CITY OF WEST LAFAYETTE, INDIANA

NOTICE TO BIDDERS, INSTRUCTIONS TO BIDDERS, BID FORM, AGREEMENT FORM, PERFORMANCE BOND, PAYMENT BOND, MAINTENANCE BOND, GENERAL CONDITIONS, SUPPLEMENTARY CONDITIONS, AND SPECIFICATIONS

FOR

SHERATON AND FAIRWAY KNOLLS LIFT STATION IMPROVEMENTS

MAYOR

JOHN R. DENNIS

BOARD OF PUBLIC WORKS AND SAFETY

John R. Dennis, President
Judith C. Rhodes, Clerk of the Board
Sana G. Booker, Member
Bradley W. Marley, Member
Jonathan C. Speaker, Member
Shawn R. Little, Member

WASTEWATER TREATMENT UTILITY DIRECTOR

David S. Henderson

PUBLIC WORKS DIRECTOR

David M. Buck, P.E.

GREELEY AND HANSEN

7820 Innovation Blvd.
Suite 150
Indianapolis, IN 46278

APRIL 2014

CITY OF WEST LAFAYETTE, INDIANA

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WILLIAM E. PFEIFFER, III
REGISTERED
No.
20809
STATE OF
INDIANA
PROFESSIONAL ENGINEER

Seal Affixed
April 25, 2014
Covering Structural Design

GREELEY AND HANSEN

7820 Innovation Blvd.
Suite 150
Indianapolis, IN 46278

APRIL, 2014

JOSEPH M. TEUSCH
REGISTERED
No.
PE 10200110
STATE OF
INDIANA
PROFESSIONAL ENGINEER

Seal Affixed
April 25, 2014

SECTION 00003

CITY OF WEST LAFAYETTE, INDIANA

SHERATON AND FAIRWAY KNOLLS LIFT STATION IMPROVEMENTS

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SECTION 00500

FORM OF AGREEMENT

BETWEEN OWNER AND CONTRACTOR

ON THE BASIS OF A STIPULATED PRICE

THIS AGREEMENT is dated as of the _____ day of _____ in the year 2014 by and between the Board of Public Works and Safety, West Lafayette, Indiana (hereinafter called OWNER) and _____hereinafter called CONTRACTOR).

OWNER and CONTRACTOR, in consideration of the mutual covenants hereinafter set forth, agree as follows:

Article 1. WORK

CONTRACTOR shall complete all Work as specified or indicated in the Contract Documents.

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

West Lafayette, Indiana
Sheraton and Fairway Knolls Lift Station Improvements

Article 2. ENGINEER

The Project has been designed by Greeley and Hansen who is hereinafter called ENGINEER and 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 3. CONTRACT TIMES

3.1 Substantial Completion

Milestone 1 – Provider agrees that all Work-related submittals (excluding Miscellaneous Submittals as defined in Section 01330) will be submitted to ENGINEER within **60 calendar days** of Notice-to-Proceed.

Milestone 2 – All work related to the installation of the Fairway Knolls force main from Station 12+00 to Station 21+98 will be completed within **90 calendar days** of the Notice-to-Proceed.

Milestone 3 – All work related to the installation of the Fairway Knolls force main from Station 0+90 to Station 12+00 and all work related to the installation of the Sheraton force main from Station 0+00 to Station 38+00 will be completed within **125 calendar days** of the Notice-to-Proceed. Completed work shall be defined as installation of all force main, manholes, backfilling, pavement, and seed in-place restoration.

Milestone 4 – Provider agrees that all remaining Work will be substantially complete within **240 calendar days** of the Notice-to-Proceed as provided in paragraph 2.03 of the General Conditions. Substantial Completion shall be defined as the installation of all sewer, force main, lift stations, manholes, backfilling, pavement, and seed in-place restoration.

3.2 Final Completion and Readiness for Final Payment

All Work shall be completed and ready for final payment in accordance with paragraph 14.07 of the General Conditions within **270 calendar days** of the Notice-to-Proceed.

