meters for this project shall be Sensus meters or approved equal.

2.4 METER BOXES

Meter boxes for 5/8" x 3/4" meters shall be 24-inch and equal to AMETEC meter box combo (box, lid and 6" riser) No. 17105 with locking device and meter reading lid. Extensions shall be equal to AMETEC and utilized as necessary.

2.5 INSTALLATION

Meters shall be set in a workmanlike manner with backfill neatly compacted in place. In yards, pastures and other grassed areas, top of meter box may be placed no higher than 1/2 inch above original ground and no lower than flush with original ground. Boxes in sidewalks or other concrete areas shall be flush with surface. In areas which have not been sodded top of box shall be 2 inches above grade. The service line must meet the same cover requirements as the main line as described in these specifications except that the service line may be brought up to a depth of approximately 24 inches within 5 feet of each side of the meter installation when a 24-inch deep meter box is used. In all other cases the service pipe will be brought up to a depth which accommodates installation at the bottom of the meter box in accordance with the Standard Details. As shown in the Details, after 5 feet from box, service pipe must return to 30 inch cover (forty-two inches (42") in traffic). If meter box area is subject to traffic a deeper box will be required to maintain forty-two inches (42") of cover over the service pipe.

2.6 PAYMENT

The Unit Price Bid shall constitute full compensation for furnishing and installing the saddle, corporation stop, meter box, cover, meter setter and valve, holding rod, and service tubing extension as shown and specified. Installation of the meters will be done by the utility.

The Unit Price Bid for Relocate Meter Service shall constitute full compensation for installing the meter setting in its new location and connections to the water main and user's service line.

3.0 **SERVICES**

3.1 GENERAL

Service lines up to four feet (4') on the inlet side of the meter and two feet (2') on the customer side is included in the meter setting. Additional service pipe is an extra pay item and must be approved by the Engineer or designated Construction Representative.

3.2 SERVICE LINES NOT CROSSING A ROAD

Unless indicated otherwise on the plans, all Service Lines shall be 3/4" Type K Copper Tubing, or polyethylene plastic tubing using a corporation stop in accordance with the Standard Details. Service pipe shall meet all AWWA Specifications with a minimum pressure rating of 200 psi. Polyethylene service tubing shall be ultra high density type equal to DRISCOPIPE Series 5100, CTS.

3.3 SERVICE LINES CROSSING A COUNTY ROAD OR CITY STREETS

Same as above, except that in general all pipe shall be jacked beneath certain paved or blacktopped city streets or county roads, unless solid rock prevents using this method in which case, the open trench method may be used. The open trench method generally will be used on all unpaved city streets, county roads and private driveways. In general, blacktopped and concrete private driveways shall also be jacked under. In all cases where lines are under traffic, a minimum cover of forty-two inches (42") shall be provided. All backfill shall be compacted by air tampers in layers no greater than 6-inch depth. In cases of open trench construction, crushed stone, blacktop and concrete paving shall be replaced according to the Standard Drawings.

3.4 SERVICE LINES CROSSING A STATE HIGHWAY

Same as Section 3.3 except the pipe shall be jacked or pushed under paving. If solid rock is encountered, the crossing may be relocated to permit boring or jacking. No additional compensation will be made for relocation of service crossing. Service tubing crossing state highways shall be encased. Polyethylene pipe shall be used as casing pipe unless otherwise indicated by the plans.

3.5 PAYMENT

The Unit Price bid for the specific service pipe size shall constitute full compensation for all materials, equipment and labor for installing the service pipe. There shall be no distinction between service pipe bored, jacked or trenched. No extra shall be paid for tubing bored or jacked.

4.0 RECONNECT METER SERVICE

4.1 This item covers meter settings, which can remain in place, but need to be connected to a new water line. The Contractor shall supply all items to connect the meter to the new line. The Contractor shall close the corporation stop at the existing line if the existing line is not abandoned.

4.2 PAYMENT

The Unit Price Bid for Reconnect Meter Service shall constitute full compensation for reconnecting the existing meter setting, to the new water line.



INDEX

DIVISION 16 - ELECTRICAL

SECTION NUMBER	PAGE NUMBER
16000 - ELECTRICAL GENERAL PROVISIONS	16000-1 THRU 16000-11
16051 - BASIC MATERIALS AND METHODS	16051-1 THRU 16051-2
16110 - ELECTRICAL RACEWAYS	16110-1 THRU 16110-7
16120 - CABLE, WIRE AND CONNECTORS	16120-1 THRU 16120-4
16130 - ELECTRICAL BOXES AND FITTINGS	16130-1 THRU 16130-3
16135 - ELECTRICAL EQUIPMENT SUPPORTS	16135-1 THRU 16135-1
16140 - WIRING DEVICES	16140-1 THRU 16140-4
16150 - MOTORS	16150-1 THRU 16150-4
16155 - MOTOR STARTERS	16155-1 THRU 16155-3
16157 - ADJUSTABLE FREQUENCY DRIVES (VFDs)	16157-1 THRU 16157-7
16160 - PANELBOARDS	16160-1 THRU 16160-4
16170 - SAFETY AND DISCONNECT SWITCHES	16170-1 THRU 16170-2
16181 - FUSES	16181-1 THRU 16181-2
16200 - MISCELLANEOUS ELECTRICAL EQUIPMENT	16200-1 THRU 16200-3
16450 - ELECTRICAL GROUNDING	16450-1 THRU 16450-5
16460 - TRANSFORMERS	16460-1 THRU 16460-2
16510 - BUILDING LIGHTING FIXTURES	16510-1 THRU 16510-4
16800 - SURGE PROTECTIVE DEVICES	16800-1 THRU 16800-7
16915 - TELEMETRY CONTROL	16915-1 THRU 16915-10
16920 - CONTROLS	16920-1 THRU 16920-5
16941 - CONTROL AND INSTRUMENTATION CABLE AND WIRE	16941-1 THRU 16941-2



SECTION 16000 - ELECTRICAL GENERAL PROVISIONS

1. RELATED DOCUMENTS

A. General Provisions of Contract, General and Supplementary Conditions, and General Requirements, apply to this Section.

B. This Section shall be governed by alternates insofar as they apply to this work.

2. DESCRIPTION OF WORK

A. Provide labor, equipment, materials, supplies and components, including lamps and fuses; and perform all operations including cutting, channeling, chasing, trenching and backfilling necessary for installation of complete electrical system.

B. Appliances, equipment, and fixtures shall be current models for which replacement parts are available. Store and protect materials and equipment delivered to site in such a manner as to effectively prevent damage from climatic conditions, condensation, dust, and physical abuse. Install and connect materials and equipment in accordance with manufacturer's instructions and recommendations. Each major component of equipment shall have manufacturer's name, address, model number, and ratings on a plate securely affixed in a conspicuous place.

C. It is not the intent of this section to make any Contractor, other than the General Contractor alone, the single responsible party to the Owner. All transactions such as submittal of shop drawings, claims for extra costs, requests for equipment or materials substitution, shall be done through the General Contractor. No attempt has been made to arbitrarily assign responsibility of work, material, equipment or services to a particular trade or Contractor. Unless stated otherwise, subdivision and assignment of work shall be General Contractor's responsibility.

D. Facilities and systems of electrical work are described (but not by way of limitation) as follows:

(1) Electrical connecting of equipment not specified to be connected as work of another Division.

(2) Electrical service and distribution including connecting of equipment not specified to be connected as work of another Division.

(3) Motor starters and control/protection work as indicated.

(4) Electric equipment and motor connections.

(5) Control/monitoring work as indicated.

(6) Lighting systems.

(7) Emergency power system equipment.

E. Each CONTRACTOR bidding on the work included in these Specifications shall view the site and carefully examine the Contract Drawings and Specifications, so that he/she may fully understand what is to be done, and to document existing conditions.

3. QUALITY ASSURANCE

A. Minimum standards for all electrical work shall be latest revision of NEC. Whenever and wherever OSHA, Federal and State laws, regulations and design require higher standards than NEC, these laws, regulations, and designs shall be followed.

B. Provide electrical inspection by a licensed and recognized Electrical Inspector. Notify Electrical

(1) Inspector in writing, immediately upon start of work with a copy of notice to Engineer. Schedule inspection for rough as well as finished work. Approval from Electrical Inspector will not be allowed as reason for deviation from Contract Documents. All costs incidental to Electrical Inspection shall be borne by Contractor. Prior to final acceptance of work and release of final payment, deliver to Engineer the certificate of final inspection.

C. Obtain all permits required for entire construction of electrical system from authorities governing such work. Bear all costs of these permits.

D. All materials shall be new and best of their respective kinds unless otherwise specified and shall be listed by UL and shall be so labeled. All equipment shall conform to latest approved standards of I.E.E.E., N.E.M.A., A.N.S.I., U.L. and O.S.H.A. See individual specification sections for other specific requirements.

4. CONTRACT DOCUMENTS

A. Contract Documents are intended to cover furnishing and installing of complete electrical systems (interior and exterior) including miscellaneous systems, all tested and ready for operation.

B. Contract Documents are complementary, each to the other, and work required by either shall be included in the contract as if called for by both. Necessary items or work omitted, not clearly included, specified or indicated and material or apparatus believed inadequate or unsuitable, in violation of laws, ordinances, or rules shall be clarified by a written request to Engineer prior to bidding. In absence of such written notice, Contractor shall be responsible for approved satisfactory functioning of entire system without extra compensation.

C. Drawings other than electrical drawings, and other sections of this specification, may show or specify electrically operated equipment and wiring diagrams. Examine all such drawings and specifications. Determine characteristics and provide necessary wiring and connections for all such equipment.

D. Keep electrical record drawings up to date each day. Record drawings will be reviewed by Engineer each month with Contractor's pay request review. Entries and notes shall be made in a neat and legible manner and these drawings delivered to the ENGINEER after completion of the construction, for use in preparation of Record Drawings.

E. Naming of a certain brand or make or manufacturer in specifications is to establish style or quality standard for articles desired. Contractor is not restricted to use of specific brand of manufacturer named unless so indicated in specifications. However, where a substitution is requested, a substitution will be permitted only with written approval of Engineer. Proposed substitutions prior to bidding shall be submitted prior to bid date. Submit three bound copies of manufacturer's data showing all pertinent data, and samples, if requested.

5. COORDINATION

A. Coordinate work of different trades so that:

(1) Interference between mechanical, electrical, architectural, and structural work including existing services shall be avoided.

(2) Within limits indicated on Drawings, the maximum practicable space for operation, repair, removal, and testing of electrical equipment shall be provided.

B. All electrical materials and equipment shall be kept close as possible to ceiling, walls and columns, to take up a minimum amount of space.

C. Provide all offsets, fittings and similar items necessary in order to accomplish requirements of coordination without additional expense to Owner.

D. Drawings are diagrammatic and indicate general location of material and equipment. Refer to architectural and structural drawings and specifications for general construction of building, for floors and ceiling heights and for locations of walls, partitions, beams, and equipment, and be guided accordingly for setting of all equipment. Do not scale electrical drawings to determine exact locations.

E. Motor horsepowers and apparatus wattage ratings indicated on Drawings or specified herein are estimated values, and corresponding sizes of feeders and other electrical equipment indicated to serve them are minimum sizes. Motors of greater horsepower and apparatus with larger wattage ratings may be provided if necessary to meet requirements of various sections of specification in which they are specified. Where larger motors or apparatus with larger wattage ratings are provided, feeders and other electrical equipment serving them shall be increased in capacity to correspond. Increase in capacity of feeder and other apparatus shall be furnished at no additional cost to the Owner.

F. Be responsible for locating all openings required in walls, floors, ceilings or roof, for all materials and equipment provided under Electrical sections.

(1) Check with other trades on scope of their work and coordinate on all locations of various items of equipment and outlets before they are finally placed and connected. Relocation of material or equipment necessitated by failure to coordinate work shall be at no cost to Owner.

(2) Do not cut work of any other trade without first consulting Engineer's representative. Repair work damaged employing services of trade whose work is damaged. Where openings or sleeves have been omitted, they shall be drilled or sawed as directed by Architect. All cutting and patching shall be responsibility of this Section.

(3) Wherever slots, sleeves or other openings are provided in floors or walls, for the passage of conduits or other forms of raceway, including bus ducts, such openings, if unused, or spaces left in such openings after installation of conduit or raceway shall be filled. Filling materials for openings in walls and floors generally shall be fire resistive and constructed and installed so as to prevent passage of water, smoke and fumes. Where conduits passing through openings are exposed in finished rooms, finishes of filling materials shall match and be flush with adjoining floor, ceiling or wall finishes.

(4) Provide exposed conduit passing through floors, walls, or ceilings of finished rooms with chrome plated escutcheons. Plates shall be split, hinged type of sufficient outside diameter to amply cover up sleeve openings for pipe.

6. WARRANTY

A. Contractor shall be responsible for warranting all work, including equipment, materials, and workmanship provided under this section. This warranty shall be against all defects of the above and shall run a minimum period of one (1) year from date of acceptance of the work, concurrent with the one year guarantee period designated for the general construction contract under which electrical work is performed. Date of acceptance shall be considered to be the date on which all "punchlist" items are completed ("punchlist" is defined to be the written listing of work that is incomplete or deficient that must be finished or replaced/repared before the CONTRACTOR receives final payment).

B. Defective work, equipment, materials and workmanship that develops within warranty period, which is not caused by ordinary wear, damage or abuse by others, shall be replaced or corrected without additional cost to Owner.

C. Repair or maintenance for the guarantee period is the responsibility of the CONTRACTOR and shall include all repairs and maintenance other than that which is considered as routine. (That is replacement of lamps, oiling, greasing, etc.)

7. EXCAVATING FOR ELECTRICAL WORK

A. Include whatever excavating and backfilling is necessary to install electrical work. Coordinate work with other excavating and backfilling in same area, including dewatering, flood protection provisions and other temporary facilities. Coordinate work with other work in same area, including other underground services (existing and new), landscape development, paving, and floor slabs on grade. Coordinate with weather conditions and provide temporary facilities needed for protection and proper performance of excavating and backfilling.

B. Except as otherwise indicated, comply with applicable provisions of Section 02200 for electrical work excavating and backfilling. Refer instances of uncertain applicability to Engineer for resolution before proceeding.

C. Where conduit is less than 2' 6" below surface of roadway, provide encasement in Class 2500 concrete, 4" minimum coverage all around.

D. After backfilling has been completed disturbed areas shall be returned to their original condition and shall match adjoining area, or in areas to be covered under site work, area shall be finished as directed by Engineer.

E. Where it is necessary to remove and replace landscape work, pavement, flooring and similar exposed finished work, engage original installer to install replacement work; except where work existed prior to work of this Contract, engage only experienced and expert firms and tradespersons to replace work.

8. CONCRETE FOR ELECTRICAL WORK

A. Work of this article is defined to include whatever concrete work is necessary or indicated specifically to install electrical work. Except as otherwise indicated, comply with applicable provisions of Division 3 for electrical work concrete, including formwork, reinforcement, mix design, materials (use mix designs and materials accepted for Division 3 work where possible), admixtures, accessories (including waterstops), placing of wet concrete, finishing, curing, protecting, testing, submittals, and other requirements of the concrete work. Refer instances of uncertain applicability to Engineer for resolution before proceeding.

B. Except as otherwise indicated, provide strength classes as follows, with the following cement content and water/cement ratios; for the indicated applications and similar required applications.

(1) 4000 psi Class: 565 lbs. cement/yd. (6.0 sacks); 0.57 water/cement ratio.
Provide 4000 Class for vaults, beam type foundations and similar structures.

(2) 3000 psi Class: 500 lbs. cement/yd. (5.25 sacks); 0.68 water/cement ratio.
Provide 3000 Class for miscellaneous underground structural concrete, reinforced encasement, block type foundations (with smallest dimension at least 0.2 x largest dimension), curbs, pads, and similar structural support work.

(3) 2500 psi Class: 450 lbs. cement/yd. (4.75 sacks); 0.75 water/cement ratio.
Provide 2500 Class for plain encasement, filling steel framed units, and similar work.

(4) Rough Grouting Class: 565 lbs. cement/yd. (6.0 sacks); 0.75 water/cement ratio; adjust aggregate sizes to facilitate placement. Use for rough grouting, not for setting equipment bases.

(5) Backfill Class (Lean Concrete): 375 lbs. cement/yd. (4.0 sacks); 0.87 water/cement ratio. Use for backfilling where excavations are extended below point of support for electrical work.

C. Anchor Bolts-Concrete: Provide all anchor bolts required for equipment furnished under Contract. Set anchor bolts in a substantial manner so they will not be displaced. Anchor bolts shall be set in new concrete construction before pouring. Anchor bolts shall be stainless steel.

9. TESTING AND BALANCING

A. Feeders and branch circuits shall have their insulation tested after installation, and before connection to fixtures and equipment. Perform with a 500 volt megger. Conductors shall test free from short circuits and grounds. Test conductors phase to phase and phase to ground. Test readings shall be recorded and delivered to Engineer.

B. Verify rotation of all three phase motors with trade furnishing equipment. Bump or run these motors uncoupled in presence of trade furnishing equipment to insure proper rotation.

C. Circuit numbers are indicated on Drawings for reference; however Contractor shall make corrections as necessary to obtain proper phase balance under operating conditions.

D. After the wiring system is completed, and at such time as the ENGINEER may direct, the CONTRACTOR shall conduct an operating test for acceptance. The equipment shall be demonstrated to operate in accordance with the requirements of these Specifications and the Contract Drawings. The test shall be performed in the presence of the ENGINEER or his authorized representative. The CONTRACTOR shall furnish all instruments and personnel required for the tests, as well as the necessary electrical power.

E. Before energizing the system, the CONTRACTOR shall check all connections and set all relays and instruments for proper operation. He shall obtain all necessary clearances, approvals, and instructions from the serving utility company prior to placing power on the equipment.

1.10 TRAINING

A. All manufacturers supplying equipment for this division shall provide the OWNER'S operations staff with training in the operation and maintenance on the equipment being furnished. The training shall be conducted at the project site by a qualified representative of the manufacturer.

B. The cost of this training shall be included in the bid price.

C. The required training shall consist of both classroom and hands-on situation. Classroom training shall include instruction on how the equipment works, its relationship to all accessories and other related units, detailed review of shop drawings, detailed presentation of written O&M instructions, troubleshooting and record-keeping recommendations. Hands-on training shall include a review of the manufacturer's O&M instructions, check out of each operator to identifying key elements of the equipment, tear down as appropriate, calibration, adjustment, greasing and oiling points, and operating manipulations of all electrical and mechanical controls.

D. The training shall be scheduled through the CONTRACTOR with the OWNER. The timing of the training shall closely coincide with the startup of the equipment, but no training shall be conducted until the equipment is operational.

E. The minimum number of training hours to be provided by manufacturer supplying equipment on this project shall be in accordance with the following tables:

Item	Training Hours	
	Classroom	Hands-on
Motor Control Systems	3	3

F. At least 60 days prior to the training the manufacturer shall submit through the CONTRACTOR to the ENGINEER an outline of the training proposed for the ENGINEER'S review and concurrence.

G. The OWNER reserves the right to videotape all training sessions.

1.11 STORAGE AND CLEANING

A. All work, equipment, and materials shall be protected against dirt, water, or other damage during the period of construction.

B. Sensitive electrical equipment such as light fixtures, motor starters and controls, delivered to the job site, shall be protected against damage or corrosion due to atmospheric conditions or physical damage by other means. Protection is interpreted to mean that equipment shall be stored under roof, in a structure properly heated in cold weather and ventilated in hot weather. Provision shall be made to control the humidity in the storage area to 50 percent relative. The stored equipment shall be inspected periodically, and if it is found that the protection is inadequate, further protective measures shall be employed.

C. The CONTRACTOR shall not store submersible pump units in the wet well. If it is absolutely necessary to do so, the open power cable ends are to be suspended above the maximum flood elevation or maximum expected water level. If not stored in this manner, the CONTRACTOR may be called upon to replace the pump motors and cables with new units to ensure that water has not penetrated the cable and entered the motor housing.

D. At completion of work required under this Contract and just prior to acceptance by Owner, thoroughly clean all exposed equipment fittings, fixtures and accessories.

E. During construction, cover all OWNER equipment and furnishings subject to mechanical damage or contamination in any way.

1.12 SUPPORT OF ELECTRICAL ITEMS

A. Unless otherwise indicated, all electrical items or their supporting hardware, including but not limited to, conduits, raceways, cable trays, busways, cabinets, panelboards, wall mounted transformers, starters, boxes, and disconnect switches shall be securely fastened to building structures with the following methods. Fastening shall be by wood screws or screw type nails on wood; by toggle bolts on hollow masonry units; by concrete inserts or expansion bolts on concrete or brick; by machine screws, welded threaded studs, or spring tension clamps on steel work. Threaded studs driven in by a powder charge and provided with lock washers and nuts may be used instead of expansion bolts or machine or wood screws. Threaded C clamps with retainers may be used on rigid steel conduit only. Conduits or pipe straps shall not be welded to steel structures. In partitions of light steel construction, sheet metal screws shall be used.

B. Equipment supports at process structures remote from buildings shall be as detailed and/or noted on Drawings. Where a particular support type is not noted, aluminum channel (uni-strut) shall be used. Channel type supports shall not be used in lieu of other supports noted unless approved by Engineer.

(1) All mounting brackets and strut used outside shall be aluminum. Fasteners used to mount equipment outside shall be stainless steel. The only exception to the above shall be anchor bolts for area lightpoles which shall be allowed to have galvanized threads and galvanized nuts.

- a. All mounting brackets and strut used inside shall be aluminum.
- b. All free standing equipment shall be anchored to its foundation using expansion bolts of the size and number recommended by the equipment manufacturer.
- c. The load applied to any fastener shall not exceed one of the proof test load. Fasteners attached to concrete ceilings shall be vibration and shock resistant.

C. Since this project is in Seismic Zone 1, the CONTRACTOR shall be sure that all supports are consistent with the KBC requirements in this regard.

1.13 IDENTIFICATION

A. Equipment disconnect switches, motor starters, pushbutton stations, panels, switchgear, special device plates, and similar material shall be clearly marked. Coordinate size of lettering and wording with Engineer.

B. Mark panels, giving panel designation in one half inch letters and voltage in one quarter inch letters centered above door on exterior trim. Mark equipment mounted remotely from source of power (such as roof exhaust fans) with equipment number and source of power. Where starters are remotely mounted, marking shall include equipment name and number.

C. Except as indicated, mark all equipment with engraved lamacoid plates having black foreground and white letters. Attach interior mounted plates with contact type permanent adhesive and exterior mounted plates with self tapping stainless steel screws except where screws should not penetrate substrate use waterproof contact adhesive. Align plates on equipment being marked in center near top.

(1) All control panels, disconnects, [instruments,] etc., shall be marked to indicate the circuit they control, [or variable monitored.] Marking is to be done with engraved laminated nameplates and shall bear the designation shown on the Contract Drawings where this information is given. Nameplates shall be fastened to equipment with stainless steel screws, minimum of one each side. In no way shall the installation of mounting screws void the NEMA enclosure rating of the equipment in which they are installed. If there are more than one identical unit, they shall be given consecutive numbers or other descriptions as designated by the ENGINEER. Nameplate background color shall be white, with black engraved letters, unless otherwise noted.

(2) Control panels and disconnect switches shall be labeled with vinyl self-adhesive signs that warn of "High Voltage" (state the specific voltage). Other major equipment such as transformers, transfer switches, pump control panels, etc., shall be labeled as such. The type of labels to be used shall have orange as the basic color to conform with OSHA requirements, letters shall be black. The labels shall be of proper size to fit flatly on the surface of the enclosure to make for a neat appearance and not interfere with the operating functions of the device it is attached to. These labels shall be as manufactured by the Brady Identification Systems Division, Safety Sign Company, Westline Products Company, or equal.