3.3 Incentive Payments

If completion for Milestone 1 is met in advance of the time specified in paragraph 3.1 Incentive Payments may be paid out of the Incentive Payment - Submittals Contract Item as described in Section 01291.

If Substantial Completion for Milestone 4 is met in advance of the time specified in paragraph 3.1 Incentive Payments may be paid out of the Incentive Payment - Substantial Completion Contract Item as described in Section 01291.

3.4 Liquidated Damages

OWNER and CONTRACTOR recognize that time is of the essence of this Agreement and that OWNER will suffer financial loss if the Work is not completed within the times specified in paragraphs 3.1 and 3.2 above plus any

extensions thereof allowed in accordance with Article 12 of the General Conditions. They also recognize the delays, expense and difficulties involved in proving, in a legal or arbitration proceeding, the actual loss suffered by OWNER if the Work is not completed on time. Accordingly, instead of requiring any such proof, OWNER and CONTRACTOR agree that as liquidated damages for delay (but not as a penalty) CONTRACTOR shall pay OWNER One Thousand Five Hundred dollars ($1,500) for each calendar day that expires after the time specified for Milestones 1, 2, and 3. CONTRACTOR shall pay OWNER One Thousand dollars ($1,000) for each calendar day that expires after the time specified for Final Completion and Readiness for Final Payment.

Article 4. CONTRACT PRICE

OWNER shall pay CONTRACTOR for completion of the Work in accordance with the Contract Documents an amount in current funds equal to the total sum of the amounts determined pursuant to the CONTRACTOR's Guaranteed Maximum Price.

As provided in paragraph 11.03 of the General Conditions, estimated quantities are not guaranteed, and determinations of actual quantities and classifications are to be made by ENGINEER as provided in paragraph 9.08 of the General Conditions. Unit prices have been computed as provided in paragraph 11.03 of the General Conditions.

Article 5. PAYMENT PROCEDURES

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.

5.1 Progress Payments; Retainage

OWNER shall make progress payments on the basis of CONTRACTOR's Applications for Payment, on or about the thirtieth day of each month during performance of the Work as provided in paragraphs 5.1.1 and 5.1.2 below. All such payments will be measured by the schedule of values established in paragraph 2.07.A of the General Conditions (and in the case of Unit Price Work based on the number of units completed).

5.1.1 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, in accordance with paragraph 14.02 of the General Conditions.

Progress payments shall not exceed an amount equal to 90 percent of the Work completed and of the cost of materials not incorporated in the Work but delivered and suitably stored (with the balance being retainage). If the Work is 50 percent complete as determined by ENGINEER, and if the character and progress of the Work have been satisfactory to OWNER and ENGINEER, OWNER, on recommendation of ENGINEER, may determine that as long as the character and progress of the Work remain satisfactory to them, there will be no retainage on account of Work subsequently completed, in which case the remaining progress payments prior to Substantial Completion will be in an amount equal to 100 percent of the Work completed less the aggregate of payments previously made; and

5.1.2 Upon Substantial Completion, OWNER may pay an amount sufficient to increase total payments to CONTRACTOR to 100 percent of the Work completed, less 200 percent of ENGINEER's estimate of the value of Work to be completed or corrected attached to the certificate of Substantial Completion.

5.2 Final Payment

Upon final completion and acceptance of the Work in accordance with paragraph 14.07 of the General Conditions, OWNER shall pay the remainder of the Contract Price as recommended by ENGINEER as provided in said paragraph 14.07.

Article 6. CONTRACTOR'S REPRESENTATIONS

In order to induce OWNER to enter into this Agreement CONTRACTOR makes the following representations:

6.1 CONTRACTOR has examined and carefully studied the Contract Documents (including the Addenda) and the other related data identified in the Documents including "technical data".

6.2 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.

6.3 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.