D. Provide warning signs where there is hazardous exposure or danger associated with access to or operation of electrical facilities, such as pad mount transformers. Provide text of sufficient clarity and lettering of sufficient size to convey adequate information at each location; mount permanently in an appropriate and effective location. Comply with recognized industry standards for color and design.

E. Bury a continuous, pre printed, bright colored plastic ribbon cable marker with each underground power or signal circuit, regardless of whether conductors are in conduit or concrete encasement. Locate each directly over cables, 6" to 8" below finished grade.

F. Provide adequate marking of conduits containing conductors operating above 600 volts, which are exposed or concealed in accessible spaces. Except as otherwise indicated use orange banding with black lettering. Provide self adhesive or snap on type plastic markers. Indicate voltage ratings of conductors. Locate markers at ends of conduit runs, near switches and other control devices, near items of equipment served by conductors, at points where conduits pass through walls or floors or enter non accessible construction, and at spacings of not more than 50' along each run of exposed conduit.

1.14 SUBMITTALS

A. Refer to the Division 1 sections for general requirements concerning work related submittals. For electrical work, the following quantities are required for each category of submittal (in lieu of quantities specified in Division 1), unless otherwise indicated in individual work sections (quantity does not include copies required by governing authorities, or by Contractor for its own purpose.)

- (1) Shop Drawings: Minimum 6 sets, including 3 for maintenance manuals.
- (2) Product Data: Minimum 6 sets, including 3 sets for maintenance manuals.
- (3) Samples: 4 sets for final submission.
- (4) Certifications: 3 copies.
- (5) Test Reports: 3 copies.
- (6) Warranties (Guarantees): 6 copies, including 3 for maintenance manuals.

(7) Maintenance Manuals: 3 final copies, including wiring diagrams, maintenance and operating instructions, parts listings, and copies of other submittals indicated for inclusion.

B. Each submittal shall have Engineer's Project Number, Specification Section Number, Schedule, Material and Date Submitted, indicated on its cover sheet so Engineer may readily determine particular item Contractor proposes to furnish.

C. An example of above requirements is indicated by:

(Job Number)

Division 16 ELECTRICAL

Section 16510 Building Lighting Fixtures

Date Submitted:

D. Operating and Maintenance Manual

(1) Submit to Engineer prior to substantial completion three (3) copies of complete operating and maintenance instructions for equipment provided under this Contract. Provide complete parts lists for all new major equipment items.

(2) Organize each maintenance manual with index and thumb tab marker for each section of information; bind in 2", 3 ring, vinyl covered binder with pockets to contain folded sheets, properly labeled on spine and face of binder with the following:

TITLE: (Project Name)

Electrical System Operation and Maintenance Data

Name and Address of Architect/Engineer

Name and Address of Consultants/Contractors

(3) Index of contents shall include equipment vendor's name and address.

(4) Include Brochures, data, all approved shop drawings, parts lists, warranties, wiring diagrams and manufacturers operating and maintenance instructions.

E. Contractor shall refer to each separate section of these specifications for information on electrical items requirement shop drawing submission and additional maintenance manual documentation.

F. Electronic Submittals

(1) Submittals sent electronically shall have a cover sheet with all information as noted in items B. and C. above. Each separate section, i.e. 16120, 16155, etc., shall have a separate cover sheet for the sections submitted. All items covered in a separate section of specs, i.e. 16510, shall be combined within a single PDF submittal file for that section (i.e. Do not submit 5 separate PDF files for 5 different light fixtures as covered in section 16510). Submittals/sections without cover sheets will not be reviewed.

1.15 MATERIALS

A. All materials used shall be new and at least meet the minimum standards as established by the NEC and/or National Electrical Manufacturers Association (NEMA). All materials shall be UL listed for the application, where a listing exists. Additional requirements are found in Division 1. All equipment shall meet applicable FCC requirements and restrictions.

B. The material and equipment described herein has been specified according to a particular trade name or make to set quality standards. However, each CONTRACTOR has the right to substitute other material and equipment in lieu of that specified, other than those specifically mentioned as matching or for standardization, providing such material and equipment meets all of the requirements of those specified and is accepted, in writing by the ENGINEER.

C. The reuse of salvaged electrical equipment and/or wiring will not be permitted unless specified herein or indicated on the Contract Drawings.

D. All salvaged or abandoned electrical materials shall become the property of the OWNER and shall be removed from the job site upon completion of the project as directed by OWNER.

1.16 TEMPORARY FACILITIES

A. Refer to Division 1 sections for general requirements for temporary facilities.

B. The CONTRACTOR is responsible for coordinating all activities onsite by the Power Company

C. The CONTRACTOR shall be responsible for providing temporary electrical power as required during the course of construction and shall remove temporary service equipment when no longer required. Temporary power is also addressed in Division 1.

D. All such equipment shall be removed when permanent connections have been completed. Where it is determined, during construction, that temporary facilities, as installed, interfere with construction operations, relocate said facilities in an approved manner at no cost to Owner. Temporary connections shall be in accordance with NEC and OSHA requirements. Repair damage or injury to equipment, materials, or personnel caused by improperly protected temporary installations. The Contractor shall be responsible for all costs for materials and installation for temporary electrical facilities and energy for their operation.

1.17 ERRORS, CORRECTIONS AND/OR OMISSIONS

A. Should a piece of utilization equipment be supplied of a different size or horsepower than shown on the Contract Drawings, the CONTRACTOR shall be responsible for installing the proper size wiring, conduit, starters, circuit breakers, etc., for proper operation of that unit and the complete electrical system at no extra cost to the OWNER.

B. It is the intent of these Specifications to provide for an electrical system installation complete in every respect, to operate in the manner and under conditions as shown in these Specifications and on the Contract Drawings. The CONTRACTOR shall notify the ENGINEER, in writing, of any omission or error at least 10 days prior to opening of bids. In the event of the CONTRACTOR'S failure to give such notice, CONTRACTOR may be required to correct work and/or furnish items omitted without additional cost. Further requirements on this subject may be found in the General Requirements, Division 1.

(1) Necessary changes or revisions in electrical work to meet any code or power company requirements shall be made by the CONTRACTOR without additional charge.

1.18 MAINTAINING CONTINUOUS ELECTRICAL SYSTEM AND SERVICE

A. Existing service(s) continuity shall be maintained at all times. In no way shall the installation and/or alteration of the electrical work interfere with or stop the normal operation of the existing facilities, except when prior arrangements have been made.

B. When additions and taps to existing service(s) require electrical outages of duration in excess of a few minutes, arrangements shall be made in advance for such outages. All outages shall be held to an acceptable minimum with none exceeding 4 hours continuous duration. If necessary, work shall be performed on premium time. If performed at night, requiring a general outage, the CONTRACTOR shall furnish an auxiliary source of light and power as required. Under no circumstances shall an electrical outage of any duration be initiated until the OWNER and ENGINEER have concurred, and as far as possible in advance.

1.19 SERVICE ENTRANCE

A. Conductors and terminations for service entrances shall be furnished and installed by the CONTRACTOR. Voltage, phase, and number of wires shall be as shown on the Drawings. Clearances for overhead entrance wires shall be per Power Company, NEC, and NESC requirements.

B. Any details not shown on the Drawings or written in the Specifications pertaining to the service entrance shall be per power company requirements. It is the CONTRACTOR'S responsibility to contact the utility prior to bidding and obtain any special requirements or costs they will be imposing. Those costs shall be included in the bid.

C. On underground service entrances from pad mounted transformers, the CONTRACTOR shall be responsible for furnishing and installing all primary, secondary, and metering conduits, as well as secondary service/metering conductors. The CONTRACTOR shall be responsible for furnishing pull wires in primary conduits for use by the power company. The CONTRACTOR shall be responsible for fabricating the required concrete pad that the transformer will be mounted on. The CONTRACTOR shall also mount the meter base furnished by the power company.

END SECTION



SECTION 16051 - BASIC MATERIALS AND METHODS

1. RELATED DOCUMENTS

- A. General provisions of Contract, General and Supplementary Conditions and General Requirements apply to this Section.
- B. Requirements of Electrical General Provision Sections govern this Section, where applicable.
- C. Requirements of the sections govern work specified in this section, where applicable.

2. DESCRIPTION OF WORK

- A. Provide labor, material, equipment and services necessary for complete and proper Basic Materials and Methods.
- B. Requirements of this section apply to electrical work specified elsewhere.

3. BASIC MATERIALS AND METHODS

- A. Unless otherwise indicated, install all wiring in rigid metal conduit, electric metallic tubing, or flexible metallic conduit specified below or as indicated on Drawings. Do not use surface metal raceways on floor. Do not use nonmetallic sheathed cable, or armored cable (Bx or Type AC).
- B. Provide complete wiring from point of service connection to all receptacles, lighting fixtures, devices, utilization equipment and outlets for future extensions, as indicated on Drawings. Provide ample slack wire for connections. Unless otherwise specified, provide No. 12 AWG or larger for all branch circuit conductors. In outlet boxes designated for future use, tape ends of wires and install blank covers. Do not install telephone signal wires unless otherwise specified.
- C. Do not bend cables, either permanently or temporarily during installation, to radii less than 10 times outer diameters, except where shorter radii are approved by engineer for conditions making specified radius impracticable.
- D. All conductors No. 10 and smaller located in branch circuit panelboards, signal cabinets, signal control boards, switchboards and motor control centers shall be neatly and securely bundled. For conductors larger than No. 10 located in switchboards, motor control centers and pull boxes, neatly and securely cable in individual circuits. Use nylon straps made of self extinguishing nylon having a temperature range of 65 degrees F. to + 350 degrees F. Construct each strap with a locking hub or head on one end and a taper on other.
- E. Shared neutrals shall not be used for multiple branch circuits run within the same conduit. Install a separate neutral for each circuit.
- F. Where two or more conduits have been installed in place of a single conduit because of space conditions, use duplicate conductors in each conduit, including neutrals where required, and total capacity of duplicate conductors shall be not less than capacity of conductors replaced.
- G. Where length of a branch circuit, from panel to first outlet, exceeds 75 feet for a 120 volt, 20 amp. circuit or 175 feet for a 277 volt circuit, use No. 10 AWG conductor size.
- H. Where homerun circuit numbers are indicated on Drawings, follow such numbers in connecting circuits to panelboards. Where homerun circuit numbers are not indicated on Drawings, divide similar types of connected loads among phase buses in such a manner that, in normal usage, phase bus currents will be approximately equal. Connect each branch circuit homerun containing two or more circuits to

circuit breakers or switch in a three wire or four wire branch circuit panelboard in such a manner that no two circuits will be fed from same bus. Where panelboard cabinets are recessed, conduits with sufficient capacity to carry required number and size of future conductors for all spare branch circuit protective devices and spaces in panelboard shall be stubbed up concealed to a junction box for future connections and extensions located as follows:

(1) In an area with removable ceiling, junction box shall be accessible above suspended ceiling.

(2) In an area with non-removable ceiling, recess junction box in ceiling directly over panelboard location.

(3) In an area without finished ceiling but with finished walls, recess junction box in wall directly above panelboard location at ceiling line.

(4) In an area without suspended ceiling but with unfinished walls, recess junction box on ceiling directly over panelboard location.

I. Provide all junction boxes in accordance with NEC as to conductor capacity for future conductors with adequate knock outs on all four sides and a blank screw cover. Plates shall match those installed in that particular area.

J. Install only one 277 volt circuit in a wall switch outlet box. Where more than one 277 volt circuit (on different phases) is indicated on drawings as being run to multi wall switch units from a ceiling branch circuit outlet box, provide individual conduit with phase and lighting fixture control wiring and separate outlet boxes with separated wall plates to segregate each phase.

END SECTION

SECTION 16110 - ELECTRICAL RACEWAYS

1.1 RELATED DOCUMENTS

- A. General provisions of Contract, General and Supplementary Conditions and General Requirements.
- B. Requirements of Electrical General Provision Sections govern this Section, where applicable.
- C. This section shall be governed by Alternates insofar as they apply to this work.

1.2 DESCRIPTION OF WORK

- A. Provide labor, materials, equipment and services necessary for proper and complete installation of electrical raceways.
- B. The requirements of this section apply to electrical raceway work specified elsewhere in these specifications.

1.3 QUALITY ASSURANCE

- A. Comply with applicable portions of National Electrical Manufacturers Association standards pertaining to metallic and nonmetallic conduit, duct and EMT.
- B. Comply with applicable portions of Underwriters' Laboratories safety standards pertaining to electrical raceways; and provide products which have been UL listed and labeled.
- C. Comply with National Electrical Code (NFPA No. 70) as applicable to construction and installation of electrical raceways.
- D. Raceways shall be marked with the manufacturer's name or trademark as well as type of raceway and size. This marking shall appear at least once every 10 feet and shall be of sufficient durability to withstand the environment involved. All raceways shall be furnished and installed as outlined under the following sections of this Specification.

1.4 SUBMITTALS

- A. Submit manufacturer's standard data sheets for rigid metal conduit, EMT, wireways, rigid PVC conduit, flexible metal conduit, bitumastic coatings and fittings for all types of raceways.

1.5 MATERIAL

- A. Types/acceptable manufacturers of electrical raceways:

Electrical metallic tubing – Allied Tube, Wheatland Tube

Liquid tight flexible metal conduit – Allied Tube, Eastern Wire

Rigid steel conduit – Allied Tube, Maverick Tube

Rigid aluminum conduit – Wheatland Tube, Allied tube, Indalex

Wireways – Square "D"; Cooper B-Line

Rigid PVC conduit – Carlon, Allied Tube, Can Tex

B. For each electrical raceway system indicated, provide assembly of conduit, tubing or duct, and fittings, including, but not necessarily limited to, connectors, couplings, offsets, elbows, straps, bushings, expansion joints, hangers, and other components and accessories needed for a complete system.

(1) Provide metal conduit, tubing and fittings of types, grades, sizes and weights (wall thicknesses) for each service indicated. Where types and grades are not indicated, provide proper selection determined by Installer to fulfill wiring requirements, and comply with applicable portions of National Electrical Code for electrical raceways.

a. Provide threaded steel conduit and fittings in accordance with U.L. 6 and ANSI C80.1, zinc coated or coated with and approved corrosion resistant coating on inside. Conduits not completely encased in concrete but laid directly in or in contact with ground or on a vapor barrier shall be field coated on outside with asphaltum before installation or shall have an additional outside factory coating of polyvinyl chloride or phenolic resin epoxy material or other equally flexible and chemical resistant material.

b. Provide electrical metallic tubing, EMT and fittings in accordance with U.L. 797 and ANSI C80.3, zinc coated on outside and either zinc coated or coated with an approved corrosion resistant coating on inside.

c. Liquid tight flexible metal conduit shall consist of a core of flexible galvanized steel tubing over which is extruded a liquid tight jacket of poly vinyl chloride (PVC). Liquid tight flexible conduits not larger than 1 1/4 inch size shall be provided with a continuous copper bonding conductor wound spirally between convolutions. Products shall comply with U.L. 1 and U.L. 360.

d. Flexible metal conduit (commercial Greenfield) and fittings shall be in accordance with U.L. 1 and U.L. 1479.

e. Fittings for threaded steel and thin wall (EMT type) conduit shall be either iron or steel only.

f. Compression type threadless fitting shall not be used with threaded steel conduit. Where it is impractical (due to limited working space when employing normal installation practices) to use common construction tools for installation of threaded steel conduit with standard couplings, locknuts and bushings, steel set screw connectors and couplings will be permitted provided they meet the following requirements: body of steel set screw connector and coupling shall have a wall thickness at least equal to wall thickness of conduit with which it is to be used. Set screws shall be of case hardened steel with hex head, and with cup point to firmly seat in wall of conduit for positive ground. Set screws shall be tightened to embed in conduit wall. Tightening screws with pliers will not be permitted.

1/2 through 2 inch connectors shall have one set screw each.

2 1/2 through 4 inch connectors shall have two set screws each.

1/2 through 2 inch couplings shall have two set screws each.

2 1/2 through 4 inch couplings shall have four set screws each.

Conduit nipples with running threads shall not be used.

g. Couplings and connectors for EMT shall be made of either steel or malleable iron only, shall be "Concretetight" or "Raintight" and shall be of either gland and ring compression type, or stainless steel multiple point locking type. All connectors shall have insulated throats. Fittings using indentations as a means of attachment shall not be used.

h. Bushings for threaded steel conduit and connectors for EMT shall be insulated type, designed to prevent abrasion of wires without impairing continuity of conduit grounding system. Insulating insert shall be made of thermosetting or fiber material which conforms to flame test requirements of UL 514, molded or locked into metallic body of fitting. Conduit bushings made entirely of nonmetallic material shall not be used.

i. Fittings for liquid tight flexible conduit shall be in accordance with U.L. 1 and U.L. 360 of a type incorporating a threaded grounding cone, a steel, nylon or equal plastic compression ring, and a gland for tightening. Fitting shall be made of either steel or malleable iron only, shall have insulated throats and shall be of a type having a male thread and locknut or male bushing with or without "O" ring seal.

j. Die cast zinc alloy fittings and fittings made of inferior materials, such as "pot metal", shall not be used on any type of rigid or flexible conduit or EMT.

(2) Wireways

a. Provide wireways of sizes indicated. Constructed of galvanized steel with screw on covers and knockouts approximately 6" o.c. Provide raceway fittings indicated which match and mate with raceway. Finish wireways with gray epoxy paint over corrosion resistant primer.

b. Use wireways only where indicated on Drawings.

c. Effectively ground all wireways.

(3) PVC Conduit

a. Provide nonmetallic conduit, ducts and fittings of types, sizes and weights (wall thicknesses) for each service indicated. Where types and grades are not indicated, provide proper selection determined by Installer to fulfill wiring requirements, and comply with applicable portions of National Electrical Code for electrical raceways. Products shall be in accordance with NEMA TC-2 and U.L. 651.

b. PVC Conduit and Tubing Fittings: NEMA Standards Pub. No. TC 3 and U.L. 514B.

c. Except as otherwise indicated, provide conduit, tubing and duct accessories of types, sizes, and materials indicated, including, but not necessarily limited to, hangers, clamps, rollers, traps, fasteners, brackets, expansion and deflection fittings, complying with manufacturer's published product information, and designed and constructed by manufacturer for use in applications indicated.

(4) Provide watertight hub connections at all conduits connecting to NEMA 3R or 4 enclosures. Myers or equal.

(5) Aluminum Conduit

a. Aluminum conduit shall be extruded from alloy 6063 and shall be the rigid type, non-toxic, corrosion resistant, and non-staining. It shall be manufactured per UL standards as well as listed/labeled by same.

b. Fittings, boxes and accessories used in conjunction with aluminum conduit shall be die cast aluminum, copper free type. They shall be resistant to both chemical and galvanic corrosion. All covers shall have neoprene gaskets.

c. Standard threaded couplings, locknuts, bushings, and elbows made only of aluminum alloy materials. Aluminum fittings containing more than 0.4 percent copper are prohibited.

d. Locknuts and bushings: As specified for rigid steel conduit, except of aluminum materials.

e. Set screw fittings: Not permitted for use with aluminum conduit.

C. Conduit Supports

(1) Pipe straps and supports shall be PVC coated steel in pipe galleries and chemical feed rooms. All others shall be zinc coated steel.

(2) Provide individual pipe hangers, multiple (trapeze) pipe hangers, and riser clamps as necessary to support conduits. All parts and hardware shall be zinc coated throughout. Provide all U bolts, clamps, attachments, and other hardware necessary for hanger assembly, and for securing hanger rods and conduits. Design each multiple hanger to support a load equal to or greater than sum of weights of conduits, wires, hanger itself, and 200 pounds.

(3) Fasten pipe straps and hanger rods to surfaces as specified under "Support of Electrical Items" paragraph in the 'ELECTRICAL, GENERAL PROVISIONS' section.

(4) All EMT and conduits not embedded in concrete or masonry shall be securely and independently supported so that no strain will be transmitted to outlet box and pull box supports. Supports shall be rigid enough to prevent distortion of conduits during wire pulling.

(5) Support individual horizontal conduits by one hole pipe straps or separate pipe hangers for sizes 1 1/2 inch and smaller, and by separate pipe hangers for larger sizes. Spring steel fasteners may be used in lieu of pipe straps or hangers for sizes 1 1/2 inch and smaller in dry locations only. Hanger rods used with spring steel fasteners shall be not less than 1/4 inch diameter steel with corrosion resistant finish. Spring steel fasteners shall be specifically designed for supporting single conduits or EMT. Unless otherwise specified, do not use wire as a means of support.

(6) Where two or more horizontal conduits or EMT run parallel and at same elevation, they shall be supported on multiple (trapeze) pipe hangers. Secure each conduit or EMT to horizontal hanger member by a U bolt, one hole strap or other specially designed and approved fastener.

(7) Branch circuit conduits and raceways above suspended ceilings may be supported from floor construction above or from main ceiling support members, however, finished installation shall not interfere with removability of ceiling panels.

1.6 INSTALLATION

A. Install conduit, tubing and wireway products as indicated, in accordance with manufacturer's written instructions, applicable requirements of NEC and complying with recognized industry practices to ensure that products serve intended functions. Handle conduit and tubing carefully to prevent bending and end damage, and to avoid scoring finish. Store pipe and tubing inside and protect from weather. When necessary to store outdoors, elevate well above grade and enclose with durable, watertight wrapping. Provide color coded end cap thread protectors on exposed threads of metal conduit.

B. Conduit buried in concrete shall be rigid steel unless otherwise indicated. Do not install EMT underground, in slabs on grade, in wet locations, in hazardous areas, or for circuits operating at more than 600 volts. Do not use EMT in concrete placements where vibrators will be used. Metallic conduit buried in concrete shall be threaded steel only. Outside diameter of conduit buried in concrete shall not exceed one third of the thickness of structural slab, wall or beam in which it is placed. Locate conduit entirely within middle third of member wherever possible. Lateral spacing of conduits buried in concrete slabs shall be not less than three diameters except where drawings definitely indicate that concrete slab has been specially designed to accommodate a closer spacing of conduits entering wire closets, panelboards, or electrical boxes or arrangements is approved by Engineer.

C. Use flexible conduits for connections to motors and other electrical equipment when it is subject to movement, vibrations, misalignment, cramped quarters or where noise transmission is to be eliminated or reduced. Flexible conduit used to meet the above requirements shall in addition be liquid tight type when installed under any of the following conditions:

- (1) Exterior locations
- (2) Moisture or humidity laden atmosphere where it is possible for condensation to accumulate.
- (3) Corrosive atmosphere.
- (4) Where water or spray due to wash down operations is frequent or possible.
- (5) Wherever there is a possibility of seepage or dripping of oil, grease, or water.

D. Run concealed conduit and EMT in as direct lines as possible with a minimum number of bends of longest possible radius. Run exposed conduits and EMT parallel to or at right angles to lines of building. All bends shall be free from dents or flattening.

E. Conduit and EMT runs shall be mechanically and electrically continuous from service entrance to all outlets. Unless otherwise specified, each conduit shall enter and be securely connected to a cabinet, junction box, pull box or outlet box by means of a locknut on outside and a bushing on inside or by means of a liquid tight, threaded, self locking, cold weld type wedge adapter. Where nominal circuit voltage exceeds 250 volts, (1) in rigid conduit, an additional locknut shall be provided, one locknut being inside and one locknut outside and (2) in EMT or flexible metal conduit, the one locknut shall be made wrench tight. All locknuts shall be bonding type with sharp edges for digging into metal wall of an enclosure and shall be installed in a manner that will assure a locking installation. Locknuts and bushings or self locking adapters will not be required where conduits are screwed into tapped connections. All vertical runs of conduit or EMT terminating in bottoms of wall boxes or cabinets shall be protected from entrance of foreign material prior to installation of conductors.

F. The minimum size of threaded conduit, EMT, and flexible metallic conduit shall be 3/4" except as follows:

- (1) Unless otherwise specified or indicated on drawings.
- (2) Unless otherwise indicated on Drawings, telephone, telemetry and control circuit conduits shall be not less than 1 inch trade size.

G. Check size of all raceways to determine that green equipment ground conductor, specified, indicated or required can be installed in same raceway with phase and neutral conductors in accordance with percentage of fill requirements of NEC. If necessary, sizes of duct, conduit, tubing or raceway indicated or specified shall be increased to accommodate all conductors without additional cost to Owner.

H. Unless otherwise specified or indicated on Drawings, all conduit and EMT shall be installed concealed. Unless otherwise indicated on Drawings, conduit and EMT may be run exposed on unfinished walls, on unfurred basement ceilings, in penthouses, attics and roof spaces.

I. In wood construction, run conduits and EMT in rough underflooring, on top of joists or between joists. Furring strips may be notched at any point but joists may be notched only at points not more than one foot from a point of support and notches may not be deeper than 1 3/8". Conduits and EMT may be run exposed on bottoms of joists only in unfinished rooms where permitted by Engineer.

J. Horizontal cross runs of conduit or EMT may be installed in partitions only where explicitly permitted by Architect. Install exposed horizontal runs, where permitted, close to ceiling or ceiling beams and

above water, steam or other piping. Run conduits and EMT connected to wall outlets in such a manner that they will not cross water, steam or waste pipes or radiator branches. Do not run conduits and EMT through beams, except where clearly indicated on Drawings or where permitted by Architect.

K. Install every conduit system complete before conductors are drawn in.

L. Expansion Fittings: Each conduit that is buried in or rigidly secured to building construction on opposite sides of a building expansion joint and each long run of exposed conduit that may be subject to excessive stresses shall be provided with an expansion fitting. Expansion fitting shall be made of hot dipped galvanized malleable iron and shall have a factory installed packing, which will prevent entrance of water, a pressure ring, and a grounding ring.

(1) In addition to grounding ring, provide a separate external copper bonding jumper secured by grounding straps on each end of fitting.

(2) Where conduits are buried in concrete, they shall cross building expansion joints at right angles, and expansion fittings shall be installed in accordance with manufacturer's instructions. Provide free ends of conduits with insulated bushings.

M. Sealing Fittings: Sealing fittings for use with threaded steel conduits shall be threaded, zinc or cadmium coated and cast or malleable iron type fittings. Fittings used to prevent passage of water vapor shall be of the continuous drain type.

(1) Install and seal sealing fittings in accordance with manufacturer's recommendations at suitable, approved, accessible locations. In concealed work, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates.

(2) Install sealing fittings at the following points, and elsewhere as indicated.

a. Where conduits enter or leave hazardous areas equipped with explosion proof lighting fixtures, switches or receptacles to prevent passage of explosive vapors.

b. Where conduits pass from warm locations to cold locations, such as refrigerated spaces and air conditioned spaces, to prevent passage of water vapor.

c. Where required by NEC.

N. Expansion and Deflection Couplings

(1) Accommodate 1.9 cm (0.75 inch) deflection, expansion, or contraction in any direction and allow 30 degree angular deflections.

(2) Include internal flexible metal braid sized to guarantee conduit ground continuity and fault currents in accordance with UL, and the NEC code tables for ground conductors.

(3) Watertight, seismically qualified, corrosion-resistant, threaded for and compatible with rigid metal conduit.

(4) Jacket: Flexible, corrosion-resistant, watertight, moisture and heat resistant molded rubber material and stainless steel jacket clamps.

1.7 SPECIAL INSTALLATION INSTRUCTIONS

A. The following installation requirements are specific to this project and shall be strictly enforced.

(1) All exterior below grade conduits shall be Schedule 80 PVC except as noted on Drawings for telephone and power company circuits. Above grade shall be rigid aluminum. Rigid steel below grade shall be asphaltum coated with minimum two (2) coats Carboline Bitumastic 50 or equal.

(2) All conduit installed within pump station building shall be rigid aluminum.

(3) Aluminum conduit in contact with concrete and/or where installed below grade or in direct contact with concrete shall have polytape applied per Section 16200.

END SECTION

SECTION 16120 - CABLE, WIRE AND CONNECTORS

1.1 RELATED DOCUMENTS

- A. General provisions of Contract, General and Supplementary Conditions and General Requirements apply to work specified in this section.
- B. Requirements of Electrical General Provision Sections govern this Section, where applicable.
- C. This section shall be governed by Alternates insofar as they affect this work.

1.2 DESCRIPTION OF WORK

- A. Provide labor, materials, equipment and services necessary for proper and complete installation of cable, wire and connectors.
- B. Requirements of this section apply to cable and wire work specified elsewhere in these specifications.

1.3 QUALITY ASSURANCE

- A. Comply with National Electrical Code (NFPA 70) as applicable to construction and installation of electrical cable, wire and connectors.
- B. Provide electrical cable, wire and connectors which have been listed and labeled by Underwriters Laboratories.
- C. Comply with National Electrical Manufacturers Association/Insulated Power Cable Engineers Association Standards publications pertaining to materials, construction and testing wire cable, where applicable.
- D. Manufacturers offering products complying with requirements include:
 - (1) Cable and Wire:
 - Paige Pump Wire
 - Southwire Company
 - Triangle PWC, Inc.
 - Belden
- E. Connectors:
 - Buchanan
 - Burndy Corporation
 - 3M Company
 - Thomas and Betts Co.
 - King Innovation

1.4 SUBMITTALS

A. Submit manufacturer's product data on all 4-20MA signal cables and Telemetry System shielded cables.

B. Submit manufacturer's product data for watertight wire connectors.

1.5 MATERIALS

A. Cable and Wire

(1) Provide factory fabricated cable, wire and connectors of sizes, ratings, materials and types indicated for each service. Where not indicated, provide proper selection as determined by equipment manufacturer to comply with project's equipment installation requirements and NEC standards, including equipment control and instrumentation requirements.

(2) Use single conductor annealed copper type for all wires and cables for secondary service, feeders and branch circuits, unless specified otherwise.

(3) Use No. 12 or No. 10 solid conductor for branch circuit wiring connected to receptacles, lighting switches and snap switches.

(4) Use minimum 75 degrees C rated insulation unless specified otherwise, indicated on Drawings, or required by NEC.

(5) Wire #12 - #1 shall be applied based on a 60 degree Celsius temperature rise. Building wire larger than #1 may be applied at its 75 degree Celsius temperature rise.

(6) Use 600 volt insulation rating unless specified or indicated otherwise. Where operating voltage is less than 100 volts, wires or cables may be insulated for 300 volts provided they are isolated from higher voltage systems.

B. Use (1) 16 ga. twisted/shielded pair cable for 4-20ma signal circuits from flow, level, alarm transmitters, V.F. drives, etc. Cable shall be Belden No. 8719, or General Cable type VNTC with 100% shield coverage and stranded/tinned 18 ga. drain wire, 600V rated.

C. Valves, valve controllers, start-stop selector switches, etc. Use minimum 75 degrees C rated insulation unless specified otherwise, indicated on Drawings, or required by NEC. Use 600 volt insulation rating unless specified or indicated otherwise.

D. Connectors

(1) All power circuit wire connectors for wiring #6 AWG and smaller shall be made using watertight type connectors which have been prefilled with silicone sealant. Connectors shall have lifetime guarantee and be UL 50 raintight/watertight listed. Connectors shall have a temperature rating of 105 degrees C. minimum and silicone sealant shall be rated for -45 to 400 degrees F.

(2) Watertight type wire connectors shall be King Innovation DryConn or equivalent.

E. Electrical Lugs

(1) Lugs from #6 AWG - 1000 MCM shall be compression types with barrels to provide maximum conductor contact and tensile strength. They shall be manufactured from high conductivity copper and entirely tin plated. The lugs must have a current carrying capacity equal to the conductors for which they are rated and must also meet all UL requirements. All lugs above 4/0 shall be 2 hole lugs with NEMA

spacing. The lugs shall be rated for operation through 35 KV. The lugs shall be of closed end construction to exclude moisture migration into the cable conductor.

1.6 INSTALLATION

A. Install electrical cable wire and connectors as indicated, in accordance with manufacturer's written instructions, applicable requirements of NEC and NECA's "Standard of Installation", and in accordance with recognized industry practices to ensure products serve intended functions.

B. Store cable, wire and connectors in factory installed coverings in a clean, dry indoor space which provides protection against weather.

C. Pull conductors together where more than one is being installed in a raceway.

D. Use pulling compound or lubricant, when necessary; compound must not deteriorate conductor and insulation.

E. Do not use a pulling means, including fish tape, cable or rope which can damage raceway.

F. Install exposed cable, parallel and perpendicular to surface or exposed structural members and follow surface contours, where possible.

G. Color Code: All secondary service, feeder and branch circuit conductors throughout projects as follows:

208Y/120 volts	Phase	480y/277 volts
Black	A	Brown
Red	B	Orange
Blue	C	Yellow
White	Neutral	White
Green	Ground	Green

H. Keep conductor splices to a minimum.

I. Install splices and taps for power wiring which has equivalent or better mechanical strength and insulation as conductor.

J. Use splice and tap connectors on power wiring which is compatible with conductor material.

K. Do not install more than three conductors in any one splice.

L. Install poly pull line in all spare/empty conduits.

M. Prior to energization, check cable and wire for continuity of circuitry and for short circuits. Correct malfunction when detected.

N. Subsequent to wire and cable hook ups, energize circuitry and demonstrate functioning in accordance with requirements.

O. Multi conductor cables shall not be spliced but shall run continuous from point of supply to equipment connection.

P. Shielded pair cable shall be grounded at one end only and as close to signal source as possible.

Q. A minimum separation of 12 inches between analog signal leads and a-c power leads should be maintained. For a-c power leads carrying 100 amps or greater, a 24 inch separation should be maintained. Parallel runs should be limited to less than 500 feet. Perpendicular runs may be as close as 6 inches.

1.7 SPECIAL INSTALLATION INSTRUCTIONS

A. Wire or cable splices for control and instrumentation circuits shall not be accepted.

B. Do not install any control or instrumentation cable or wiring in same conduit or J-box with electrical power wiring, unless otherwise noted.

C. NOTE: Electrical Contractor shall be responsible for providing and installing all power, control and instrumentation wiring and cable from all remote devices to their respective system control panels. This shall include the termination of wires/cables on both ends and installation of wire No. markers.

END SECTION

SECTION 16130 - ELECTRICAL BOXES AND FITTINGS

1. RELATED DOCUMENTS

- A. General provisions of contract General and Supplementary Conditions and General Requirements.
- B. Requirements of Electrical General Provision Sections govern this Section, where applicable.
- C. This Section shall be governed by Alternates insofar as they affect this work.

2. DESCRIPTION OF WORK

- A. Provide labor, materials, equipment, and services for proper and complete installation of electrical boxes and fittings.
- B. Extent of electrical box and electrical fitting work is indicated by drawings and schedules, and requirements of this section.

3. QUALITY ASSURANCE

- A. Comply with National Electrical Code (NFPA 70) as applicable to construction and installation of electrical boxes and fittings.
- B. Provide boxes and fittings which have been listed and labeled by Underwriters' Laboratories.
- C. Comply with National Electrical Manufacturers Association standards as applicable to non-metallic fittings for underground installation.

4. MATERIAL

- A. Provide boxes, cabinets, and fittings as indicated on Drawings, schedules, and as required for job.
- B. Interior Outlet Boxes: Provide galvanized steel interior outlet wiring boxes, of type, shape and size, including depth of box, to suit each respective location and installation; constructed with stamped knockouts in back and sides, and with threaded holes with screws for securing box covers or wiring devices.
- C. Interior Outlet Box Accessories: Provide outlet box accessories as required for each installation, including mounting brackets, wallboard hangers, extension rings, fixture studs, cable clamps and metal straps for supporting outlet boxes, compatible with outlet boxes being used and meeting requirements of individual wiring situations. Choice of accessories is Installer's option.
- D. Weatherproof Outlet Boxes: Provide corrosion resistant cast metal weatherproof outlet wiring boxes, of type, shape and size, including depth of box, with threaded conduit ends and cast metal face plate, including face plate gasket and corrosion proof fasteners.
- E. Junction and Pull Boxes: Provide galvanized sheet steel junction and pull boxes, with screw on covers; of type, shape and size, to suit each respective location and installation; with welded seams and equipped with stainless steel nuts, bolts, screws and washers.
- F. Conduit Bodies: Provide galvanized or aluminum cast metal conduit bodies, of type, shape, and size, to suit each respective location and installation, constructed with threaded conduit ends, removable cover, and corrosion resistant screws.

G. Bushings, Knockout Closures and Locknuts: Provide corrosion resistant punched steel box knockout closures, conduit locknuts and malleable iron conduit bushings of type and size to suit each respective use and installation.

H. Acceptable Manufacturers

(1) Appleton, Crouse-Hinds, Hoffman and T&B or equal.

5. INSTALLATION

A. Install electrical boxes and fittings as indicated, or in compliance with NEC requirements, in accordance with manufacturer's written instructions and with recognized industry practices to ensure that boxes and fittings serve intended purposes.

B. Provide weatherproof outlets for interior and exterior locations exposed to weather or moisture exposure.

C. Provide knockout closures to cap unused knockout holes where blanks have been removed.

D. Locate boxes and conduit bodies so as to ensure accessibility of electrical wiring.

E. Avoid using round boxes where conduit must enter box through side of box, which would result in a difficult and insecure connection with a locknut or bushing on rounded surface.

F. Secure boxes rigidly to substrate upon which they are being mounted, or solidly embed boxes in concrete or masonry.

G. Do not use sectional (gangable) boxes.

H. Use threaded hub type outlet boxes (NEMA 4X) with gasketed weatherproof covers and stainless steel hardware where surface mounted at following locations:

- (1) Exterior locations
- (2) Where exposed to moisture laden atmosphere
- (3) Where indicated on drawings
- (4) At pump station and valve vault areas.

I. Measure mounting height from finished floor or finished grade to center line of cover plate.

J. NEMA 4 junction and pull boxes shall be stainless steel, unless otherwise noted.

K. Junction boxes for use in wet-wells and other hazardous areas shall be water tight, rust proof, corrosion resistant, and explosion proof with threaded conduit openings (5 ½ full threads - minimum) and provided with rust proof hardware.

L. Explosion proof sealing fittings shall be furnished and installed in accordance with NEC requirements.

M. Outlet or junction boxes for use with exposed aluminum conduit shall be copper free, cast aluminum type, or stainless steel.

N. Saw cut openings for boxes in exposed masonry walls.

END SECTION

SECTION 16135 - ELECTRICAL EQUIPMENT SUPPORTS

1. RELATED DOCUMENTS

- A. General provisions of contract General and Supplementary Conditions and General Requirements.
- B. Requirements of Electrical General Provision Sections govern this Section, where applicable.
- C. This Section shall be governed by Alternates insofar as they affect this work.

2. DESCRIPTION OF WORK

- A. Provide labor, materials, equipment, and services for proper and complete installation of electrical equipment supports.

3. QUALITY ASSURANCE

- A. Comply with National Electrical Code (NFPA 70) as applicable to construction and installation of electrical equipment supports.
- B. Provide fittings which have been listed and labeled by Underwriters' Laboratories.
- C. Acceptable Manufacturers: Kindorf, Unistrut, Allied or equal.

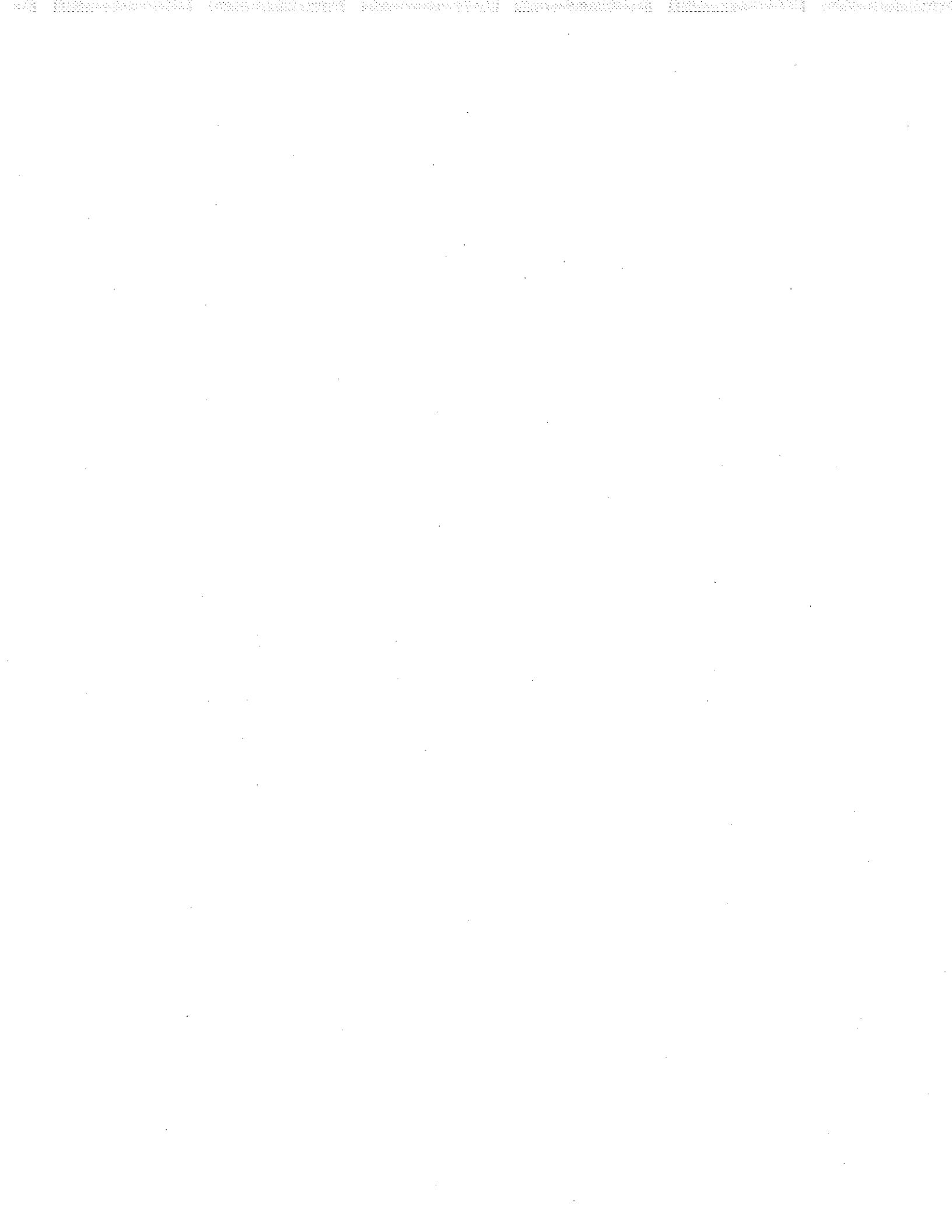
4. MATERIALS

- A. All exterior and interior mounting brackets and strut shall be aluminum. Fasteners used to mount equipment where exposed to weather or in corrosive environments shall be non-magnetic stainless steel.

5. INSTALLATION

- A. All electrical equipment shall be rigidly mounted, and installed using supporting devices as indicated on the Contract Drawings, as required by the work, and described herein.
- B. All free standing equipment shall be anchored to its foundation using expansion bolts with stainless steel fasteners of the size and number recommended by the equipment manufacturer.
- C. Where required by building codes for compliance with seismic conditions, seismic restraints shall be provided and installed for electrical equipment.

END SECTION



SECTION 16140 - WIRING DEVICES

1. RELATED DOCUMENTS

- A. General provisions of Contract, General and Supplementary Conditions and General Requirements.
- B. Requirements of Electrical General Provision sections govern this Section, where applicable.
- C. This section shall be governed by alternates insofar as they affect this work.

2. DESCRIPTION OF WORK

Provide labor, material, equipment and services for proper and complete installation of wiring devices.

3. QUALITY ASSURANCE

- A. Comply with National Electrical Code (NFPA No. 70) as applicable to construction and installation of electrical wiring devices.
- B. Provide electrical wiring devices which have been tested, listed and labeled by Underwriters' Laboratories.
- C. Comply with National Electrical Manufacturers Association standards for wiring devices.

4. SUBMITTALS

- A. Submit manufacturer's data on wiring devices and plates.
- B. Device manufacturers other than those listed below must have ten day written prior approval.
- C. It is the responsibility of the contractor to provide data that devices are equal other than by catalog numbers.

5. MATERIAL

A. Provide factory-fabricated wiring devices, in type, color, and electrical rating for service indicated and as described below. Where type and grade are not indicated, provide proper selection as determined by Installer to fulfill wiring requirements, and comply with NEC and NEMA standards for wiring devices.

B. Devices and Plates

(1) All non-weatherproof metal wall plates shall be smooth anodized aluminum, coated to prevent oxidation, unless otherwise noted. Plates manufactured by Hubbell "A" type or equal.

(2) All devices in dusty and or wet locations shall use weatherproof corrosion resistant cover plates of cast aluminum, rustproof, weatherproof, with spring loaded cover for receptacle and external handle or neoprene cover for switch. Similar to Hubbell 1795 for switches and cast aluminum WP8M or WP26MH in-use type for receptacles.

(3) All switches and standard receptacles in process, control, lab and equipment rooms shall be grey in color with aluminum faceplates unless otherwise noted.

(4) All switches and standard receptacles in offices, reception areas, restrooms, public corridors and conference/meeting rooms shall be grey in color with aluminum faceplates.

(5) All corrosion resistant standard receptacles shall be yellow in color. Corrosion resistant GFCI receptacles shall be grey in color. All faceplates/covers for corrosion resistant devices shall be aluminum.

(6) All device plates in chlorine rooms shall be smooth impact resistant nylon equal to Hubbell "P" Series.

(7) All receptacles installed outdoors shall be "WR" rated and shall bear this mark.

C. Switches

(1) All switches shall be 20 ampere for 120/277 volt AC lighting circuits.

(2) All switches shall be specification grade side wired.

(3) Switches shall be of the following mfg.

	HUBBELL	BRYANT
Single Pole	CS120	1121
Double Pole	1122	1122
Three-Way	C5320	1123
Four-Way	1124	1124
Pilot Light	1121-PL	1121-PL

D. Receptacles

(1) GFCI Receptacles

a. Ground fault shall have solid state sensing circuitry and a circuit interrupter switch. It shall be rated for operation on a 60 Hz, 120V, 20A branch circuit. Device shall have nominal sensitivity to ground leakage current of four to six milliamperes and shall function to interrupt the current supply for any value of ground leakage current above five milliamperes on load side of the device. Device shall have a minimum nominal tripping time of 1/30th of a second. All GFCI receptacles shall meet 2006 UL requirements.

b. Device shall be of the following mfg.

	HUBBELL	BRYANT	PASS & SEYMOUR
15A-125V 5-15R	GF15GYL	GF15GYL	1595GRY
20A-125V 5-20R	GF20GYL	GF20GYL	2095GRY

(2) Duplex Receptacles - Specification Grade

a. All receptacles shall be specification grade unless otherwise noted.

b. Receptacles shall be either 5-15R 15A, 125V 2-pole, 3-wire or 5-20R 20A, 125V, 2 pole, 3-wire as required.

c. Receptacles shall have the following characteristics:

- 1) "T" type contacts for phase and neutral female connections.
- 2) Female ground connections shall be riveted to bridge.

- 3) Bridge shall be of hot-dipped steel.
- 4) Face plate shall be impact resistant nylon.
- 5) Receptacle body shall be of heat resistant thermoset material.
- 6) Face plate to bridge connecting rivet shall be spun brass.
- 7) Automatic self grounding clip.
- 8) Receptacles shall be of the following mfg.