6.4 CONTRACTOR 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 the Supplementary Conditions as provided in paragraph 4.02 of the General Conditions and (2) reports and drawings of a Hazardous Environmental Condition, if any, at the Site which has been identified in the Supplementary Conditions as provided in paragraph 4.06 of the General Conditions. CONTRACTOR accepts the determination set forth in paragraph SC-4.02 of the Supplementary Conditions as to the extent of the "technical data" contained in such reports and drawings upon which CONTRACTOR is entitled to rely as provided in paragraph 4.02B of the General Conditions. CONTRACTOR acknowledges that such reports and drawings are not Contract Documents and may not be complete for CONTRACTOR's purposes. CONTRACTOR acknowledges that OWNER and ENGINEER do not assume responsibility for the accuracy or completeness of information and data shown or indicated in the Contract Documents with respect to Underground Facilities at or contiguous to the Site.

6.5 CONTRACTOR has obtained and carefully studied (or assumes responsibility for having done 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 CONTRACTOR, including applying the specific means, methods, techniques, sequences and procedures of construction, if any, expressly required by the Contract Documents to be employed by CONTRACTOR, and safety precautions and programs incident thereto.

6.6 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.

6.7 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.

6.8 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.

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

Article 7. CONTRACT DOCUMENTS

The Contract Documents which comprise the entire agreement between OWNER and CONTRACTOR concerning the Work consist of the following:

7.1 This Agreement, identified as Section 00500

7.2 Performance and Payment Bonds, identified as Sections 00610 and 00620

7.3 Maintenance Bond, identified as Section 00650

7.4 Notice to Proceed, identified as Section 00680

7.5 CONTRACTOR'S Guaranteed Maximum Price (GMP)

7.6 Standard General Conditions, identified as Section 00700

7.7 Supplementary Conditions, identified as Section 00800

7.8 Specifications bearing the title City of West Lafayette, Indiana Sheraton and Fairway Knolls Lift Station Improvements

7.9 Drawings bearing the title City of West Lafayette, Indiana Sheraton and Fairway Knolls Lift Station Improvements

7.10 Addenda (numbers _____ to _____, inclusive)

7.11 Exhibit A, Wage Rates

7.12 Exhibit B, SRF Documents

The documents listed in the paragraphs above are attached to this Agreement (except as expressly noted otherwise above).

There are no Contract Documents other than those listed above in this Article 7. The Contract Documents may only be amended, modified or supplemented as provided in paragraph 3.05 of the General Conditions.

In resolving conflicts, errors, discrepancies and disputes concerning the Scope of Work to be performed by Contractor, and other rights and obligations of Owner and Contractor, the document expressing the greater quantity, quality or other scope of work in question, or imposing the greater obligation upon Contractor and affording the greater right or remedy to

Owner shall govern; otherwise the documents shall be given precedence in the order as enumerated above.

Article. 8 MISCELLANEOUS

8.1 Terms used in this Agreement which are defined in Article 1 of the General Conditions will have the meanings indicated in the General Conditions.

8.2 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.

8.3 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.

8.4 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 provisions or part thereof with a valid and enforceable provision that comes as close as possible to expressing the intention of the stricken provision.

8.5 This Contract is to be governed by the law of the State of Indiana. Venue for all disputes arising under this Contract shall be Tippecanoe County, Indiana.

8.6 Notwithstanding any term or condition in this Contract to the contrary, in the event litigations is commenced to enforce any term or condition of this Contract, the prevailing party shall be entitled to costs and expenses of litigation including a reasonable attorney fee.

8.7 By signing this Contract, CONTRACTOR certifies that it is not engaged in investment activities in the country of Iran as set forth in I.C. 5-22-16.5.

8.8 By signing this Contract, CONTRACTOR agrees to comply with the "American Iron and Steel Requirements" as outlined in Attachment I and Attachment J of Exhibit B, SRF Documents, and provide certifications as required.

IN WITNESS WHEREOF, OWNER and CONTRACTOR have signed this Agreement in duplicate. One counterpart each has been delivered to OWNER, and CONTRACTOR. All portions of the Contract Documents have been signed, or identified by OWNER and CONTRACTOR or on their behalf.

This Agreement will be effective on _____, 2014 (which is the Effective Date of the Agreement).