	HUBBELL	BRYANT	PASS & SEYMOUR
15A 125V 5-15R	5252	5262	5262
20A 125V 5-20R	5352	5362	5362

(3) **Duplex Receptacles - Corrosion Resistant**

- a. Receptacles shall be 5-20R 20A, 125V, 2 pole, 3-wire as required.
- b. Receptacles shall have the following characteristics:
 - 1) "T" type contacts for phase and neutral female connections.
 - 2) Female ground connections shall be riveted to bridge.
 - 3) Bridge shall be of nickel plated brass.
 - 4) Face plate shall be impact resistant nylon.
 - 5) Receptacle body shall be of heat resistant thermoset material.
 - 6) Face plate to bridge connecting rivet shall be spun brass.
 - 7) Automatic self grounding clip.
 - 8) Receptacles shall be of the following mfg.

	HUBBELL
15A 125V 5-15R	HBL53CM62 (Marine Grade)

(4) **GFCI Receptacles - Corrosion Resistant**

- a. Corrosion resistant GFCI receptacles shall be hospital grade.
 - 1) Hubbell GF8300A or approved equal.

6. **INSTALLATION**

A. Install wiring devices where indicated, in accordance with manufacturer's written instructions, applicable requirements of NEC and in accordance with recognized industry practices to ensure that products serve intended function.

- B. Delay installation of devices until wiring is completed.
- C. Install receptacles and switches only in electrical boxes which are clean; free from excess building materials and debris.
- D. Install receptacles with ground pin on top.
- E. All devices and plates shall be of the same manufacturer.
- F. Do not use sectional plates.
- G. Upon installation of wall plates, receptacles and switches, advise Contractor regarding proper and cautious use of convenience outlets. At time of Substantial Completion, replace those items which have been damaged, including those burned and scored by faulty plugs.
- H. Test wiring devices to ensure electrical continuity of grounding connections, and after energizing circuitry, to demonstrate compliance with requirements.
- I. All outlet boxes shall have a cover plate.

END SECTION

SECTION 16150 - MOTORS

1.1 RELATED DOCUMENTS

- A. General provisions of Contract, General and Supplementary Conditions, and General Requirements, apply to this Section.
- B. Requirements of Electrical General Provisions sections govern work specified in this Section.
- C. This section shall be governed by alternates insofar as they affect this work.

1.2 DESCRIPTION OF WORK

- A. Provide labor, materials, equipment and services necessary for proper and complete installation of motors.
- B. Motors are to be furnished with driven equipment. All motors shall conform to the following Specifications and any special requirements of the driven equipment. Special requirements of the driven equipment shall take precedence over these Specifications should a discrepancy occur. Starting torque and slip ratings shall conform to the requirements of the driven equipment. [All motors 15 horsepower and larger (230 volt) or 25 horsepower and larger (480 volt) shall be started via solid state reduced voltage starters unless otherwise noted on the Contract Drawings.]
- C. Polyphase motors shall be of the squirrel cage induction type and single phase of the capacitor start-induction run type except as otherwise noted.

1.3 QUALITY ASSURANCE

- A. Manufacturers offering products complying with requirements include:
 - General Electric
 - Westinghouse
 - U.S. Motors
 - Gould Century
 - Baldor
 - Marathon
 - Reliance
 - Magnatek
 - Siemens
 - Or Equal
- B. Provide motors which have been listed and labeled by Underwriters Laboratories.

- C. Comply with National Electrical Code (NFPA No. 70) as applicable to installation and construction of electrical power/distribution transformers.
- D. Comply with applicable portions of National Electrical Manufacturers Association Standards ST20 pertaining to power/distribution transformers.
- E. Comply with applicable American National Standards Institute (ANSI) standards pertaining to power/distribution transformers.
- F. Comply with applicable portions of Institute of Electrical and Electronic Engineers (IEEE) standards pertaining to motors.

1.4 SUBMITTALS

- A. Shop drawings shall consist of motor dimensions, name-plate data from each motor and tests as outlined above. Also included shall be efficiency and power factor at 100, 75, and 50 percent load. Operation, maintenance, and lubrication information (including bearing catalog numbers) shall be submitted with shop drawings for review.

1.5 EQUIPMENT

- A. Motors 200 Horsepower and Under for Service Under 600 Volts

- (1) Ratings and Electrical Characteristics

- a. Time: All motors shall be rated for continuous duty.
- b. Temperature: Based on NEMA standards for a maximum ambient temperature of 40 degrees Celsius and an altitude of 3,300 feet or less, according to service factor and insulation class employed.
- c. Voltage: All single phase motors shall be rated 120/208/230 volts and all polyphase motors 230/460 volts. All motors shall be capable of normal operation at balanced voltages in the range of ± 1 0 percent from rated winding voltage.
- d. Frequency: All a-c motors shall be rated for 60 Hz. operation. All motors shall be capable of normal operation at frequencies 5 percent above or below the nominal rating of 60 Hz.
- e. Horsepower: Horsepower of the motors shall be as given in the specification division on the driven equipment or as shown on the Contract Drawings. Submersible motors shall be allowed to be furnished even though the horsepower rating may not be in accordance with standard NEMA assignments. In many cases, the horsepower specified is a minimum requirement and certain alternate manufacturers may require larger horsepower motors. The larger motor shall be furnished at no extra cost to the OWNER.
- f. Locked Rotor Current: Locked rotor current shall be in accordance with NEMA standards.
- g. Efficiency and Power Factor: Efficiency and power factor shall be given consideration during shop drawing review. The ratings at full, 3/4, and 1/2 load shall be compared to similar motors manufactured by acceptable

suppliers listed in these Specifications. Excessive variation shall be considered grounds for rejection.

- h. Speed: Synchronous speed of motors shall correspond to standard NEMA ratings. Actual speed shall be as given in the specification division on the driven equipment. Slip shall not exceed 5 percent at full load.
- i. Service Factor: The service factor shall be 1.0 unless requirements of the driven load necessitate a higher service factor.
- j. Insulation Class: Insulation class for submersible motors shall be NEMA Class F. Motors to be operated at variable speed shall also be Class F. Class F insulated motors shall operate at a Class B rise at nameplate horsepower loading.
- k. Design Level: Motors shall be NEMA design B, except as otherwise noted.
- l. Enclosure: Submersible motors shall be air [or oil filled] and of watertight construction.
- m. Frame Size: Frame designations shall be in accordance with NEMA standards.
- n. Winding Over-temperature Sensors: All submersible motors shall be provided with motor winding thermostats. The devices shall be hermetically sealed, snap-acting thermal switches, actuated by a thermally responsive bi-metallic disk. A minimum of 1 per phase is required; with switches wired into the control circuit of the starter to provide de-energization should overheating threaten.
- o. All submersible pump/motor assemblies shall be equipped to detect presence of moisture and alarm at the controller.
- p. Motors to be controlled by VFD's shall be inverter duty rated, NEMA MG-1.

(2) Mechanical Characteristics

- a. Submersible Motor Construction
 - 1) See Equipment Specifications.

(3) Tests, Nameplates and Shop Drawings

- a. Tests
 - 1) Tests shall be required on integral horsepower motors only. A factory certified test report of "electrically duplicate motors previously tested" shall be supplied on all motors under 200 horsepower. The test shall be certified by the factory and shall contain a statement to the effect that complete tests affirm the guaranteed characteristics published in the manufacturer's catalogs or descriptive literature.
 - 2) Tests will be in accordance with IEEE test procedures.

b. Nameplates

- 1) Each motor shall have a permanently affixed nameplate of brass, stainless steel, or other metal of durability and corrosion resistance. The data contained on the nameplate shall be in accordance with NEMA standards.

(4) Efficiency Requirements

- a. Motor full load efficiency requirements shall be met as a minimum for premium efficiency totally enclosed 3 phase integral horsepower motors (per latest published NEMA test Methods):
- b. Where indicated on the Contract Drawings or in the Contract Specifications motors shall be of the energy efficient line offered by the motor manufacturer, having comparable performance characteristics to their standard line as far as torque and horsepower are concerned. Efficiency and power factor however, shall be higher than the manufacturer's standard line of motors and shall be documented in the shop drawings submittal in sufficient detail to allow the ENGINEER complete review of what is offered. Motors shall be referred to simply as "premium efficiency" in Specifications and Contract Drawings.
- c. All motors to be installed for connection to V.F. drives shall be inverter duty rated, NEMA MG-1.

1.6 INSTALLATION

- A. All electric motors shall be protected against the accumulation of moisture, dust and debris and physical damage during the course of installation of the job.
- B. Handle motors carefully to avoid damage to components, enclosures and finishes. Do not install damaged equipment; replace and return damaged units to equipment manufacturer.
- C. Store motors in a clean dry place and protect from weather and construction traffic.
- D. Install motors in accordance with equipment manufacturer's written instructions, and with recognized industry practices, to ensure that motors comply with requirements of National Electrical Code, and applicable portions of ANSI/NEMA standards pertaining to installation of electrical motors and ancillary equipment.
- E. All motors shall be manufactured and installed in accordance with applicable NEMA standards and NEC provisions, latest revisions.

END SECTION

SECTION 16155 - MOTOR STARTERS

1. RELATED DOCUMENTS

- A. General provisions of Contract, General and Supplementary Conditions and General Requirements apply to this Section.
- B. Requirements of Section 16000 General Provisions govern work specified in this section.
- C. This section shall be governed by alternates insofar as they apply to this section.

2. DESCRIPTION OF WORK

- A. Provide labor, materials, equipment and accessories necessary for a complete and proper motor starter system.
- B. Unless otherwise specified, required for a particular application, or indicated by details or control diagrams on Drawings, provide each motor with a motor starter.

3. QUALITY ASSURANCE

- A. Comply with National Electrical Code (NFPA 70) as applicable to construction and installation of motor starters.
- B. Provide motor starters which have been listed and labeled by Underwriters' Laboratories.
- C. Comply with National Electrical Manufacturers Association Standards.
- D. Acceptable manufacturers offering products complying with requirements:

Allen Bradley

Square D

GE

Cutler-Hammer

4. SUBMITTALS

- A. Submit manufacturer's data on motor starters.

5. EQUIPMENT

- A. Each starter and its component and related parts shall be properly designed and coordinated to suit characteristics of motor it controls and driven equipment. Starters provided with automatic control shall be capable of making as frequent starts as control devices may demand.

(1) Equip each starter with contacts to break each ungrounded line to motor. Provide a thermal overload device to open all contacts simultaneously, as an integral part of starter, in each ungrounded line to motor. Provide a suitable reset device for resetting overload trip. Overload devices shall be rated in amperes to correspond to motor nameplate rating but rating shall not exceed that recommended by motor manufacturer for application.

(2) Unless otherwise specified or indicated, starters shall have NEMA type 12 dust tight enclosures with doors arranged for padlocking. Each enclosure shall be so designed that entire starter can be readily removed and shall be of sufficient size to permit easy access for repair, replacement, and making of connections. Separately mounted starters shall be arranged for wall, floor or panel mounting and shall be complete with necessary frames and supports.

B. Unless otherwise indicated on Drawings, locate starters within sight of their associated motors. Where starter is not within sight of motor, provide a disconnect device within sight of motor.

(1) Unless otherwise specified or indicated on Drawings, disconnect device shall be either an unfused switch or a non automatic circuit breaker. Disconnect device for motors rated over 50 horsepower shall be a non automatic circuit breaker. Switches shall be unfused and circuit breakers shall be without overcurrent devices.

C. Provide magnetic starters for 1/2 horsepower and larger motors. Magnetic starters shall be full voltage (across the line) type with under voltage release for automatic control, and undervoltage protection for manual control. Magnetic starters shall be combination type with fused disconnect switch or circuit breaker, except where panelboard containing motor circuit protection is within sight of starter. Circuit breakers shall have interrupting capacity adequate for fault current available at particular location.

(1) All magnetic starters shall have both cover mounted Hand Off Automatic selector switch and start stop pushbutton unless otherwise noted. This applies to all starters in NEMA 1, 3R, 12 and NEMA 4 enclosures.

(2) Do not connect selector switches in any manner which interferes with intended operation of safety devices or safety interlocks.

(3) All starters shall have four (4) auxiliary contacts (NO/NC) and (1) set of fail contacts.

D. Magnetic starters for two speed motors shall be designed for use with two speed motors having two separate windings. Starter shall have two separate sets of contacts, mechanically and electrically interlocked to prevent simultaneous closing. Provide overcurrent protection for each winding. Manual control stations shall be three button type, with "Slow", "Fast" and "Stop" positions. Provide pilot lights to indicate speed position.

E. Reduced voltage and increment starters, where specified, shall also comply with the following requirements:

(1) Maximum line current and current increments shall conform to local power company limits.

(2) Line shall not be opened at any time during starting period (closed transition).

(3) Starting torque shall be suitable for driven machine, and shall cause motor to break away from rest on first step.

(4) Starting period shall not be long enough to result in excessive heating of or damage to motor.

(5) Resistors, if used, shall be mounted within starter case in rear of contactor panel, unless otherwise indicated or specified.

(6) Adequately ventilate case.

(7) Disconnect means for starters may be separate from starter in lieu of combination type, but shall be as hereinbefore specified for magnetic starters.

F. Unless otherwise indicated on Drawings, provide manual starters for all motors under 1/2 horsepower. Equip each starter with a manually operated trip free switch. Provide a separately mounted safety disconnect switch except where panelboard containing disconnect and circuit protection for motor is within sight of disconnect switch for starters. Provide hand off automatic selector switches where starters are controlled by automatic devices. Functions, locations, and like, shall be as specified for magnetic starters.

G. Unless otherwise specified or indicated, control circuits and indicating lights shall operate at not over 120 volts, provided, where necessary, by individual dry type control transformers located within starter cases. Each transformer shall have adequate capacity to operate both starter and other connected control equipment, if any. Protect each control transformer by one fuse on secondary side. Control circuit conductors shall be connected, grounded, and protected against overcurrent in accordance with National Electrical Code, and shall be arranged so that an accidental ground will not start any motor.

H. Where interlocking or sequence starting of motors is specified or indicated on Drawings, it shall be done in such a manner that, when main switch or breaker on any starter is open, no part of starter will be left energized. Furnish all equipment, such as relays or auxiliary contacts on breakers or disconnect switches, necessary to accomplish the above.

6. INSTALLATION

A. Install motor starters in accordance with manufacturer's written instructions, applicable requirements of NEC and in accordance with recognized industry practices to ensure that products serve the intended function.

B. Motor starter installation work with electrical raceway and cable work, as necessary for proper interface.

7. SPECIAL INSTALLATION INSTRUCTIONS

A. All starters noted to have a NEMA 4 enclosure shall be stainless steel.

B. All starters noted to have NEMA 4 non-metallic enclosures shall be fiberglass-reinforced polyester enclosures.

(1) Nonmetallic starters shall be Square D NEMA 4X CLASS 8538 watertight and corrosion resistant or equal.

END SECTION



SECTION 16157

VARIABLE SPEED DRIVES (VFD)

1.01 RELATED DOCUMENTS

- A. General provisions of Contract, General and Supplementary Conditions and General Requirements apply to this Section.
- B. Requirements of Section 16000 General Provisions govern work specified in this section.
- C. This section shall be governed by alternates insofar as they apply to this section.

1.02 DESCRIPTION OF WORK

- A. Provide labor, materials, equipment and accessories necessary for a complete and proper motor control system.
- B. This section provides specification requirements for adjustable frequency drives, variable speed drives or herein identified as AC Drives or VFD for use with NEMA® Design AC motors.
- C. The manufacturer shall furnish, field test, adjust and certify all installed AC Drives for satisfactory operation.
- D. Any exceptions or deviations to this specification shall be indicated in writing and submitted with no less than two (2) weeks prior to bid date.

1.03 QUALITY ASSURANCE

- A. Comply with:
 - (1) ANSI®/NFPA® 70 - National Electrical Code® (NEC®)
 - (2) CSA® C22.2 No. 14-M91 - Industrial Control Equipment
 - (3) IEC 61000 - Electromagnetic Compatibility
 - (4) NEMA 250 Enclosures for Electrical Equipment
 - (5) NEMA ICS7 - Industrial Control and Systems Adjustable Speed Drives
 - (6) NEMA ICS 7.1 - Safety Standards for Construction and Guide for Selection Installation and Operation of Adjustable Speed Drives
 - (7) UL® 50 – Enclosures for Electrical Equipment
 - (8) UL 98 – Disconnect Switches
 - (9) UL 507 – Electric Fans
 - (10) UL 508 – Industrial Control Equipment

- (11) UL 508C – Power Conversion Equipment
- (12) UL 991 – Safety Tests for Safety Related Controls employing Solid State Devices
- (13) OSHA® 1910.95 – AC Drive Controller Acoustical Noise
- (14) The manufacturer of the AC Drive shall be a certified ISO 9001 facility.
- (15) The AC Drive and all associated optional equipment shall be UL Listed according to UL508C Power Conversion Equipment. A UL label shall be attached inside each enclosure as verification.
- (16) The AC Drive shall be designed constructed and tested in accordance with UL, CSA, NEMA and NEC standards.
- (17) Every power converter shall be quality assurance tested with an AC induction motor under load conditions and subjected to a hi-pot test with all enclosed devices mounted and wired, prior to shipment.
- (18) Quality Assurance documentation shall be furnished to verify successful completion upon written request of the engineer.
- (19) A 12-month parts warranty shall be provided on materials and workmanship from the date of project substantial completion and acceptance of installation by manufacturer.

1.04 SUBMITTALS

- A. [6] Copies of approval drawings shall be furnished for Engineer's approval prior to factory assembly of the AC Drives. These drawings shall consist of elementary power and control wiring diagrams and enclosure outline drawings. The enclosure drawings shall include front and side views of the enclosures with overall dimensions and weights shown, conduit entrance locations and nameplate legends.
- B. Standard catalog sheets showing voltage, horsepower, maximum current ratings and recommended replacement parts with part numbers shall be furnished for each different horsepower rated AC Drive shall be provided.
- C. Submit with the delivery of the VFD an Installation and Maintenance Manual and one (1) copy of the manufacturer's drawings per shipping block.
- D. A submittal package, including drawings shall be furnished for the Engineers' approval prior to factory assembly of the AC Drives. These packages shall consist of elementary power and control wiring diagrams on one drawing and enclosure outline drawings. The enclosure drawings shall include front and side views of the enclosures with overall dimensions and weights shown, and conduit entrance locations. Standard catalog specification sheets showing voltage, horsepower and maximum current ratings shall be furnished as part of the submittal package.

1.05 EQUIPMENT

- A. Acceptable Manufacturers

- (1) The AC Drive VFD units shall be Square "D" E-Flex 6 Pulse or prior approved equal. Substitutions must be submitted in writing three (3) weeks prior to original bid date with supporting documentation demonstrating that the alternative manufacturer meets all aspects of the specifications herein.
- (2) Alternate control techniques other than pulse width modulated technology (PWM) are not acceptable.

B. General Description

- (1) The AC Drive shall convert the input AC mains power to an adjustable frequency and voltage.
- (2) The input power section shall utilize a full wave bridge design incorporating diode rectifiers. The diode rectifiers shall convert fixed voltage and frequency, AC line power to fixed DC voltage.
- (3) The output power section shall change fixed DC voltage to adjustable frequency AC voltage.
- (4) The adjustable frequency NEMA 3R drive package shall consist of a circuit breaker disconnect, line reactor, EMI/RFI filter (if drive design requires RFI interference protection), 120V control transformer, control circuit terminal board for digital and analog field wiring. AC line fuses do not meet specification.
- (5) The drive door shall have mounted and wired, Hand-Off-Auto switch, Manual Speed Potentiometer and AFC-Off switch.
- (6) The entire drive package shall be UL508C listed and coordinated with NEMA ICS 7.1. A UL508A panel builders label does not meet specification.

C. Construction

- (1) The AC Drive power converter shall be enclosed in a NEMA Type 3R enclosure with a circuit breaker disconnect, user terminal strip connections. The enclosure shall provide dedicated user terminals for power and control device connection.
- (2) Provisions shall be included for locking the disconnect in the OFF position with a padlock.
- (3) All enclosure and heat sink fans shall be accessible from the front and shall not require the removal of the AC drive power converter for fan replacement.

D. Application Data

- (1) The AC Drive shall be sized to operate a variable torque load.
- (2) The speed range shall be from a minimum speed of 1.0 Hz to a maximum speed of 72 Hz.

E. Environmental Ratings

- (1) The AC Drive shall meet IEC 60664-1 Annex A and NEMA ICS 1, UL, and CSA standards.
- (2) The AC Drive shall be designed to operate in an ambient temperature from -10 to 40 °C (14 to 104 °F).
- (3) AC Drives in Type 3R enclosures shall be designed to operate in an ambient temperature from -10 to 50 °C (14 to 122 °F) and in full sunlight.
- (4) The storage temperature range shall be -25 to 65 °C (-13 to 149 °F).
- (5) The maximum relative humidity shall be 95%, non-condensing.
- (6) The AC Drive shall be rated to operate at altitudes less than or equal to 3300 ft (1000 m). For altitudes above 3300 ft (1000 m), the AC Drive should be de-rated per drive specifications.
- (7) The AC Drive shall meet the IEC 60721-3-3-3M3 operational vibration specification.
- (8) The AC Drive shall be Seismic Qualified to 2000 IBC Level 3 "Extreme" rating with an Importance Factor $1p=1.5$.

F. Ratings

- (1) The AC Drive shall be designed to operate at the input line voltage indicated on the equipment schedule.
- (2) The AC Drive shall operate from an input frequency range of 60 Hz (\pm) 5%.
- (3) The displacement power factor shall not be less than .98 lagging under any speed or load condition.
- (4) The efficiency of the AC Drive at 100% speed and load shall not be less than 97%.
- (5) The variable torque rated AC Drive over current capacity shall be not less than 110% for 1 minute.
- (6) The output carrier frequency of the AC Drive shall be programmable at 0.5, 1, 2, 4 or 8 kHz. In addition, the output carrier frequency shall be randomly modulated about the selected frequency.

G. Protection

- (1) Upon power-up, the AC Drive shall automatically test for valid operation of memory, loss of analog reference input, loss of communication, DC-to-DC power supply, control power and pre-charge circuit.

- (2) The enclosure shall provide a fully coordinated 100,000 AIC current rating marked on the enclosure nameplate. Short circuit coordination to UL 508C Power Conversion Equipment and NEMA ICS 7.1.
- (3) The AC Drive shall be protected against short circuits, between output phases and to ground.
- (4) The AC Drive shall have a minimum AC undervoltage power loss ride-through of 200 milliseconds (12 cycles).
- (5) The AC drive shall have a programmable ride-through function, which will allow the logic to maintain control for a minimum of one-second (60 cycles) without faulting.
- (6) For a fault condition other than a ground fault, short circuit or internal fault, an auto restart function will provide up to 6 programmable restart attempts. The time delay before restart attempts will be 30 seconds.
- (7) Upon loss of the analog process follower reference signal, the AC Drive shall be programmable to display a fault.
- (8) The AC Drive shall have a solid-state UL 508C listed overload protective device and meet IEC 60947.
- (9) The output frequency shall be software enabled to fold back when the motor is overloaded.
- (10) There shall be three skip frequency ranges that can be programmed to a bandwidth of (\pm) 2.5 Hz.

H. Adjustments & Configurations

- (1) The AC Drive will be factory programmed to operate all specified optional devices.
- (2) The acceleration and deceleration ramp times shall be adjustable from 0.05 to 999.9 seconds.
- (3) The memory shall retain and record run status and fault type of the past eight faults.
- (4) The software shall have an energy economy function that, when selected, will reduce the voltage to the motor when selected for variable torque loads. A constant volts/Hz ratio will be maintained during acceleration. The output voltage will then automatically adjust to meet the torque requirement of the load. Selectable volts/Hz ratio patterns does not meet specification, the function must be automatically optimized.

I. Keypad Display Interface

- (1) A keypad display interface shall offer the modification of AC Drive adjustments through a touch keypad. All electrical values, configuration parameters, I/O

assignments, application and activity function access, faults, local control, and adjustment storage, and diagnostics shall be accessible.

- (2) The AC Drive model number, torque type, software revision number, horsepower, output current, motor frequency and motor voltage shall be listed on the drive identification portion of the LCD display.
- (3) The keypad display shall have a hardware selector switch that allows the keypad to be locked out from unauthorized personnel.

J. Operator Controls

- (1) The control power for the digital inputs and outputs shall be 24 Vdc.
- (2) The internal power supply shall incorporate automatic current fold-back that protects the internal power supply if incorrectly connected or shorted. The transistor logic outputs will be current limited and will not be damaged if shorted.
- (3) Pull-apart terminal strips shall be used on all logic and analog signal connections in the power converter
- (4) Two voltage-free relay output contacts will be provided. One of the contacts will indicate AC Drive fault status. The other contact shall indicate a drive run status.
- (5) The combination enclosure shall have the following dedicated operator controls:
 - (a) Hand-Off-Auto switch
 - (b) Manual Speed Potentiometer
- (6) The combination enclosure shall include terminal point connection for fire /freeze state interlock, to prevent drive operation. The interlock must shut down the motor in the drive modes.

K. Serial Communication

- (1) The AC Drive shall have serial communications capability.

L. Harmonic Mitigation

- (1) Each drive shall include a line reactor mounted inside the drive enclosure to reduce power system harmonics and provide power quality protection for the drive. DC bus chokes do not meet specification and shall not be substituted.

1.06 INSTALLATION

- A. Handle VFD's and enclosures carefully to prevent breakage, denting and scoring finish.
- B. Store VFD's indoors and protect from weather.
- C. Install in accordance with manufacturer's written instructions, applicable requirements of NECA and in accordance with recognized industry practices to ensure that products comply with requirements and serves intended purposes.

- D. Coordinate installation of VFD's and enclosures with cable and raceway installation work.
- E. The AC Drive manufacturer shall provide a factory certified technical representative to supervise the contractor's installation, testing and start-up of the AC Drive(s) furnished under this specification for a maximum total of 1 day. The start-up service shall be quoted as a separate line item.
- F. An on-site training course of 1 training day shall be provided by a representative of the AC Drive manufacturer to plant and/or maintenance personnel.
- G. The AC Drive supplier shall supply a comprehensive 8-1/2 x 11-inch bound instruction and installation manual that includes wiring diagrams, layout diagrams, and outline dimensions. This manual must be 3-hole punched for insertion in a shop manual supplied by the installing contractor.

1.07 SPECIAL INSTALLATION INSTRUCTIONS

- A. All drives shall be furnished with line side filters.
- B. Drives shall have contacts/IO as required for interfacing with new telemetry control and 4-20MA input/output for drive speed control.

END SECTION

SECTION 16160 - PANELBOARDS

1. RELATED DOCUMENTS

- A. General provisions of Contract, General and Supplementary conditions and General Requirements, apply to this section.
- B. Requirements of Electrical General Provision sections govern this section, where applicable.
- C. This section shall be governed by alternates insofar as they apply to this work.

2. DESCRIPTION OF WORK

- A. Provide all labor, materials, equipment and services necessary for proper and complete installation of panelboards.
- B. Refer to other Division 16 sections for cable/wire, connectors and electrical raceway work required in conjunction with panelboards and enclosures, not work of this section.

3. QUALITY ASSURANCE

- A. Special Use Markings: Provide panelboards, constructed for special use, with UL marks indicating that special usage, i.e., "suitable for use as service entrance equipment".
- B. UL Compliance: Comply with applicable UL publications pertaining to panelboards, enclosures and panelboard accessories. Provide units which have been listed and labeled by Underwriters Laboratories.
- C. NEC Compliance: Comply with National Electrical Code (NFPA 70/ANSI C1) as applicable to installation of cabinets, cutout boxes and panelboards. Comply with applicable NEC Articles pertaining to installation of wiring and equipment in hazardous locations.
- D. NEMA Compliance: Comply with National Electrical Manufacturers Association Stds. Pub. No. 250, "Enclosures for Electrical Equipment (1000 volt maximum)"; Pub. No. 250, "Enclosures for Electrical Equipment (1000 volt maximum)"; Pub. No. PB 1, "Panelboards,"; installation portion of Pub. No. PB 1.1, "Instructions for Safe Installation, Operation and Maintenance of Panelboards" and Pub. No. PB 1.2, "Application Guide for Ground Protective Devices and Equipment."

4. SUBMITTALS

- A. Submit manufacturer's data on panelboards and enclosures.
- B. Submit dimensioned drawings of panelboards and enclosures indicating accurately scaled layout of enclosures and required individual panelboard devices, including but not necessarily limited to, circuit breakers, fusible switches, fuses, ground fault circuit interrupters and accessories.

5. EQUIPMENT

- A. Except as otherwise indicated, provide panelboards, enclosures and ancillary components, of types, sizes, and ratings indicated, which comply with manufacturer's standard materials, design and construction in accordance with published product information. Equip with number of unit panelboard devices as required for a complete installation. Where types, sizes, or ratings are not otherwise indicated, comply with NEC, UL and established industry standards for applications indicated.

- (1) All terminals for wiring connections shall be suitable for copper or aluminum.
- (2) **Buses shall be tin plated copper.** Bus capacity shall be as indicated on drawings, otherwise, bus capacity shall be equal to or greater than panelboard feeder overcurrent protective device.
- (3) Provide a bare uninsulated equipment grounding bar suitably brazed or bolted to interior of each enclosure. This bar shall be equivalent in current carrying capacity to incoming feeder ground conductor and shall be suitable for brazed or approved pressure connector terminations of ground conductors for associated feeders and branch circuits.
- (4) A neutral bar, where required, shall be mounted at opposite end of each panelboard from main lugs and shall have numbered terminals for connection of neutral wires.
- (5) Bus bar connections to branch circuit overcurrent protection devices shall be of sequence phased type.
- (6) Where "provision for," "future," or "space" is indicated on drawings, space shall be equipped with bus connections to future over current device with suitable insulation and bracing to maintain proper short circuit rating and voltage clearances. All provisions shall be made for ready insertion of a future device.
- (7) All panelboards shall be dead front type.

B. Provide galvanized sheet steel cabinet type enclosures, in sizes and NEMA types as indicated, code gauge, minimum 16 gauge thickness. Construct with multiple knockouts and wiring gutters. Provide fronts with adjustable indicating trim clamps, and doors with flush locks and keys, all panelboard enclosures keyed alike, with concealed door hinges. Provide enamel finish over a rust inhibitor. Design enclosure for recessed or surface mounting as indicated. Provide enclosures fabricated by same manufacturer as panelboards, and which fit properly with panelboards to be enclosed.

- (1) Provide typewritten directories placed under a clear plastic cover on interior of doors. Directories shall identify panelboards and indicate each circuit number and description of associated branch circuit. Directories for fuse and switch panels shall also indicate switch, fuse, and branch feeder size. For panelboards without doors, provide a separate laminated phenolic identification plate on or near each device cover and provide same information that directories described above require.
- (2) Where feeders go through panelboard cabinets to serve panelboards above or beyond same, wiring gutters in panelboard cabinets shall be a minimum of 8 inches on sides and 8 inches top and bottom. Cables shall be neatly bundled, routed and supported within gutters. Do not reduce minimum bending radii as recommended by cable manufacturer.
- (3) Top and bottom feeding through panelboard buses will not be permitted. Panels served by a common feeder shall have through feeder gutter tapped or provide auxiliary gutter with a feeder tap to each panel.
- (4) Lighting and power panelboards less than 49 inches wide for surface mounting shall be equipped with a one piece sheet steel frame and shall have a hinged door. Frame shall be same size as cabinet and shall completely cover wiring gutters. Equip doors over 48 inches in height with a vault handle and a three point catch. Cabinets greater than 48 inches wide shall have sectionalized frames and multiple doors.

C. Provide panelboard accessories and devices including, but not necessarily limited to, cartridge time delay type fuses, circuit breakers and ground fault protection units, as recommended by panelboard manufacturer for ratings and applications indicated.

(1) Circuit breaker protective devices shall be rated for circuit voltage on which they are used; have trip rating and number of poles indicated on drawings; be molded case breakers of quick make, quick break, bolt on, thermal magnetic type and be trip free. Automatic tripping shall be indicated by a handle position between manual OFF and ON position.

a. All similar units of all panelboards shall be same manufacture, except where a manufacturer does not produce a frame size or type called for, and like units shall be interchangeable.

b. Adjustable magnetic trip devices shall be adjusted at factory to "low " trip setting ampere values.

c. Circuit breakers shall have a minimum interrupting rating of 10,000 amperes symmetrical, unless a greater rating is indicated on drawings. In all cases circuit breakers shall have an interrupting current rating equal or greater than available fault current at their locations in electrical system.

(2) Fusible switch branch circuit protective devices shall be as indicated on drawings, shall be interrupter switches of quick make, quick break type, and shall have sufficient load break capacity to properly coordinate with time current characteristics of current limiting fuses, where required, to provide an integrated switch and fuse device. Provide each switch pole with cartridge fuses as indicated on drawings. Interrupter switches shall have a load break capacity in excess of normal horsepower rating. Each unit shall be capable of withstanding let through current available before its fuse operates without damage or change in rating. Short circuit interrupting rating of circuit switch fuse combination shall be 100,000 RMS symmetrical amperes. Each unit shall be operable from front by means of an external operating handle and provided with an interlocking mechanism which allows access to de energized fuses and wiring only when in OFF position. Unit cover shall be so interlocked that it may not be removed or opened when switch is in ON position, except that interlock shall be tool releasable by a qualified person for inspection of contacts and mechanism. All similar switch units of all panelboards shall be of same manufacturer.

D. Manufacturers of panelboards shall be Square "D", Cutler-Hammer or equal as approved by this Engineer.

6. INSTALLATION

A. Handle panelboards and enclosures carefully to prevent breakage, denting and scoring finish.

B. Store panelboards and enclosures indoors and protect from weather. When necessary to store outdoors, elevate well above grade and enclose with durable, waterproof wrapping.

C. Install panelboards and enclosures, in accordance with manufacturer's written instructions, applicable requirements of NECA and in accordance with recognized industry practices to ensure that products comply with requirements and serves intended purposes.

(1) Install lighting and power panelboards with tops 6 feet 6 inches above floor and bottoms not less than 12 inches above floor (multi section panels shall be provided to meet these spacings) arranged for conduit or bus duct connections. Mount on metal channels. Where panelboards are equipped with remotely controlled switches or contactors, top of cabinet may be mounted above 6 feet provided height above floor of highest circuit breaker handle is not over 6 feet 6 inches.

D. Coordinate installation of panelboards and enclosures with cable and raceway installation work.

E. Anchor enclosures firmly to walls and structural surfaces, ensuring that they are permanently and mechanically secure.

F. Provide electrical connections within enclosures.

G. Fill out panelboard's circuit directory card upon completion of the work.

7. SPECIAL INSTALLATION REQUIREMENTS

A. Mini power-zone type combination transformer panels shall have stainless steel enclosures and have bolt-on type circuit breakers.

END SECTION

SECTION 16170 - SAFETY AND DISCONNECT SWITCHES

1. RELATED DOCUMENTS

- A. General provisions of Contract, General and Supplementary Conditions and General Requirements, apply to this section.
- B. Requirements of electrical general provision sections govern work specified in this section.
- C. This section shall be governed by alternates insofar as they affect this work.

2. DESCRIPTION OF WORK

- A. Provide labor, materials, equipment and services necessary for proper and complete installation of safety and disconnect switches.
- B. Types of safety and disconnect switches required for project include the following:
 - Equipment disconnects.
 - Appliance disconnects.
 - Motor circuit disconnects.
- C. Acceptable manufacturers offering products complying with requirements:
 - Square D
 - GE
 - Cutler-Hammer

3. QUALITY ASSURANCE

- A. Comply with National Electrical Code (NFPA 70) as applicable to construction and installation of electrical safety and disconnect switches.
- B. Provide safety and disconnect switches which have been listed and labeled by Underwriters Laboratories.
- C. Comply with National Electrical Manufacturers Association Stds. Pub. No. KS1.
- D. Manufacturers of safety and disconnect switches shall be Square "D", Allen-Bradley or Cutler-Hammer.

4. SUBMITTALS

- A. Submit manufacturer's data on electrical safety and disconnect switches.

5. EQUIPMENT

- A. Provide **heavy duty** type, sheet steel enclosed safety switches, of type, size and rating indicated; incorporating quick make, quick break type switches, constructed so switch blades are visible in

"OFF" position with door open; equipped with operating handle which is an integral part of enclosure base and whose position is easily recognizable and is padlockable in "OFF" position.

B. Mount switches in NEMA 12 enclosures unless otherwise indicated. Boxes exposed to wet or rain conditions shall be NEMA 4 type unless otherwise noted. Switches shall be rated at 240 or 600 minimum volts as required by voltage of circuit on which they are utilized and shall be rated in horsepower. Each shall be capable of interrupting locked rotor current of motor for which it is to be used. Current shall be assumed as ten (10) times full rated load current.

C. Mount switch parts on insulating bases to permit replacement of parts from front of switch. All current carrying parts shall be designed to carry rated load without excessive heating. Switch contacts shall be silver tungsten type or plated to prevent corrosion, pitting and oxidation and to assure suitable conductivity. Fuse clips shall be of positive pressure type and switch operating mechanism shall be designed to retain its effectiveness with continuous use at rated capacity without use of auxiliary springs in current path. Switches shall be capable of withstanding available fault current or let through current before fuse operates without damage or change in rating. Fuse clips shall be designed and coordinated to accommodate class and type of fuse specified or indicated to be used with switch.

6. INSTALLATION

A. Deliver switches individually wrapped in factory fabricated fiber board type containers.

B. Handle switches carefully to avoid damage to material components, enclosures and finish. Do not install damaged switches; remove from project site.

C. Store switches in a clean dry space. Protect switches from dirt, fumes, water and physical damage.

D. Install safety and disconnect switches where indicated, in accordance with manufacturer's written instructions, applicable requirements of NEC and in accordance with recognized industry practices.

E. Coordinate safety and disconnect switch installation work with electrical raceway and cable work, as necessary for proper interface.

F. Install disconnect switches used with motor driven appliances larger than 1/8 h.p. and motors and controllers within sight of controller position unless otherwise indicated.

7. SPECIAL INSTALLATION INSTRUCTIONS

A. All disconnect switches noted to have a NEMA 4 enclosure shall be stainless steel.

B. All disconnects noted to have NEMA 4 non-metallic enclosures shall be fiberglass-reinforced polyester enclosures.

(1) Nonmetallic disconnect switches shall be Square D NEMA 4X CLASS 3110 watertight and corrosion resistant or equal.

END SECTION

SECTION 16181 - FUSES

1. RELATED DOCUMENTS

- A. General Provisions of Contract, General and Supplementary Conditions and General Requirements, apply to this section.
- B. Requirements of electrical general provision sections govern work specified in this section.
- C. This section shall be governed by alternates insofar as they affect this work.

2. DESCRIPTION OF WORK

- A. Provide all labor, materials, equipment and services necessary for proper and complete installation of fuses.

3. QUALITY ASSURANCE

- A. Comply with National Electrical Code (NFPA 70) as applicable to construction and installation of fuses.
- B. Fuses shall be listed by Underwriters Laboratories.

4. SUBMITTALS

- A. Submit manufacturer's data on fuses and spare fuse cabinet.

5. EQUIPMENT

- A. Except as otherwise specified herein, provide complete sets of fuses for all switches requiring fuses. Fuses shall be of size indicated on drawings. Provide spare fuses in original boxes of the following quantities: one complete set (3 fuses) for each different size, type and class. A spare fuse cabinet, Bussmann type SFC or equal, shall be provided and installed as directed by owner..
- B. Install current limiting fuses in lieu of regular fuses where fault current exceeds 10,000 RMS amperes. Fuses rated over 600 amperes shall be NEMA Class L. Unless otherwise specified, fuses for use with switches rated 600 amperes and less shall be UL Class RK 1, and have interrupting rating of 200,000 RMS amperes. Class RK 1 fuses shall be dual element type with minimum time delay of ten seconds at 500 percent of rating.
- C. Current limiting high interrupting capacity fuses manufacturer with each unit as required for complete coordination.
- D. Provide all project fuses supplied by same manufacturer. Proper selectivity with associated protective equipment shall be substantiated by published catalog data.
- E. Switch size and fuse ratings indicated on Drawings and/or specified are based on general approximate values for each motor horsepower delineated. Since characteristics of fuses for motor short circuit protection vary with different manufacturers, coordinate fuse values with switch sizes for each motor.

6. INSTALLATION

A. Install fuses where indicated and required in accordance with manufacturer's written instructions, applicable requirements of N.E.C., and in accordance with recognized industry practice.

END SECTION

SECTION 16200 - MISCELLANEOUS ELECTRICAL EQUIPMENT

1. RELATED DOCUMENTS

- A. General provisions of Contract, General and Supplementary conditions and General Requirements, apply to this section.
- B. Requirements of Electrical General Provision sections govern this section, where applicable.
- C. This section shall be governed by alternates insofar as they apply to this work.

2. DESCRIPTION OF WORK

- A. Provide all labor, materials, equipment and services necessary for proper and complete installation of equipment specified.
- B. Refer to other Division 16 sections for additional work required in conjunction with electrical equipment, not work of this section.

3. QUALITY ASSURANCE

- A. Special Use Markings: Provide equipment, constructed for special use, with UL marks indicating that special usage, i.e., "suitable for use in Class 1, Division 1 Environments".
- B. UL Compliance: Comply with applicable UL publications pertaining to miscellaneous equipment. Provide units which have been listed and labeled by Underwriters Laboratories.
- C. NEC Compliance: Comply with National Electrical Code (NFPA 70) as applicable to installation of miscellaneous electrical equipment. Comply with applicable NEC Articles pertaining to installation of wiring and equipment in hazardous locations.

4. SUBMITTALS

- A. Submit manufacturer's data on all miscellaneous electrical equipment items.
- B. Submit dimensioned drawings of equipment and enclosures indicating accurately scaled layout of enclosures and required individual devices.

5. EQUIPMENT

- A. Bitumastic Coatings
 - 1. Coatings for use on conduits and between metal and concrete contact points shall be of self priming type.
 - 2. Coatings shall be black, high build type single component coal tar mastic capable of maximum 30 mil dry film thickness.
 - 3. Coatings shall be applied in two (2) coats to achieve average of 18 mil dry film thickness over surface to be protected.
 - 4. Coatings shall be Carboline Bitumastic 50 or equal.

B. Corrosion Control Tape

1. **Corrosion control tape shall be applied to all rigid aluminum conduit where in contact with concrete (passing thru slabs, etc.) and where installed below concrete or in contact with earth.**

2. Corrosion control tape shall be Polyken No. 826 yellow in color, 12 mil thickness, 2" or 4" wide as required. Use Polyken No. 1027 primer prior to tape installation per manufacturer requirements.

C. Exothermic Ground Connections

1. Exothermic welding systems shall be approved by Underwriters Laboratories to ANSI UL 467 "Grounding and Bonding Equipment."

2. Exothermic welding shall be used for making electrical connections of copper to copper, copper to steel or copper to cast iron for grounding and cathodic applications.

3. Exterior connections shall be suitable for exposure to the elements of direct burial in earth or concrete without degradation over the lifetime of the grounding system.

4. Interior connections in occupied building shall be made using a low smoke producing process.

5. Products for exothermic connections shall be Cadweld, Thermoweld, Permaweld or

D. Portable Generator Docking Station 'XS1

1. Docking station shall be as manufactured by TRYSTAR with features as follows:
480/277V Trystar Rotary Docking Station
30kAIC Rated ETL Listed to UL 1008 Standards -

- Access Door Will Not Open Unless Main Door Has Been Opened
- 2 Full Sets of Male Panel Mounts *All Aluminum Construction: Powder Coat Color: Hammer Gray
- Protective Caps on All Panel Mounts
- Front Padlockable Swinging Front Door
- Trystar Rake Theft Reduction System
- Phase Rotation Monitor
- UL-50 Listed Enclosure, NEMA 3R

2. Rotary: 200A 3 Pole Rotary Transfer Switch

- Utility (Line 1): Lugs for Primary Connection
- Generator (Line 2): 2 Full Sets of Male Panel Mounts
- Load: Lugs for Permanent Connection
- Conductor Range from #2awg-600KCMil THHN Wire, 2 wires per phase

6. **INSTALLATION**

A. Handle miscellaneous equipment carefully to prevent breakage, denting and scoring finish.

B. Store miscellaneous electrical equipment indoors and protect from weather. When necessary to store outdoors, elevate well above grade and enclose with durable, waterproof wrapping.

C. Install miscellaneous electrical equipment, in accordance with manufacturer's written instructions, applicable requirements of NECA and in accordance with recognized industry practices to ensure that products comply with requirements and serves intended purposes.

D. Coordinate installation of miscellaneous electrical equipment with cable and raceway installation work and work of other trades.

E. Anchor equipment firmly to walls and structural surfaces, ensuring that they are permanently and mechanically secure.

END SECTION



SECTION 16450 - ELECTRICAL GROUNDING

1. RELATED DOCUMENTS

- A. General provisions of Contract, General and Supplementary Conditions and General Requirements, apply to this section.
- B. Electrical general provision sections govern this section, where applicable.
- C. This section shall be governed by Alternates insofar as they apply to this work.

2. DESCRIPTION OF WORK

A. Provide labor, material, equipment and services for proper and complete electrical grounding system.

B. Grounding of electrical installations comprises both system and equipment grounding, and includes, but is not necessarily limited to, metal raceways, transformer frames, switchgear enclosures, metal enclosures of electrical devices, and circuit conductors.

C. Requirements of this section apply to electrical grounding work specified elsewhere in these specifications.

D. Electrical cable, wire, connectors, clamps, and raceway work are specified in applicable Division 16 basic material sections.

E. Method

(1) Supplement grounded neutral of secondary distribution system by and equipment grounding systems to properly safeguard equipment and personnel. Design equipment grounding system so all metallic structures, enclosures, raceways, junction boxes, outlet boxes, cabinets, machine frames, portable equipment, and other conductive items in close proximity with electrical circuits operate continuously at ground potential and provide a low impedance path for possible ground fault currents.

(2) The AC secondary system ground shall be connected using exothermic welds to at least three ground rods minimum 3/4 inch by 10 feet. Where required to meet requirements of herein specified tests, install extra rods at no additional cost to Owner. Locate rods a minimum of 10 feet from each other or any other electrode and loop interconnect with each other by a minimum No. 6 AWG bare copper conductor brazed to each rod below grade. Do not splice grounding electrode conductor.

(3) In addition, provide in conduit a minimum 3/0 or as required green insulated copper ground conductor to main metallic water service entrance and connect to same by means of adequate ground clamps. Where a dielectric main water fitting is installed, connect this ground conductor to street side of dielectric water fitting. Do not install a jumper around this fitting. Bond to ground conductor at each end. Provide with ground clamps a 3/0 jumper around water meter.

(4) Connect system neutral ground and equipment ground system to common ground bus as indicated on Drawings, or if not indicated, as required by NEC.

(5) Ground secondary services at supply side of secondary disconnecting means and at related transformers in accordance with NEC. Provide each service disconnect enclosure with a neutral disconnecting means and an insulated neutral stud which interconnects with insulated neutral and uninsulated equipment ground buses to establish system common ground point. Locate neutral

disconnecting link or links so that low voltage neutral bar with all interior secondary neutrals can be isolated from common ground bus and service entrance conductors.

(6) Size required equipment grounding conductors and straps in compliance with NEC. Provide equipment grounding conductors with green insulation equivalent to insulation on associated phase conductors. Braze related feeder and branch circuit grounding conductors to grounding bar or connect with approved pressure connectors. A feeder serving several panelboards shall have a continuous grounding conductor which shall be connected to each related cabinet bar. Aluminum, straps or bars may be substituted for proposed copper items if this is consistent with materials proposed for low voltage distribution system. Aluminum materials shall be comparable in current carrying capacity, temperature, rise, and mechanical strength, and installation shall include all necessary precautions regarding electrical connections with dissimilar metals.