OWNER: Board of Public Works and Safety
City of West Lafayette

By: _____

Title: _____

[CORPORATE SEAL]

Attest: _____

Title: _____

Address for giving notices:

711 West Navajo Street

West Lafayette, IN 47906

(If OWNER is a public body, attach evidence of authority to sign and resolution or other documents authorizing execution of Agreement)

Designated Representative:

Name: _____
Title: _____

Address: _____
_____

Phone: _____
Fax: _____

CONTRACTOR: _____
_____

By: _____

Title: _____

[CORPORATE SEAL]

Attest: _____

Title: _____

Address for giving notices:

_____

_____

License No. _____
Agent for service of process: _____
_____

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

Designated Representative:

Name: _____
Title: _____

Address: _____
_____

Phone: _____
Fax: _____

END OF SECTION

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):

CONTRACT
Date:
Amount:
Description (Name and Location):

BOND
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
Company: (Corp. Seal)

Signature: _____
Name and Title:

SURETY
Company: (Corp. Seal)

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

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

CONTRACTOR AS PRINCIPAL
Company: (Corp. Seal)

Signature: _____
Name and Title:

SURETY
Company: (Corp. Seal)

Signature: _____
Name and Title:

EJCDC No. 1910-28-A (1996 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. The CONTRACTOR and the Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to the Owner for the performance of the Contract, which is incorporated herein by reference.

2. If the CONTRACTOR performs the Contract, the Surety and the 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, the Surety's obligation under this Bond shall arise after:

3.1. The OWNER has notified the CONTRACTOR and the Surety at the addresses described in paragraph 10 below, that the OWNER is considering declaring a CONTRACTOR Default and has requested and attempted to arrange a conference with the CONTRACTOR and the Surety to be held not later than fifteen days after receipt of such notice to discuss methods of performing the Contract. If the OWNER, the CONTRACTOR and the Surety agree, the CONTRACTOR shall be allowed a reasonable time to perform the Contract, but such an agreement shall not waive the OWNER's right, if any, subsequently to declare a CONTRACTOR Default; and

3.2. The OWNER has declared a CONTRACTOR Default and formally terminated the CONTRACTOR's right to complete the Contract. Such CONTRACTOR Default shall not be declared earlier than twenty days after the CONTRACTOR and the Surety have received notice as provided in paragraph 3.1; and

3.3. The OWNER has agreed to pay the Balance of the Contract Price to:

3.3.1. The Surety in accordance with the terms of the Contract;

3.3.2 Another contractor selected pursuant to paragraph 4.3 to perform the Contract.

4. When the OWNER has satisfied the conditions of paragraph 3, the Surety shall promptly and at the Surety's expense take one of the following actions:

4.1. Arrange for the CONTRACTOR, with consent of the 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 the OWNER for a contract for performance and completion of the Contract, arrange for a contract to be prepared for execution by the OWNER and the contractor selected with the 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 the OWNER the amount of damages as described in paragraph 6 in excess of the Balance of the Contract Price incurred by the OWNER resulting from the 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;

4.4.1 After investigation, determine the amount for which it may be liable to the OWNER and, as soon as practicable after the amount is determined, tender payment therefor to the OWNER; or

4.4.2 Deny liability in whole or in part and notify the OWNER citing reasons therefor.

5. If the Surety does not proceed as provided in paragraph 4 with reasonable promptness, the Surety shall be deemed to be in default on this Bond fifteen days after receipt of an additional written notice from the OWNER to the Surety demanding that the Surety perform its obligations under this Bond, and the OWNER shall be entitled to enforce any remedy available to the OWNER. If the Surety proceeds as provided in paragraph 4.4, and the OWNER refuses the payment tendered or the Surety has denied liability, in whole or in part, without further notice the OWNER shall be entitled to enforce any remedy available to the OWNER.