(7) Provide low voltage distribution systems with a separate green insulated equipment grounding conductor for each single or three phase feeder and each branch circuit. Install required grounding conductor in common conduit with related phase and/or neutral conductors. Where there are parallel feeders installed in more than one raceway, each raceway shall have a green insulated equipment ground conductor. Single phase branch circuits required for 120 and 277 volt lighting, receptacles, and motors shall consist of phase, neutral and grounding conductors installed in common metallic conduit. Provide flexible metallic conduit equipment connections utilized in conjunction with the above single phase branch circuits with suitable green insulated grounding conductors connected to approved grounding terminals at each end of flexible conduit. Provide single phase branch circuits required for special equipment and all branch circuits installed in nonmetallic or flexible conduits with a separate grounding conductor.

(8) Determine number and size of pressure connectors to be provided on all equipment grounding bars required in panelboards and other electrical equipment for termination of equipment grounding conductors. In addition to active circuits, provide pressure connectors for all three phase spares and spaces.

(9) Provide a green colored equipment ground conductor and connected as described below. Provide each ground conductor with spade tongue terminals or solderless pressure connectors to suit conditions.

a. From green ground terminal of all receptacles to green 10 32 "washer in head" outlet box machine screw. Note: Receptacles with special cast boxes and factory designed and approved ground path will not require a separate ground jumper.

b. From green 10 32 "washer in head" machine screw in ceiling outlet box or junction box through flexible metallic conduit to ground terminal in fixture.

c. From green 10 32 "washer in head" machine screw in ceiling outlet box or junction box through flexible metallic conduit to green 10 32 "washer in head" machine screw in switch outlet box in movable partitions.

d. From green 10 32 "washer in head" machine screw in junction box or disconnect switch through flexible metallic conduit to ground terminal in connection box mounted on single phase fractional horsepower motor.

e. From equipment ground bus in motor control center through conduit and flexible metallic conduit to ground terminal in connection box mounted on three phase motor. Note: where motor has separate starter and disconnect device, ground conductor shall originate at ground bar in panelboard supplying these motors and be bonded to each starter and disconnect device enclosure also.

f. From equipment ground bar to equipment grounding bar on a busway, install and connect by an approved method a ground conductor.

g. From a computer area power panel ground bar, provide each branch circuit with a green insulated equipment ground conductor. Minimum size of this conductor shall be per NEC but no ground conductor circuit shall exceed 3 ohms resistance to building ground system.

(10) Nonmetallic conduits or ducts shall contain a green insulated grounding conductor unless otherwise specified.

a. Equipment grounding conductors are not required for telephone ducts.

(11) Where electric devices such as electric air cleaners or heaters are installed in air ducts, provide a green insulated equipment ground conductor. Bond conductor to each unit, air duct, and to ground in panelboard.

(12) Where electric immersion type water heater or surface anti frost heating cables are installed, provide a green insulated equipment ground conductor. Bond this conductor to water piping at unit and to ground bar in panelboard.

(13) Subject completed equipment grounding system to a megger test at each service disconnect enclosure ground bar to insure that ground resistance, without chemical treatment or other artificial means, does not exceed twenty five (25) ohms. Certified test reports of ground resistance shall be submitted to Engineer for approval. Necessary modifications for compliance with the twenty five (25) ohm value shall be performed without additional expense to Owner.

(14) Where steel conduit(s) terminate without mechanical connection to a metallic housing of electrical equipment by means of locknut and bushings or adapters such as switchboards, switchgear, motor control centers, the following procedure shall be followed: Provide each conduit with a ground bushing and each bushing connecting with a bare copper conductor to ground bus in electrical equipment. Ground conductor shall be in accordance with article on Grounding of NEC. Bond electrically non continuous metallic conduits containing ground wiring only to ground wire at both conduit entrance and exit in a manner similar to that described above.

3. QUALITY ASSURANCE

A. Comply with NFPA No. 70, National Electrical Code, as applicable to materials and installation of electrical grounding systems and associated equipment and wiring.

B. Comply with UL standards and IEEE Greenbook pertaining to electrical grounding and bonding.

C. Manufacturers offering products complying with requirements include: Cadweld, ITT Blackburn, ITT Weaver, Copperweld Bimetallics Group, Cathodic Engineering Equipment Co., or equal.

4. SUBMITTALS

A. Submit manufacturer's information on exothermic type connection system. Submit written results of grounding system megger test.

5. EQUIPMENT

A. Except as otherwise indicated, provide for each electrical grounding indicated, a complete assembly of materials including but not necessarily limited to cable, wire, connectors, terminals (solderless lugs), grounding rods/electrodes and plate electrodes, bonding jumper braid, and other items and accessories needed for a complete installation. Where more than one type meets indicated requirements, selections is Installer's option. Where material or component is not otherwise indicated, provide products complying with NEC, and established industry standards.

B. Unless otherwise indicated, provide electrical grounding conductors for grounding connections matching power supply wiring materials and sized according to NEC.

C. Provide electrical connectors, terminals and clamps as recommended by connector, terminal and clamp manufacturer for intended applications.

D. Steel ground rods with copper clad exterior, 3/4" dia. x 10'.

E. Acceptable Manufacturers:

(1) Grounding equipment shall be Cadweld, ITT Blackburn, ITT Weaver, Copperweld Bimetallics Group, Cathodic Engineering Equipment Co., or equal.

6. INSTALLATION

A. Testing

(1) The CONTRACTOR shall be required to provide all labor, tools, instruments, and materials as necessary to perform testing of the grounding electrode system. Results shall be submitted in writing to the ENGINEER. The testing shall be done to determine the effectiveness of the selected grounding scheme and to see that it conforms with resistance specified (2.5 ohms maximum).

(2) The testing should be done using a fall-of-potential method test at the point of grounding electrode conductor connection to main power distribution equipment and at each separately derived system or MCC. The test shall be performed no sooner than 48 hours after a rainfall event.

(3) The written report should contain the following information:

a. Type of ground scheme used, i.e., building steel, driven rod, mat, etc.

b. Type of instrument used.

1) Mfr.

2) Model number

3) Confirm fall-of-potential test

4) *Serial number

5) *Where instrument was obtained

* These 2 items are required so that the same instrument may be utilized should reproduction of the test be necessary due to unsatisfactory readings/instrument miscalibration.

c. Ground resistance readings obtained at various test distances.

d. Ground resistance/distance curve.

e. Value of Grounding Electrode Resistance at knee of curve.

f. Sketch showing setup of instrumentation and location electrode and test probes.

g. Proposed method to achieve the specified resistance, should an unacceptable reading be obtained.

h. Ground resistance readings obtained (if applicable) after modification incorporated.

B. Ground Enhancement Material

(1) Where indicated on the Drawings or as deemed necessary by the CONTRACTOR to achieve design grounding electrode system resistance, a ground enhancement material shall be utilized, in accordance with manufacturer's recommendations.

(2) The ground enhancement material must be permanent and maintenance free (no recharging with salts or chemicals which may be corrosive) and maintain its earth resistance for the life of the system. It must set up firmly and not dissolve or decompose, or otherwise pollute the soil or local water table. The material shall be capable of being applied dry or in a slurry form, and shall reduce resistance by at least 40 percent.

(3) Basic components of this material shall be carbon, hydraulic cements, and hydrous aluminum silicates. Minimum 4-inch diameter holes shall be used with ground rod installations, with depth 6" shorter than length of rod, completely filled with the material. Trenches for grounding electrode conductor shall also utilize this material the full length from electrode to building, in accordance with manufacturer installation recommendations, except trench depth shall allow buried conductor to be at least 2'-6" deep.

(4) Ground enhancement material shall be GEM by Erico Products, Powerfill by Cathodic Engineering Equipment Company, or equal.

(5) Should ground rods be impractical for use due to rocky conditions, then grounding electrode plates may be used after acceptance by the ENGINEER or a case by case basis.

(6) Install electrical grounding systems where indicated, in accordance with manufacturer's instructions and NEC as necessary to interface installation of electrical grounding system with other work.

C. Special Installation Instructions

(1) Contractor shall coordinate with General Contractor and connect main AC system ground to exposed rebar stub at main service disconnect per 2014 N.E.C. requirements.

(2) All connections to ground rods, rebar stubs, and structural steel shall be made using exothermic (Cadweld) type connections.

END SECTION



SECTION 16460 - TRANSFORMERS

1. RELATED DOCUMENTS

- A. General provisions of Contract, General and Supplementary Conditions, and General Requirements, apply to this Section.
- B. Requirements of Electrical General Provisions sections govern work specified in this Section.
- C. This section shall be governed by alternates insofar as they affect this work.

2. DESCRIPTION OF WORK

- A. Provide labor, materials, equipment and services necessary for proper and complete installation of transformers.
- B. Types of transformers required for this project include the following:
 - Dry type distribution transformers.

3. QUALITY ASSURANCE

- A. Manufacturers offering products complying with requirements include:
 - Square D Co.
 - Cutler-Hammer
 - Or equal
- B. Provide transformers which have been listed and labeled by Underwriters Laboratories.
- C. Comply with National Electrical Code (NFPA No. 70) as applicable to installation and construction of electrical power/distribution transformers.
- D. Comply with applicable portions of National Electrical Manufacturers Association standards pertaining to power/distribution transformers.
- E. Comply with applicable American National Standards Institute (ANSI) standards pertaining to power/distribution transformers.
- F. Comply with applicable portions of Institute of Electrical and Electronic Engineers (IEEE) standards pertaining to power/distribution transformers.

4. SUBMITTALS

- A. Submit manufacturer's data on power/distribution transformers, including certification of transformer performance efficiency at indicated loads, percentage regulation at 100% and 80% power factor, no load and full load losses in watts, % impedance at 75 degrees C, hot spot and average temperature rise above 40 degrees C ambient, sound level in decibels, and standard published data.

5. EQUIPMENT

A. Except as otherwise indicated, provide manufacturer's standard materials and components as indicated by published product information designed and constructed as recommended by manufacturer, and as required for a complete installation.

B. Dry Type Distribution Transformers

(1) Provide factory assembled general purpose air cooled dry type distribution transformers where shown, of size, characteristics, and rated capacity as indicated; single phase, or three phase, 60 hertz, standard impedance. Provide NEMA ST 20 TAP arrangements (2) 2 1/2% ANFC and (4) 2 1/2% BNFC). Insulate with Class 220 insulation and rate for continuous operation at rated KVA. Limit transformer surface temperature rise to maximum of 65 degrees C. Provide terminal enclosure, with cover, to accommodate primary and secondary coil wiring connections and electrical supply raceway terminal connector. Equip terminal leads with connectors installed. Limit terminal compartment temperature to 75 degrees C when transformer is operating continuously at rated load with ambient temperature of 40 degrees C. Provide wiring connectors suitable for copper or aluminum wiring. Electrically ground core and coils to transformer enclosure by means of flexible metal grounding strap. Provide transformers with fully enclosed sheet steel enclosures. Apply manufacturer's standard light gray indoor enamel over cleaned and phosphatized steel enclosure. Cushion mount transformer with external vibration isolation supports recommended by manufacturer to limit sound level rating to 50 d.b. as determined in accordance with NEMA standards.

6. INSTALLATION

A. Deliver transformers with factory installed shipping skids; package transformers in watertight containers or wrappings.

B. Handle transformers carefully to avoid damage to components, enclosures and finishes. Do not install damaged equipment; replace and return damaged units to equipment manufacturer.

C. Store transformers in a clean dry place and protect from weather and construction traffic.

D. Install transformers in accordance with equipment manufacturer's written instructions, and with recognized industry practices, to ensure that transformers comply with requirements of National Electrical Code, and applicable portions of ANSI/NEMA standards pertaining to installation of electrical transformers and ancillary equipment.

E. Provide positive equipment ground and bond for transformer equipment where indicated.

F. Upon completion of installation of transformers, energize primary circuit at rated voltage and frequency from normal power source and test transformer, including, but not limited to, audible sound levels, to demonstrate compliance; otherwise, remove and replace with new units and with retesting.

END SECTION

SECTION 16510 - BUILDING LIGHTING FIXTURES

1. RELATED DOCUMENTS

- A. General provisions of Contract, General and Supplementary Conditions and General Requirements, apply to this section.
- B. Requirements of electrical general provision sections govern the work specified in this section, where applicable.
- C. This Section shall be governed by alternates insofar as they affect this work.

2. DESCRIPTION OF WORK

- A. Provide material, equipment, labor and services necessary for proper and complete installation of interior lighting fixtures.

3. QUALITY ASSURANCE

- A. Comply with National Electrical Code (NFPA No. 70) as applicable to installation and construction of interior lighting fixtures.
- B. Comply with applicable portions of National Electrical Manufacturers Association standards pertaining to lighting equipment.
- C. Comply with applicable American National Standards Institute standards pertaining to lamp materials, and lamp ballasts and transformers, and interior lighting fixtures.
- D. Provide interior lighting fixtures which have been listed and labeled by Underwriters Laboratories.
- E. Provide fluorescent-lamp ballasts which comply with Certified Ballast Manufacturers Association standards and carry CBM label.
- F. Comply with additional fixture requirements contained in Interior Lighting Fixture Schedule at end of this section or indicated on Drawings.

4. SUBSTITUTIONS

- A. Lighting fixtures detailed on drawings and specified in schedules are intended to indicate general fixture type. Fixture products of other manufacturers may be proposed, provided these are of similar design, equally efficient, have aesthetically acceptable appearance, and are approved by Architect or Engineer.
- B. In addition to requirements of Section 16000 Products, proposal shall consist of three (3) bound copies of cuts on lighting fixtures and shall include the following information:
 - (1) Name of Manufacturer
 - (2) Catalog Number
 - (3) Fixture drawings, showing metal gauges and finish.
 - (4) Photometric distribution curves.
 - (5) Coefficient of utilization as determined by an independent testing laboratory.

5. SUBMITTALS

A. Submit fixture shop drawings and manufacturer's data in booklet form with a separate sheet for each fixture, assembled in luminaire "type" numerical/alphabetical order, with proposed fixture and accessories clearly indicated on each sheet.

6. LIGHT FIXTURES

A. Light fixtures shall consist of, but not be limited to lamps, lampholders, reflectors, ballasts, starters, and wiring.

B. Provide all recessed fixtures installed in plaster or drywall ceilings with plaster frames supplied by fixture manufacturer.

C. All ferrous metal surfaces of fixtures and plaster frames shall be treated and given rust inhibiting and finish coat adherence properties before finish coats are applied. Finish coats shall be enamel baked on at approximately 320 degrees F or dry powder electrostatically applied.

D. Unless otherwise specified, metal baffles and plastic or glass diffuser panels and low-brightness lens panels shall be contained in rigid, hinged or safety chained metal frames. Diffusers and lens panel shall be replaceable without the use of tools other than screwdriver or pliers. Frames and lens shall provide proper tolerance for normal expansion and contraction without damage to panels.

E. Plastic members shall be uncolored 100 percent virgin acrylic.

F. Fixtures shall allow replacement of ballasts without removal of fixture.

G. It shall be possible to remove and install lamps in fixtures without tools.

7. LAMPS

A. Provide new and unused lamps for all fixtures.

B. Provide mercury vapor and metal Halide lamps with extinguishing mechanisms to prevent operation of lamps when outer globe is broken.

C. Incandescent lamps shall be rated 130 volts.

8. BALLASTS

A. Each ballast shall meet requirements of "Certified Ballast Manufacturer's Association". Securely fasten ballasts in place with mounting surface of ballast making as complete contact with surface of ballast mounting area of fixture as practical. Attach ballasts to mounting surface of fixture by one bolt and nut or sheet metal screw for each ballast mounting hole or as recommended by ballast manufacturer for optimum heat transfer. Ballasts shall have an "A" sound rating.

B. Equip all fixtures with ballasts with external GLR line fuses in HLR holders. Fuse size shall be determined by fixture manufacturer.

C. Provide low temperature fluorescent ballasts in fixtures mounted in cold rooms, outdoors, and as indicated.

D. H.I.D. ballasts shall be constant wattage autotransformer, high power factor type, unless otherwise indicated.

E. Fluorescent ballast to be high performance electronic to operate at a frequency of 25KHz or

higher with less than 2% lamp flicker, at an input voltage of 108 to 132 VAC (120 volt line) or 249 to 305 VAC (277 volt line) at an input frequency of 60 Hz minimum of .99 power factor. Light output to remain constant for line voltage of \pm 5%. Ballast to comply with EMI and RFI limits set by FCC (CFR 47 part 18) for normal electrical equipment and have less than 1.5 lamp current crest factor (LCCF). Units shall be full rapid start except slimline and maintain full cathode heat during operation. Ballast to meet ANSI standard (82.41) and UL listed Class P Type 1 outdoor. Ballast shall be non-PCB. Ballast to have less than 10% total harmonic distortion less than 6% third harmonic distortion. Ballast to have A sound rating with a power factor greater than .99 and have a twenty year rated lamp life. Ballast to operate 1, 2, 3 or 4 T8 or T12 or T5 lamps as specified in fixture specification. Number of ballasts in multi-lamped fixture to be determined by switching or multiple fed luminaires. Responsibility for correct number of ballasts in luminaires and correct voltage to be responsibility of fixture suppliers. Motorola, Advance or Universal are acceptable manufacturers.

9. INSTALLATION

- A. Deliver lighting fixtures individually wrapped in factory-fabricated fiberboard type containers.
- B. Handle fixtures carefully to prevent breakage, denting and scoring of fixture finishes. Do not install damaged lighting fixtures; replace and return damaged units to equipment manufacturer.
- C. Store lighting fixtures in a clean, dry space. Store in original cartons and protect from dirt and debris, physical damage, weather and construction traffic.
- D. Install lighting fixtures of types indicated, where indicated, and at indicated heights; in accordance with lighting fixture manufacturer's written instructions and with recognized industry practices; to ensure that fixtures comply with requirements and serve intended purposes. Comply with NEMA standards, and requirements of National Electrical Code pertaining to installation of lighting fixtures.
- E. Set lighting fixtures and equipment plumb, square, and level and secure to structural support members of building. Provide all steel supports necessary for lighting fixtures in addition to those specified under general building construction. Recessed and semi-recessed fixtures may be supported from suspended ceilings and ceiling tees if ceiling system support rods or wires are provided not more than 6 inches from each edge of each fixture. Secure fixtures in suspended ceilings to framing members in accordance with NEC 410-16 by using standard clips made for the purpose. Sheet metal screws are not acceptable.
- F. Mounting heights specified or indicated shall be to bottom of fixture. Coordinate exact mounting of lighting fixtures with type, style and pattern of ceiling being installed.
- G. Clean interior lighting fixtures of dirt and debris upon completion of installation. Protect installed fixtures from damage during remainder of construction period.
- H. Upon completion of installation of lighting fixtures, and after building circuitry has been energized, apply electrical energy to demonstrate capability and compliance with requirements. Where possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units, and proceed with retesting.
- I. At date of substantial completion, replace lamps in lighting fixtures which are observed to be noticeably dimmed after Contractor's use and testing, as judged by Engineer.

BUILDING LIGHTING FIXTURE SCHEDULE

- LF-1 4'-0" surface mounted LED industrial with polycarb. housing, UL listing for wet location, polycarb. diffuser secured to fully gasketed housing by stainless steel. 4000 lumens nominal. Holophane EVT4-59LED-SYM-MVOLT-SF-WL-STSL-MOUNT BRACKET AS REQUIRED
- LF-2 Surface mounted self-contained emergency light with thermoplastic housing, dual voltage input capability, solid state charger, short-circuit protection, thermal protection, AC/LVD reset, 54 watt capacity sealed maintenance free lead calcium battery, brownout protection, low voltage disconnect, UL label, and three (3) year total customer satisfaction warranty. Unit to be supplied with (2) H2012 lamp heads.
Lithonia IND 1254-H2012
Chloride equal
Holophane equal
- OLF-1 LED Exterior Wallpack fixture. Cast alum. Housing, prismatic glass lens and photocell.
LITHONIA TWR1-2-50K-MVOLT-PE

END SECTION

SECTION 16800 - SURGE PROTECTIVE DEVICES

1. RELATED DOCUMENTS

- A. General Provisions of Contract, General and Supplementary Conditions and General Requirements, apply to this section.
- B. Requirements of electrical general provision sections govern this section, where applicable.
- C. This section shall be governed by alternates insofar as they apply to this section.

2. DESCRIPTION OF WORK

- A. This Section includes Surge Protection Devices for low-voltage power, control and communication equipment.
- B. Provide labor, material, equipment and services necessary for proper and complete installation of secondary surge (lightning) arresters and surge protective devices.
- C. In addition to this section, the Contractor shall refer to other specification sections and drawings to ascertain the extent of work included.

3. QUALITY ASSURANCE

- A. Comply with National Electrical Code Article 285 as applicable to construction and installation of surge arresters.
- B. Provide surge arresters which have been listed and labeled by Underwriters Laboratories.
 - (1) UL1449 3rd Edition: Surge Protective Devices (SPD)
 - (2) UL1283 5th Edition: Electromagnetic Interference Filters
- C. Comply with applicable portions of ANSI/IEEE:
 - (1) C62.41.1: 2002 IEEE Guide on the Surge Environment in Low-Voltage (1000V and less) AC Power Circuits
 - (2) C62.41.2: 2002 IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000V and Less) AC Power Circuits
 - (3) C62.45: 2002 IEEE Recommended Practice on Surge Testing for Equipment Connected to Low-Voltage (1000V and Less) AC Power Circuits
 - (4) C62.62: 2000 IEEE Standard Test Specifications for Surge Protective Devices for Low Voltage (1000V and Less) AC Power Circuits
 - (5) C62.72: 2007 IEEE Guide for the Application of Surge Protective Devices for Low Voltage (1000V and Less) AC Power Circuits
- D. Surge protective devices selected for project shall comply with short circuit current ratings per N.E.C. 285.6.

E. Surge protective devices selected for project shall comply with NFPA 780 – Standard for the Installation of Lightning Protection Systems.

F. Source Limitations: All secondary service suppression devices and accessories shall be from a single manufacturer.

4. SUBMITTALS

A. Submit manufacturer's data on secondary lightning arresters.

B. Submit manufacturer's data on surge protective devices.

5. PRODUCTS

A. The types of surge protective devices required for project shall include the following as noted within plans and specifications:

(1) Surge protective devices (modular-replaceable module solid state type).

(2) Surge protective devices (non-modular encapsulated non-replaceable component- solid state type).

(3) Telephone, data, signal and instrumentation surge protective devices.

B. Surge Protective Devices (SPDs)

(1) Description

(a) This section describes the materials and installation requirements for transient voltage surge suppressors (TVSS) for the protection of all AC electrical circuits from the effects of lightning induced currents, substation switching surges and internally generated surges resulting from inductive and/or capacitive load switching.

(2) Modular Surge Protection (Type 1)

(a) Configured as shown on the riser diagram and/or panel schedules.

(b) The SPD surge current ratings shall be based on the electrical system ampacity listed in the table below.

Electrical System Ampacity @ SPD Install Point	Surge Protection (kA)	
	Per Mode	Per Phase
2500 – 6000A	300	600
1200 – 2000A	250	500
600 – 1000A	200	400
225 – 400A	150	300
125 – 225A	100	200

(c) The SPD shall be rated for voltage, phase and wye or Delta configuration as indicated on Drawings or noted in specifications.

(d) Modes of Protection: The SPD system shall provide surge protection in all possible modes (L-N, L-G, L-L, and N-G) for the circuit or service to be protected. Each replaceable module must provide the uncompromising ability to deliver full surge current rating per mode.

(e) SPD modules shall be configured to isolate individual suppression component failures without causing total loss of surge protection in that mode.

(f) Opening of supplementary protective devices, internal or external, is not permissible during UL1449 3rd Edition Nominal Discharge testing.

(g) Optional Connection Methods: [Fused Disconnect, 60A, #6AWG] [Surge Rated Disconnect, 100A, #2AWG] [Distribution Block, 100A, #2AWG] [Terminal Block, 60A #6AWG].

(h) Each individual module shall feature an LED indicating the individual module has all surge protection devices active. If any module is taken off-line, the LED will turn off and/or a "fail" LED will illuminate, providing individual module status.

(i) Monitoring: Units shall have Status Indication Lights, Surge Counter with Audible Alarm and Form "C" Contacts.

(j) The modular SPD shall be provided in a NEMA 4 enclosure for exterior use and NEMA 12 enclosure for interior use unless otherwise noted.

(k) The SPD shall provide EMI/RFI electrical noise attenuation of 36 to 44dB in the range of 50kHz to 100MHz as defined by MIL-STD-220A test procedures.

(l) Voltage Protection Ratings: The UL1449 3rd Edition Voltage Protection Ratings "VPR" (6kV, 3000 Amps, 8/20µs waveform) must not exceed the UL assigned values listed below.

	208/120V	480/277V
Line to Neutral	900V	1200V
Line to Ground	800V	1200V
Neutral to Ground	700V	1200V
Line to Line	1200V	2000V

(m) The SPD shall have a minimum UL 1449 3rd Edition Nominal Discharge Current Rating (In) of 10,000 Amps. When used in conjunction with a UL 96A certified Lightning Protection System the (In) rating shall be 20,000 Amps.

(n) Approved Manufacturers: The following SPD manufacturers and respective models are acceptable, subject to conformance with indicated requirements:

Current Technologies TSr Product Series

THOR SYSTEMS SL2 Product Series

Liebert Interceptor II Series

(3) NON-MODULAR SURGE PROTECTION (Type 2)

(a) Configured as shown on the riser diagram and/or panel schedules.

(b) The SPD surge current ratings shall be based on the electrical system ampacity listed in the table below.

Electrical System Ampacity @ SPD Install Point	Surge Protection (kA)	
	Per Mode	Per Phase
400 – 800A	150	300
125 – 225A	100	200
15-100A	50	100

(c) The SPD shall be rated for voltage, phase and wye or Delta configuration as indicated on Drawings or noted in specifications.

(d) Modes of Protection: The SPD system shall provide surge protection in all possible modes (L-N, L-G, L-L, and N-G) for the circuit or service to be protected. Each replaceable module must provide the uncompromising ability to deliver full surge current rating per mode.

(e) All non-modular units shall be factory wired for each phase conductor and for Neutral and Ground conductors.

(f) Continuous LED indication of the system integrity (including N-G mode for a Wye system) utilizing LEDs. Monitoring: Units shall have Solid State Status Indication Lights, Surge Counter with Audible Alarm and Form "C" Contacts.

(g) The non-modular SPD shall be provided in a NEMA 4 enclosure for exterior locations or NEMA 12 enclosure for interior locations unless otherwise noted.

(h) The SPD shall provide EMI/RFI electrical noise attenuation of 32 to 37dB in the range of 50kHz to 100MHz as defined by MIL-STD-220A test procedures.

(i) Voltage Protection Ratings: The let-through voltage test results used to obtain the UL1449 3rd Edition Voltage Performance Ratings "VPR" (6kV, 3000 Amps, 8/20µs waveform) must not exceed the UL assigned values listed below.

	208/120V	480/277V
Line to Neutral	700V	1200V
Line to Ground	700V	1200V
Neutral to Ground	800V	1200V
Line to Line	1000V	2000V

(j) The SPD shall have a minimum UL 1449 3rd Edition Nominal Discharge Current Rating (In) of 10,000 Amps. When used in conjunction with a UL 96A certified Lightning Protection System the (In) rating shall be 20,000 Amps.

(k) Approved Manufacturers: The following NON-MODULAR SPD manufacturers and respective models are acceptable, subject to conformance with indicated requirements:

Current Technologies	TSn Product Series
THOR SYSTEMS	TG Product Series
Liebert	Accuvar All Product Series

(4) Transient Voltage Surge Suppressors - Telephone, Data, Signal and Instrumentation.

(a) TVSS shall be listed in accordance with UL 497A where applicable.

(b) TVSS shall be of compact in-line design and have low shunt capacitance for minimum signal loss.

(c) TVSS shall utilize high speed avalanche diodes for protection.

(d) TVSS units shall meet or exceed the following criteria:

- 1) Response time < 10ns
- 2) Maximum shunt capacitance < 40pf except coaxial. Devices which shall be < 30AR.
- 3) Coaxial cable devices shall have -0.5db insertion loss and no series resistance.
- 4) Telephone/Data units shall exceed Category 5.
- 5) Standard clamp voltages/peak pulse currents shall meet or exceed the following as applicable to respective system requirements:

Ethernet 10-base T	7.5V/750A
Telephone Dial-up	240V/250A
CSU/DSU	60V/200A
T-1	60V/200A
DDS	60V/200A
Cable TV	7.5V/750A
Satellite TV	18V/340A
4-20MA Instrumentation (Analog)	30V/370A

(e) TVSS shall have a warranty for a period of five years.

(f) Manufacturers

- 1) Surge protectors shall be as manufactured by Current Technologies, TSC, DDC, MTC and CCC Series or equal. EDCO Series SS65 (4-20ma instrumentation) or equal.

(5) Transient Voltage Surge Suppressors - 120VAC Hardwired Equipment

1283. (a) TVSS shall be listed in accordance with UL 1449 Third Edition and UL

(b) TVSS shall provide surge current diversion paths for all modes of protection; L-N, L-G, N-G.

(c) TVSS shall have operational status indicators and each MOV shall be fused.

(d) Unit shall be housed in NEMA 4 enclosure, have terminal screw connections and each MOV shall be fused.

(e) TVSS shall meet or exceed the following criteria:

1) Maximum surge current capability (single pulse rated) PER PHASE (2 x per mode) shall be:

a) Hardwired equipment (40) kA per phase or as noted on drawings.

(f) Manufacturers

Surge protectors shall be as manufactured by EDCO, HSP Series or equivalent.

6. INSTALLATION

A. Deliver each piece of equipment in durable shipping cartons. Maintain cartons through shipping, storage and handling as required to prevent damage and eliminate dirt and moisture. Store cartons inside and protect from weather.

B. Install system and materials in accordance with manufacturer's instructions and roughing in drawings, and details on drawings. Install electrical work and use electrical products complying with requirements of applicable Division 16 sections of these specifications.

C. Term "wiring" is defined to include providing of wire, conduit and miscellaneous materials as required for mounting and connecting devices.

D. Install a complete wiring system as required for system(s) surge protection.

E. Number Code or Color Code conductors, appropriately and permanently for identification and servicing of systems.

F. Contractor shall install surge protective devices and lightning arresters.

G. Surge Protective Devices shall be provided in quantities such that all modes of protection of the secondary service is protected. This protection shall be provided at the main service panel.

H. Surge Protective Devices shall be installed such that both line and ground lead lengths are as short as possible. Splicing of additional conductor to increase lead length as provided by manufacturer will not be accepted.

I. Existing Utilities: Do not interrupt utilities serving facilities occupied by the Owner or others except when permitted and then only after arranging to provide temporary utility services according to requirements indicated. Notify and coordinate with the engineer when an interrupt is required and prior to interrupting.

J. Coordinate location of field-mounted surge protective devices to allow adequate clearances for maintenance.

K. All devices must be installed on the load side of the facility after the first overcurrent protection or disconnect unless otherwise noted.

L. Products shall be installed external to service, distribution, and branch panel equipment. All SPDs must have the same or greater AIC, Interrupting or Fault rating of the equipment the SPD is protecting.

M. Continuity measurements shall be made between the Neutral and Ground connections to verify the Neutral-to-Ground bond.

7. WARRANTY

A. All Surge Protective Devices (SPDs), associated hardware, and supporting components shall be warranted to be free from defects in materials and workmanship, under normal use and in accordance with the instructions provided, for a period of five (5) years.

B. Any component or subassembly contained within the surge protection system that shows evidence of failure or incorrect operation during the five (5) year warranty period, shall be replaced by the manufacturer.

8. SPECIAL INSTALLATION INSTRUCTIONS

A. Contractor shall furnish and install (1) Type "1" SPD on all new and existing services fed from utility company transformers.

END SECTION



SECTION 16915 - TELEMETRY CONTROL

1. RELATED DOCUMENTS

- A. General provisions of Contract, General and Supplementary Conditions and General Requirements apply to this Section.
- B. Requirements of Section 16000 General Provisions govern work specified in this section.
- C. This section shall be governed by alternates insofar as they apply to this section.

2. DESCRIPTION OF WORK

- A. Provide labor, materials, equipment and accessories necessary for complete and proper control systems.
- B. Description of Work - The work to be accomplished under this section shall consist of furnishing the equipment necessary for a complete automatic control and monitoring system to function as specified herein and as shown on the drawings. The system integrator's shall furnish a completely integrated all solid-state radio telemetry base Supervisory Control and Data Acquisition (SCADA) system. It shall be the system integrator's responsibility to supply a system that is compatible with existing equipment, (or replace it), new equipment supplied by others as part of this contract, and equipment supplied in other contracts. The complete system shall be designed, fabricated, programmed, tested, started up, and warranted by a single supplier to insure a single source of responsibility.
- C. Scope of Work
 - (1) This section covers a radio telemetry based SCADA and Instrumentation System Modification to include:
 - a. (2) Additional Pump Station Remote Units (KY HWY 80 & Apple Orchard Road)
 - b. (1) Modification to the existing Micro-Comm Central Unit, incorporating the proposed RTUs data into the existing Central Unit, located at the Water Plant.
 - c. (1) Update/Renewal of the existing FCC licenses, including the proposed sites.
- D. System Integrator Shall Supply:
 - a. Engineering submittal and shop drawings prior to installation.
 - b. Operation and maintenance manuals, as detailed in this section.
 - c. All start-up labor and services, as required for equipment specified in this section.
 - d. Operator training as detailed in this section.
- E. General/Electrical Contractor Shall Supply

- (1) All equipment required in other sections of the specifications.
- (2) All labor for installation of the system.

F. Owner/General Contractor Shall Supply:

- (1) Access and easements as needed for all sites.
- (2) 120VAC power at all sites.

3. QUALITY ASSURANCE

A. Manufacturer's Qualifications

- (1) The system specified herein shall be the product of a manufacturer who can demonstrate at least ten (10) years of satisfactory experience in furnishing and installing comparable radio based telemetry/control systems for water and wastewater installations.
- (2) The manufacturer of this system shall maintain a 24-hour available inventory of all replaceable modules to assure the Owner of prompt maintenance service and a single source of responsibility. The manufacturer shall certify this to the Engineer in writing at the time of bidder pre-qualification.

B. Approved System Integrator

- (1) Micro-Comm, Inc. Olathe, Kansas
 - a. (Local contact information: Delaney and Associates (859) 342-4944)
- (2) Other integrators desiring to bid this project as "alternate" integrators must seek pre-bid approval by providing a submittal (14) days prior to the bid date. Submissions that fail to include a complete submittal as detailed shall be deemed unresponsive. The Consulting Engineer and the Owner shall be the sole judge as to whether the alternate equipment is considered an approved equal. Approval of an alternate system by the Engineer will not relieve the alternate system of strict adherence to these specifications. The pre-bid submittal shall include the following:
 - a. An installation list with the names and phone numbers of both the Owner and Consulting Engineer for at least ten projects of similar size and complexity.
 - b. A "statement of compliance" detailing paragraph by paragraph the bidders compliance to these specifications.
 - c. Block diagrams for the various sites in the proposed system showing the selected pieces of hardware equipment to be used.
 - d. Sample electrical drawings for typical sites proposed in this contract.
 - e. A product performance data sheet shall be included for each hardware component in the system (i.e. antennas, radios, coaxial cables & arrestors, programmable controllers, power supplies, time delays and relays, and the various sensors required) and each software component

(programming & configuration software and operator display console software).

- f. Radio path study for each radio path in the system. Bidders shall satisfy themselves that the necessary radio frequency(s) can be obtained. The radio path study provided by each bidder shall utilize either:

- 1. Computer generated techniques utilizing a USGS 3 second terrain database to plot the path profiles for each radio path with elevation samples at not more than 200 foot increments.

- 2. Actual field measurements to showing the necessary antenna heights, transmitter power, and antenna gains required to insure a 20db fade margin as detailed in Section 2.02 of these specifications. The a physical path analysis shall be made using temporary equipment installations and a radio communications analyzer to measure actual path margins. The bidder shall include in his bid, all the calculations used to extrapolate the measured data. The bidder is expected to obtain the necessary temporary FCC license for the study.

- g. Communications diagram for the entire system showing normal CTU-RTU communications paths and Peer-to-Peer back-up communications paths.

C. Approval Agencies

- (1) The control system and its components shall comply will all applicable requirements of the following:

- a. Electrical Code Compliance (National & Local)
- b. UL 508A
- c. NEMA Compliance
- d. IEEE Compliance
- e. EIA Compliance
- f. FCC Compliance

4. SUBMITTALS:

- A. Complete submittal shall be provided to the engineer for approval prior to equipment fabrication. The submittal data shall include the following:

- (1) Product Data - Provide product data sheets for each instrument and component supplied in the system. The data sheets shall show the component name as used on reference drawings, manufacturer's model number or other product designator, input and output characteristics, scale or ranges selected, electrical or mechanical requirements, and materials compatibility.

- (2) Shop Drawings - Provide drawings for each panel showing the wiring diagrams for control circuits and interconnections of all components. The

drawings shall include wiring diagrams for all remote devices connected to the panel.

- (3) Panel Layout Drawings - A front panel and sub-panel layout shall be included as part of each control panel drawing. Components shall be clearly labeled on the drawing.
- (4) Installation Drawings - Typical installation drawings applicable to each site in the system shall be included.
- (5) Operator Interface Software - The submittal shall include a generic but detailed technical description of the Operator's Interface Software as proposed for this system including:
 - a. Sample text screens and menus
 - b. Sample graphics screens
 - c. Sample report logs and printed graphs

5. MAINTENANCE INFORMATION

A. Maintenance Data Manuals

- (1) Submit maintenance manuals and "as built" drawings on all items supplied with the system. The manuals and drawings are to be bound into one or more books as needed. In addition to "as built" engineering submittal data and drawings, the manual shall include trouble shooting guides and maintenance and calibration data for all adjustable items.

6. JOB CONDITIONS

A. All instruments and equipment shall be designed to operate under the environmental conditions where they are to perform their service. The equipment shall be designed to handle lightning and transient voltages as normal environmental hazards. The environmental conditions are as follows:

- (1) Outdoor - The equipment will be exposed to direct sunlight, dust, rain, snow, ambient temperatures from -20 to +120 degrees F, relative humidity of 10 to 100 percent, and other natural outdoor conditions. The installations shall be hardened to with stand normal vandalism.
- (2) Indoor - The equipment will be capable of operating in ambient temperatures of +32 to +130 degrees F and relative humidity of 20 to 100 percent.

7. EQUIPMENT EXAMINATION

A. The control system shall be completely tested prior to shipment. The entire control system shall be "Burned In" at the factory for a period of at least 20 days. The component equipment shall be computer tested and temperature cycled at zero degrees and at fifty degrees centigrade.

8. SYSTEM START-UP

- A. The manufacturer shall supply "Factory" personnel for start-up service as needed to insure satisfactory operation. Subsequent trips to the job site to correct defects shall be made at no charge to the Owner during the warranty period.

9. SUBSTANTIAL COMPLETION

- A. The Engineer will grant substantial completion only after completion of the start-up and initial training phase of the project. The Engineer shall make an inspection of the system to determine the status of completion. Substantial completion will be awarded only when the system is providing usable service to the Owner. If the system is commissioned in phases, the Contractor may request substantial completion for the completed phases.

10. WARRANTY/SUPPORT PROGRAM

- A. The control system manufacturer shall supply a Five (5) year parts and labor warranty and comprehensive support program for all items and software supplied under this section (except as noted below). Power surges and lightning damage shall be included as part of the warranty.
- B. The warranty shall begin from the time of "substantial completion" as issued by the engineer. The manufacturer shall provide a 24-hour response to calls from the Owner. The manufacturer, at his discretion, may dispatch replacement parts to the Owner by next-day delivery service for field replacement by the Owner. Any damage to the control system caused by the actions of the Owner in attempting these field replacements shall be the sole responsibility of the manufacturer. If, during the warranty period, satisfactory field repair cannot be attained by field replacement of parts by the Owner, the manufacturer shall dispatch "factory" personnel to the job site to complete repairs at no cost to the Owner.
- C. The support program shall begin from the time of "substantial completion" as issued by the engineer.
- D. Flow meters, control valves, process analyzers (ie turbidity, chlorine, pH, etc) supplied, as part of this contract shall be covered by a one (1) year warranty beginning with "substantial completion".

11. DETAILED EQUIPMENT DESCRIPTION - PUMP STATION REMOTE (M1550/S4500) UNIT REQUIREMENTS:

A. Installation Requirements:

- (1) The General/Electrical Contractor shall install the RTU panel and instruments as shown on the drawings. All conduit and wiring, physical panel mounting, instrument, and transducer(s) installation shall be included.
- (2) The General/Electrical Contractor shall be responsible for mounting a 10' long X 1-1/2" diameter mast secured to the side of the building or on a 20' power pole with 3/4" rigid conduit and a weather-head run to the RTU enclosure.
- (3) The RTU panel and instruments shall be shipped to the job site for installation by the General/Electrical Contractor. Optionally, the RTU panel and instruments may ship directly to the pump station manufacturer for RTU installation.

- (4) Micro-Comm shall be responsible for all FCC licensing fees for adding this RTU to the SCADA system.

B. Discrete Outputs:

- a. Pump #1 CALL (to VFD by others)
- b. Pump #2 CALL (to VFD by others)
- c. -4. spare

C. Discrete Inputs:

- a. Pump #1 Running (from VFD by others)
- b. Pump #2 Running (from VFD by others)
- c. Pump #1 VFD Fail (from VFD by others)
- d. Pump #2 VFD Fail (from VFD by others)
- e. Entry Alarm (Door limit switch by others)
- f. Building Temp High Alarm (Temp switch by Micro-Comm)
- g. - 8. Spares

D. Analog Inputs:

- a. Suction Pressure (L5A Pressure Transducer by Micro-Comm)
- b. Discharge Pressure (L5A Pressure Transducer by Micro-Comm)
- c. Flow Rate/Total (from Flow Meter supplied by others)
- d. -4. Spares

E. Analog Outputs:

- a. Pump #1 VFD Speed (to VFD by others)
- b. Pump #2 VFD Speed (to VFD by others)

F. Operational Description:

- a. The pumps should Start/Stop based on operator adjustable setpoints compared to the Tank water level.

12. CENTRAL UNIT MODIFICATION REQUIREMENTS:

A. The proposed RTU Information to be added to the existing Central Unit:

1. The new RTU site information shall be displayed, monitored, and controlled via the existing SCADAview software program.

13. RADIO TRANSCEIVERS & ACCESSORIES

A. General

- (1) The radio transceivers shall be standard "un-modified" radios that can be tuned, aligned, and repaired at any two-way radio shop. Interface to external data modems shall be through the front panel microphone jack. The radios shall be synthesized and fully field programmable and include a built-in time-out timer to disable the transmitter after 0-60seconds. The units shall be tuned to FCC specifications for the specific frequency assigned.

- (2) FCC LICENSING

- a. The system manufacturer/supplier shall be responsible for collecting all information, generating all paper work, and paying all fees required for modifying the license on behalf of the Owner.

B. VHF Radio Transceiver (154Mhz or 173Mhz)

- (1) The system manufacturer shall supply a 5-watt VHF radio transceiver to insure a high level of quality and reliability. The radios shall be adjustable to 4 watts output power as may be required by the FCC for ERP (Effective Radiated Power) restrictions. All connections to the radio shall be plug-in. The VHF radio transceiver shall have the following specifications:

C. Antenna & Coaxial Cable

- (1) The radio antenna shall be as determined by the Telemetry Equipment Supplier.
- (2) Antennas shall be cabled to the transmitter enclosure connection by a RG/8U type low loss (less than 1.8db per 100ft @ 100MHz) coaxial cable with cellular polyethylene (foam) dielectric. The coaxial cable shall have a braided copper shield coverage of 97% and a long life weather resistant polyvinyl chloride jacket. The antenna coaxial cable connection shall be a constant impedance weatherproof Type N connector, taped with a weather resistant electrical tape to insure a lifetime watertight assembly. The coaxial cable shall be Belden 8214 or 9913 cable.

D. Antenna Lightning Protection

- (1) Coaxial connection to remote and central unit enclosures shall be by means of a coaxial type bulkhead lightning arrestor. The units shall be rated at 1 kilowatt with a minimum 500V and maximum 2000V-breakdown voltage. Coaxial lightning arrestors shall be a PD-593 or PolyPhaser IS-B50LN-C1.

E. Antenna Mounting Systems

- (1) Antennas shall be mounted at a height above ground that is consistent with FCC rules and regulations and provides adequate signal fade margin. Antennas must be a minimum of 15 feet above ground and mounted as determined by the Telemetry System Supplier.
 - a. Stations: The antenna shall be mounted on a 20' high Class II power pole with a 10' long X 1-1/2" galvanized mast secured to the side of the pole and extending 5' above the pole or a 20' high free-standing antenna tower. A 1" rigid conduit with a weather-head shall be provided from below ground to a location 10 feet up the power pole for the coaxial cable.
 - b. Antenna Towers (>20feet): A bracketed antenna tower shall be supplied where required. The tower shall be assembled from 10 sections built on a 12-1/2" (or 18" for ROHN 45G) equilateral triangle design. Tower sections shall be constructed of 1-1/4" steel tubing with continuous solid steel rod "zigzag" cross bracing electrically welded to the tubing. The entire 10' sections shall be Hot-Dip Galvanized after fabrication for long life. The antenna towers shall be ROHN Model 25G (for unsupported heights of up to 33 feet) or ROHN Model 45G (for unsupported heights less than 45 feet).
 - c. Antenna, coaxial cable and required pole/tower products and their installations shall be the responsibility of the Telemetry System Supplier.

14. INSTALLATION AND COORDINATION

- (1) Coordination
 - a. The Systems Integrator shall coordinate with other electrical and mechanical work including wires/cables, raceways, electrical boxes and fittings, controls supplied by others, and existing controls, to properly interface installation and commissioning of the control system.
 - b. Sequence installation and start-up work with other trades to minimize downtime and to minimize the possibility of damage and soiling during the remainder of the construction period.
- (2) Deliver control panels/equipment with factory-installed shipping skids and shims; package accessories in factory-fabricated fiber-board type containers. Do not deliver damaged, dented or cracked equipment; replace and return damaged units to equipment manufacturers. All items shall be stored in a dry sheltered place, not exposed to the outside elements, until ready for installation. All items shall be handled with appropriate care to avoid damage during transport and installation.
- (3) Install control panels/equipment where indicated, in accordance with equipment manufacturer's written instructions, and with recognized industry practices to ensure that sets comply with requirements and serve intended purposes. Comply with NEMA standards, requirements of National Electric Code pertaining to installation of Radio Telemetry Systems.

- (4) Ground cable shields and equipment according to system manufacturer's written instructions to eliminate shock hazard and to minimize, to the greatest extent possible, ground loops, common-mode returns, noise pick-up, cross talk and other impairments.
- (5) Wiring within Enclosures: Install conductors parallel with or at right angles to sides and back of the enclosure. Bundle, lace, and train conductors to terminal points with no excess. Connect conductors that are terminated, spliced or interrupted in any enclosure associated with the fire alarm system to terminal blocks. Mark each terminal according to the system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.
- (6) Upon completion of installation, start-up and testing shall be performed by a manufacturer trained service representative. When possible, field correct malfunctioning units, then retest to demonstrate compliance. Operating and maintenance instruction books shall be supplied upon delivery of unit and procedures explained to operating personnel.

END SECTION



SECTION 16920 - CONTROLS

1. RELATED DOCUMENTS

- A. General provisions of Contract, General and Supplementary Conditions and General Requirements apply to this Section.
- B. Requirements of Section 16000 General Provisions govern work specified in this section.
- C. This section shall be governed by alternates insofar as they apply to this section.

2. DESCRIPTION OF WORK

- A. Provide labor, materials, equipment and accessories necessary for complete and proper control systems.
- B. Unless otherwise specified, required for a particular application, or indicated by details or control diagrams on Drawings, provide each motor with a motor starter of type specified.

3. QUALITY ASSURANCE

- A. Comply with National Electrical Code (NFPA 70) as applicable to construction and installation of control panels.
- B. Provide control panels which have been listed and labeled by Underwriters' Laboratories. UL508.
- C. Comply with National Electrical Manufacturers Association Standards.

4. SUBMITTALS

- A. Submit manufacturer's data complete with wiring diagrams and individual manufacturer cutsheets for all items contained within control panels.

5. EQUIPMENT

- A. General
 - (1) Equipment controls shall be as specified herein and shown on the Contract Drawings.
 - (2) Certain equipment starters contain nonresettable elapsed time meters as shown in the Contract Drawings.
 - (3) All starters contain red "on" lights, control transformers, and (2) sets spare auxiliary contacts. Reset pushbuttons shall also be provided for overloads built into the starters.
- B. Custom Control Panels
 - (1) All control panels furnished under this Contract shall be manufactured in accordance with industry standards and as herein specified. Control panels are specified to be furnished with the equipment controlled.

(2) Control panel construction shall comply with OSHA and other code requirements as applicable, and may be attested to by UL listing the panels as an assembly. Otherwise, panel modifications as required by the Electrical Inspector shall be performed by the supplier at no extra cost to the Owner.

(3) Control panels to be furnished on this project shall be wired to function according to schematics shown on the Contract Drawings. In addition to the requirements shown on the Contract Drawings, the panels shall adhere to additional requirements as written herein, and in the utilization equipment specifications.

(4) Enclosures shall be dead front with all operators devices accessible in a lockable switch compartment on the enclosure door. All relays, timers, terminal strips, etc., shall be mounted to a subpanel inside the enclosure. All control wiring must be stranded and sized to be protected by a 15 A/IP circuit breaker. Supplemental overcurrent protection may be used in lieu of oversized wiring.

(5) All terminal strips and lugs shall be of a type UL listed to terminate the size and quantity of wires encountered. Where conduits enter the boxes, if they are NEMA 4X, sealing locknuts or hubs must be used to maintain the box rating.

(6) Wet location or outdoor mounted enclosures shall comply with Article C. below.

(7) Elementary control schematics and connection diagrams showing the spatial relationship of components and wiring shall be submitted for review. Also, a bill of materials, drawing of device arrangement on front, and enclosure fabrication drawings shall be submitted. Further, descriptive literature is required on all components. A copy of the shop drawings shall be furnished and stored in a pocket inside the enclosure.

(8) Sleeve type wire markers or other "permanent" type marker shall be installed on all wires, keynoted back to the elementary schematic or the connection diagram, and all terminals identified.

C. Control Panel Enclosures For Outdoor/Wet Locations

(1) The purpose of this Specification is to provide details of an enclosure that protects internal equipment from rain, dust, vandalism, and other conditions found in an outdoor environment or otherwise harsh environment.

(2) The manufacturer shall provide part numbers on all components for repair purposes. Enclosure shall be single or double door as required.

(3) Control panel enclosure sizing shall be by supplier in accordance with appropriate standards and codes.

a. Minimum size of pad mount enclosures not including floor stands shall be 48"W x 60" high.

(4) The enclosure(s) will meet or exceed the requirements of a 3R rating and shall be UL listed.

D. Cabinet Construction

(1) The cabinet and door or doors shall be constructed from 5052-H32 sheet aluminum alloy which has thickness of 0.125 inch. External welds shall be made by using the Heliarc welding method, whereas internal welds will be made by the wire welding method. All welds shall be neatly formed and free of cracks, blow holes and other irregularities.

- (2) All inside and outside edges of the cabinet shall be free of burrs.

E. Door Hardware

- (1) The cabinet door or doors shall be a minimum of 80 percent of the front surface area and shall be hinged on the right side when facing the cabinet (right and left outside edges for double door enclosures).

- (2) Each door shall be furnished with a gasket that satisfies the physical properties as found in UL508 table 21.1 and shall form a weathertight seal between the cabinet and door.

- (3) The hinges shall be continuous and bolted to the cabinet and door utilizing ¼-20 stainless steel carriage bolts and ny-lock nuts.

- (4) The hinges shall be made of 0.093 inch thick aluminum and shall have a 3" open width with a 0.250 inch diameter stainless steel hinge pin.

- (5) The hinge pin shall be capped top and bottom by weld to render it tamperproof.

- (6) All bolt holes shall be gasketed.

- (7) The latching mechanism shall be a 3-point draw roller type.

- (8) The center catch and pushrods shall be cadmium plated, Type II, Class 1 or equal.

- (9) An operating handle shall be furnished.

- (10) The handle shall be stainless steel with ¾ inch diameter shank.

- (11) The latching handle shall have a provision for padlocking in the closed position.

F. Switch Compartment

- (1) A switch compartment, with removable back panel, is to be supplied on the enclosure main door. It shall be large enough to include all operating devices.

- (2) The switch compartment door opening shall be double flanged on all four sides for strength and to prevent liquids or dirt from dropping into the compartment when the door is open.

- (3) The door shall be furnished with a gasket that satisfies the physical properties as found in UL508 Table 21.1 and will form a weathertight seal between cabinet and door.

- (4) The switch compartment door shall have a tight key lock. Two keys shall be furnished with each lock.

- (5) The switch compartment door hinge shall be 0.063 inch stainless steel with a 0.120 diameter stainless steel hinge pin.

G. Equipment Mounting

- (1) The enclosure shall be equipped with two adjustable "C" mounting channels on both side walls and back wall of the enclosure, allowing versatile positioning of shelves or panels.

(2) The mounting channels shall provide infinite vertical and horizontal adjustment and not limit the positioning of shelves or panels. All mounting hardware will be furnished.

(3) If equipment is to be shelf mounted, the enclosure shall be provided with shelves fabricated from 5052-H32 aluminum having a thickness of 0.125 inch.

(4) The shelf depth shall be a minimum of 10.5 inches. The enclosure will have provision for positioning shelves or panels to within 4 inches of the bottom and to within 8 inches of the top of the enclosure.

(5) If the equipment is to be panel mounted, the enclosure shall be provided with a 5052-H32 aluminum back panel having a thickness of 0.125.

(6) The panel shall be natural finish. All mounting hardware will be furnished.

(7) A control panel shop drawing storage pocket shall be provided inside the enclosure at a convenient location.

H. Cabinet Finish & Mounting

(1) Unless otherwise specified, the outside surface of the cabinet shall have a smooth, uniform, natural aluminum finish.

(2) Pad Mounted Enclosure (Where Applicable)

a. Enclosure shall have 12" high floor stands to support entire enclosure bottom from contact with concrete pad.

I. Acceptable Manufactures

(1) Cabinet is to be as manufactured by Hoffman or a UL listed equivalent.

6. GENERAL SYSTEM DESCRIPTIONS

A. The systems description section of these Specifications is supplementary to the descriptions in other Divisions of the Specifications and to the Contract Drawings. Refer also to the equipment specifications and controls shown on the Contract Drawings.

7. PUMP STATION REMOTE CONTROL PANEL

A. Refer to Division 11000 of Specifications for additional control requirements.

B. Panel controls shall include, but not be limited to the following:

- H-O-A Switch – One For Each Pump
- Pump Stop Pilot Light – One For Each Pump
- Pump Run Pilot Light – One For Each Pump
- 4-20ma VFD speed control with speed indication display – One For Each Pump

8. INSTALLATION

A. Deliver custom control panels with factory-installed shipping skids and shims; package accessories in factory-fabricated fiber-board type containers. Do not deliver damaged, dented or cracked equipment; replace and return damaged units to equipment manufacturers.

B. Install control panels where indicated, in accordance with equipment manufacturer's written instructions, and with recognized industry practices to ensure that sets comply with requirements and serve intended purposes. Comply with NEMA standards, requirements of National Electric Code pertaining to construction of fabricated control panels.

C. Ground cable shields and equipment according to system manufacturer's written instructions to eliminate shock hazard and to minimize, to the greatest extent possible, ground loops, common-mode returns, noise pick-up, cross talk and other impairments.

D. Wiring within Enclosures: Install conductors parallel with or at right angles to sides and back of the enclosure. Bundle, lace, and train conductors to terminal points with no excess. Connect conductors that are terminated, spliced or interrupted in any enclosure associated with the control system to terminal blocks. Mark each terminal according to the system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.

E. Upon completion of installation, start-up and testing shall be performed by a manufacturer trained service representative. When possible, field correct malfunctioning units, then retest to demonstrate compliance. Operating and maintenance instruction books shall be supplied upon delivery of unit and procedures explained to operating personnel.

9. SPECIAL INSTALLATION INSTRUCTIONS

A. Where control panel fabricators/suppliers opt to include all pump station service voltage electrical equipment within a single main control panel. The main breaker and installation of such breaker shall be service entrance (S.E.) rated or an S.E. rated main fusible disconnect switch or circuit breaker shall be provided for installation external to the main control panel.

B. Where control panel fabricators/suppliers opt to include all pump starters/VFDs within a single main control panel provisions must be made for individual pump feeder disconnects to be accessible and lockable in the OFF position from the front of the control panel while closed or an individual separate external disconnect shall be provided for each pump in accordance with specification section 16700. All disconnects on load side of VFD type starters shall be of the non-fusible type.

C. Where control panel fabricators/suppliers opt to include all pump starters within a single main control panel the starters shall be of types as specified and in accordance with specification sections 16155 and 16156 and schedules/notes as indicated on drawings.

D. Electrical Contractor shall be responsible for all wire and cable installation from pressure transducers and/or switches as indicated on electrical/piping drawings.

END SECTION



SECTION 16941 - CONTROL AND INSTRUMENTATION CABLE AND WIRE

1. RELATED DOCUMENTS

- A. General Provisions of Contract, General and Supplementary Conditions and General Requirements apply to work specified in this section.
- B. Requirements of Electrical General Provision Sections govern this Section, where applicable.
- C. This section shall be governed by Alternates insofar as they affect this work.

2. DESCRIPTION OF WORK

- A. Provide labor, materials, equipment and services necessary for proper and complete installation of control and instrumentation cable and wire.
- B. Requirements of this section apply to cable and wire work specified elsewhere in these specifications.
- C. Unless specified otherwise in this Section or indicated on Drawings, control and instrumentation device/equipment power wiring is specified under Section 16120.

3. QUALITY ASSURANCE

- A. Comply with National Electrical Code (NFPA 70) as applicable to construction and installation of control cable and wire.
- B. Provide cable and wire which has been listed and labeled by Underwriters Laboratories.
- C. Comply with National Electrical Manufacturers Association/Insulated Power Cable Engineers Association Standards publications pertaining to materials, construction and testing wire cable, where applicable.
- D. Manufacturers offering products complying with requirements include:
 - (1) Wire:
Southwire Company
Triangle PWC, Inc.
Or equal
 - (2) Cable:
Belden
Or equal

4. SUBMITTALS

- A. Submit manufacturers' product data on all 4-20MA signal cables and power cables.

5. MATERIALS

- A. Provide factory-fabricated cable and wire of sizes, ratings, materials and types indicated. Where not indicated, provide proper selection as determined by main control and instrumentation panel supplier to comply with project's installation requirements and NEC standards.

B. Use (1) 16 ga. twisted/shielded pair cable for 4-20ma signal circuits from transmitters etc. Cable shall be Belden No. 8719, or General Cable C2536A, 16 ga. with 100% shield coverage and stranded/tinned 18 ga. drain wire.

C. Use No. 12 stranded conductor for control circuit wiring connected to lighting switches and snap switches.

D. Valves, valve controllers, start-stop selector switches etc. Use minimum 75 degrees C rated insulation unless specified otherwise, indicated on Drawings, or required by NEC. Use 600 volt insulation rating unless specified or indicated otherwise.

6. INSTALLATION

A. Install cable and wire as indicated, in accordance with manufacturer's written instructions, applicable requirements of NEC and NECA's "Standard of Installation", and in accordance with recognized industry practices to ensure products serve intended functions.

B. Store cable, wire and connectors in factory-installed coverings in a clean, dry indoor space which provides protection against weather.

C. Pull conductors together where more than one is being installed in a raceway.

D. Use pulling compound or lubricant, when necessary; compound must not deteriorate conductor and insulation.

E. Do not use a pulling means, including fish tape, cable or rope which can damage raceway.

F. Install exposed cable, parallel and perpendicular to surface or exposed structural members and follow surface contours, where possible.

G. Wire or cable splices for control and instrumentation circuits shall not be accepted.

H. Install poly pull line in all spare control and instrumentation circuit conduits.

I. Prior to energization, check cable and wire for continuity of circuitry and for short circuits. Correct malfunction when detected.

J. Do not install any control or instrumentation cable or wiring in same conduit or J-box with electrical power wiring.

K. **NOTE:** Electrical Contractor shall be responsible for providing and installing all control and instrumentation wiring and cable from all remote devices to the main control panel (MCP). This shall include the termination of wires/cables on both ends and installation of wire No. markers.

7. SPECIAL INSTALLATION INSTRUCTIONS

A. Wire or cable splices for control and instrumentation circuits shall not be accepted.

B. Do not install any control or instrumentation cable or wiring in same conduit or J-box with electrical power wiring, unless otherwise noted.

C. All 4-20MA signal cables shall be run complete without splice in minimum 1" conduit. These cables shall not be run in same conduit or through exterior pull boxes which contain power wiring.

END SECTION

APPENDIX A

**GENERAL CERTIFICATION
NATIONWIDE PERMIT #12**





STEVEN L. BESHEAR
GOVERNOR

LEONARD K. PETERS
SECRETARY

ENERGY AND ENVIRONMENTAL PROTECTION CABINET

DEPARTMENT FOR ENVIRONMENTAL PROTECTION

DIVISION OF WATER

200 FAIR OAKS LANE

FRANKFORT, KENTUCKY 40601

www.kentucky.gov

**General Certification--Nationwide Permit # 12
Utility Line Backfill and Bedding**

This General Certification is issued March 19, 2012, in conformity with the requirements of Section 401 of the Clean Water Act of 1977, as amended (33 U.S.C. §1341), as well as Kentucky Statute KRS 224.16-050.

For this and all nationwide permits, the definition of surface water is as per 401 KAR 10:001 Chapter 10, Section 1(80): Surface Waters means those waters having well-defined banks and beds, either constantly or intermittently flowing; lakes and impounded waters; marshes and wetlands; and any subterranean waters flowing in well-defined channels and having a demonstrable hydrologic connection with the surface. Lagoons used for waste treatment and effluent ditches that are situated on property owned, leased, or under valid easement by a permitted discharger are not considered to be surface waters of the commonwealth.

Agricultural operations, as defined by KRS 224.71-100(1) conducting activities pursuant to KRS 224.71-100 (3), (4), (5), (6), or 10 are deemed to have certification if they are implementing an Agriculture Water Quality Plan pursuant to KRS 224.71-145.

For all other operations, the Commonwealth of Kentucky hereby certifies under Section 401 of the Clean Water Act (CWA) that it has reasonable assurances that applicable water quality standards under Kentucky Administrative Regulations Title 401, Chapter 10, established pursuant to Sections 301, 302, 304, 306 and 307 of the CWA, will not be violated for the activity covered under NATIONWIDE PERMIT 12, namely Utility Line Backfill and Bedding, provided that the following conditions are met:

1. The activity will not occur within surface waters of the Commonwealth identified by the Kentucky Division of Water as Outstanding State or National Resource Water, Cold Water Aquatic Habitat, or Exceptional Waters.
2. The activity will not occur within surface waters of the Commonwealth identified as perpetually-protected (e.g. deed restriction, conservation easement) mitigation sites.
3. This general water quality certification is limited to the crossing of surface waters by utility lines. This document does not authorize the installation of utility lines in a linear manner within the stream channel or below the top of the stream bank.

General Certification--Nationwide Permit # 12
Utility Line Backfill and Bedding
Page 2

4. For a single crossing, impacts from the construction and maintenance corridor in surface waters shall not exceed 50 feet of bank disturbance.
5. This general certification shall not apply to nationwide permits issued for individual crossings which are part of a larger utility line project where the total cumulative impacts from a single and complete linear project exceed ½ acre of wetlands or 300 linear feet of surface waters. Cumulative impacts include utility line crossings, permanent or temporary access roads, headwalls, associated bank stabilization areas, substations, pole or tower foundations, maintenance corridor, and staging areas.
6. Stream impacts under Conditions 4 and 5 of this certification are defined as the length of bank disturbed. For the utility line crossing and roads, only one bank length is used in calculation of the totals.
7. Stream impacts covered under this General Water Quality Certification and undertaken by those persons defined as an agricultural operation under the Agricultural Water Quality Act must be completed in compliance with the Kentucky Agricultural Water Quality Plan (KWQP).
8. The Kentucky Division of Water may require submission of a formal application for an individual certification for any project if the project has been determined to likely have a significant adverse effect upon water quality or degrade the waters of the Commonwealth so that existing uses of the water body or downstream waters are precluded.
9. Activities that do not meet the conditions of this General Water Quality Certification require an Individual Section 401 Water Quality Certification.
10. Blasting of stream channels, even under dry conditions, is not allowed under this general water quality certification.
11. Utility lines placed parallel to the stream shall be located at least 50 feet from an intermittent or perennial stream, measured from the top of the stream bank. The cabinet may allow construction within the 50 foot buffer if avoidance and minimization efforts are shown and adequate methods are utilized to prevent soil from entering the stream.
12. Utility line stream crossings shall be constructed by methods that maintain flow and allow for a dry excavation. Water pumped from the excavation shall be contained and allowed to settle prior to re-entering the stream. Excavation equipment and vehicles shall operate outside of the flowing portion of the stream. Spoil material from the excavation shall not be allowed to enter the flowing portion of the stream.

General Certification--Nationwide Permit # 12
Utility Line Backfill and Bedding
Page 3

13. The activities shall not result in any permanent changes in pre-construction elevation contours in surface waters or wetlands or stream dimension, pattern or profile.
14. Utility line activities which impact wetlands shall not result in conversion of the area to non-wetland status. Mechanized land clearing of forested wetlands for the installation or maintenance of utility lines is not authorized under this certification.
15. Activities qualifying for coverage under this General Water Quality Certification are subject to the following conditions:
 - Erosion and sedimentation pollution control plans and Best Management Practices must be designed, installed, and maintained in effective operating condition at all times during construction activities so that violations of state water quality standards do not occur.
 - Sediment and erosion control measures, such as check-dams constructed of any material, silt fencing, hay bales, etc., shall not be placed within surface waters of the Commonwealth, either temporarily or permanently, without prior approval by the Kentucky Division of Water's Water Quality Certification Section. If placement of sediment and erosion control measures in surface waters is unavoidable, design and placement of temporary erosion control measures shall not be conducted in such a manner that may result in instability of streams that are adjacent to, upstream, or downstream of the structures. All sediment and erosion control devices shall be removed and the natural grade restored within the completion timeline of the activities.
 - Measures shall be taken to prevent or control spills of fuels, lubricants, or other toxic materials used in construction from entering the watercourse.
 - Removal of riparian vegetation shall be limited to that necessary for equipment access.
 - To the maximum extent practicable, all in-stream work under this certification shall be performed under low-flow conditions.
 - Heavy equipment, e.g. bulldozers, backhoes, draglines, etc., if required for this project, should not be used or operated within the stream channel. In those instances in which such in-stream work is unavoidable, then it shall be performed in such a manner and duration as to minimize turbidity and disturbance to substrates and bank or riparian vegetation.

General Certification--Nationwide Permit # 12
Utility Line Backfill and Bedding
Page 4

- Any fill shall be of such composition that it will not adversely affect the biological, chemical, or physical properties of the receiving waters and/or cause violations of water quality standards. If rip-rap is utilized, it should be of such weight and size that bank stress or slump conditions will not be created because of its placement.
- If there are water supply intakes located downstream that may be affected by increased turbidity and suspended solids, the permittee shall notify the operator when such work will be done.
- Should evidence of stream pollution or jurisdictional wetland impairment and/or violations of water quality standards occur as a result of this activity (either from a spill or other forms of water pollution), the Kentucky Division of Water shall be notified immediately by calling (800) 928-2380.

Non-compliance with the conditions of this general certification or violation of Kentucky state water quality standards may result in civil penalties.

APPENDIX B

**LIST OF MATERIALS SUPPLIED BY MICROCOMM
FOR EACH PUMP STATION**



MICROCOMM

15895 S. Pflumm Rd.
Olathe, KS 66062-8502
(913) 390-4500
FAX: (913) 390-4550
www.micro-comm-inc.com

Revised Date: November 12, 2014 (added FCC Renewal)

Date: November 7, 2014

Project: Wood Creek/East Laurel Water District
SCADA System Modifications/Additions

Estimator: Jay Fromholtz

Sales Representative:
Jason Bivins; Delaney and Associates

Material and Labor Specification Information

(2) M1550 Pump Station Remote Units (KY HWY 80 & Apple Orchard Road PS)

Micro-Comm M1550 remote unit in a Wall mount JIC enclosure with "Single-Board M1550" RTU module, I/O Sub-panel type construction, Motorola radio, coaxial cable lightning arrestor, coaxial cable, cable connectors, and Yagi antenna.

RTU panel to include:

Qty Description

- 1 Hoffman Nema 12 Enclosure
- 1 120VAC/20VAC Power Supply
- 1 24 hour battery back-up, (20A/hr)
- 1 M1550 Single-Board RTU assembly
- 1 Motorola Radius SM50 VHF Radio
- 1 Motorola Radius SM50 Power & Modem Interface Cable
- 1 Coaxial Lightning Arrestor, Patch Cord & Bracket
- 1 (4) Discrete Outputs as follows:
 - 1 Pump #1 Call Output
 - 1 Pump #2 Call Output
 - 1 Telemetry Control Output
- 1 (8) Discrete Inputs as follows:
 - 1 Pump #1 Running
 - 1 Pump #2 Running
 - 1 Entry Alarm Indication
 - 1 High Building Temp Alarm
 - 1 Power Failure
- 1 (4) Analog Inputs as Follows
 - 1 Discharge Pressure Indication
 - 1 Suction Pressure Indication
 - 1 Flow Rate & Total (Signal by others)
- 1 (2) Analog Outputs as Follows
 - 1 Reserved for VFD#1 Control
 - 1 Reserved for VFD#2 Control
- 1 4x20 LCD & Keypad Module & Cable
- 1 Engineering, Programming, & Testing

The following items will be shipped separately for field mounting:

- 1 Yagi antenna with mounting U-bolts
- 1 lot of coaxial cable & Connectors as needed
- 2 Submersible Pressure Transducer w/prewired cable & 1/4" NPT fittings
- 1 MicroSwitch Nema 4 Door/Hatch Switches
- 1 Temperature Switch (Nema 1 Hi or Lo)
- 1 Factory start-up and adjustment services of above Micro-Comm equipment

(1) Central Unit Modifications

Micro-Comm shall modify the Central Unit Equipment at the Water Plant, adding all new sites to the existing software program.

CTU modifications:

Qty Description

- 1 Central Unit CTU Program Radio/PLC modifications
- 1 Central Unit SCADAview Program Configuration/modifications
- 1 Factory start-up and adjustment services of above Micro-Comm equipment

MISCELLANEOUS ITEMS TO INCLUDE:

Qty Description

- 1 Engineering and Design
- 6 Engineering Submittal
- 6 Operation and Maintenance Manuals
- 1 FCC License Fees and Paperwork (Including existing FCC renewals)
- 1 Freight to Job Site (FOB Factory, Freight allowed)
- 1 Factory Startup and Adjustment Service

Total Project Price: \$35,790.00