6. After the OWNER has terminated the CONTRACTOR's right to complete the Contract, and if the Surety elects to act under paragraph 4.1, 4.2, or 4.3 above, then the responsibilities of the Surety to the OWNER shall not be greater than those of the CONTRACTOR under the Contract, and the responsibilities of the OWNER to the Surety shall not be greater than those of the OWNER under the Contract. To a limit of the amount of this Bond, but subject to commitment by the OWNER of the Balance of the Contract Price to mitigation of costs and damages on the Contract, the Surety is obligated without duplication for:

6.1. The responsibilities of the CONTRACTOR for correction of defective Work and completion of the Contract;

6.2. Additional legal, design professional and delay costs resulting from the CONTRACTOR's Default, and resulting from the actions or failure to act of the Surety under paragraph 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 the CONTRACTOR.

7. The Surety shall not be liable to the OWNER or others for obligations of the 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 the OWNER or its heirs, executors, administrators, or successors.

8. The Surety hereby waives notice of any change, including changes of time, to the 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 the CONTRACTOR ceased working or within two years after the Surety refuses or fails to perform its obligations under this Bond, whichever occurs first. If the provisions of this paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.

10. Notice to the Surety, the OWNER or the 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 or other legal requirement in the location where the Contract was be performed, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted here from and provisions conforming to such statutory or other legal 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 the OWNER to the CONTRACTOR under the Contract after all proper adjustments have been made, including allowance to the CONTRACTOR of any amounts received or to be received by the OWNER in settlement of insurance or other Claims for damages to which the CONTRACTOR is entitled, reduced by all valid and proper payments made to or on behalf of the CONTRACTOR under the Contract.

12.2. Contract: The agreement between the OWNER and the CONTRACTOR identified on the signature page, including all Contract Documents and changes thereto.

12.3. CONTRACTOR Default: Failure of the 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 the OWNER, which has neither been remedied nor waived, to pay the 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)
AGENT or BROKER: OWNER'S REPRESENTATIVE (Engineer or other party):

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):

CONTRACT
Date:
Amount:
Description (Name and Location):

BOND
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
Company: (Corp. Seal)

Signature: _____
Name and Title:

SURETY
Company: (Corp. Seal)

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

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

CONTRACTOR AS PRINCIPAL
Company: (Corp. Seal)

Signature: _____
Name and Title:

SURETY
Company: (Corp. Seal)

Signature: _____
Name and Title:

EJCDC No. 1910-28-B (1996 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. The CONTRACTOR and the Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to the OWNER to pay for labor, materials and equipment furnished for use in the performance of the Contract, which is incorporated herein by reference.

2. With respect to the OWNER, this obligation shall be null and void if the CONTRACTOR:

2.1. Promptly makes payment, directly or indirectly, for all sums due Claimants, and

2.2. Defends, indemnifies and holds harmless the OWNER from all claims, demands, liens or suits by any person or entity who furnished labor, materials or equipment for use in the performance of the Contract, provided the OWNER has promptly notified the CONTRACTOR and the 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 the CONTRACTOR and the Surety, and provided there is no OWNER Default.

3. With respect to Claimants, this obligation shall be null and void if the CONTRACTOR promptly makes payment, directly or indirectly, for all sums due.

4. The Surety shall have no obligation to Claimants under this Bond until:

4.1. Claimants who are employed by or have a direct contract with the CONTRACTOR have given notice to the Surety (at the addresses described in paragraph 12) and sent a copy, or notice thereof, to the 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 the CONTRACTOR:

1. Have furnished written notice to the CONTRACTOR and sent a copy, or notice thereof, to the 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 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 the CONTRACTOR, or not received within 30 days of furnishing the above notice any communication from the CONTRACTOR by which the 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 the Surety and sent a copy, or notice thereof, to the OWNER, stating that a claim is being made under this Bond and enclosing a copy of the previous written notice furnished to the CONTRACTOR.

5. If a notice required by paragraph 4 is given by the OWNER to the CONTRACTOR or to the Surety, that is sufficient compliance.

6. When the Claimant has satisfied the conditions of paragraph 4, the Surety shall promptly and at the Surety's expense take the following actions:

6.1. Send an answer to the Claimant, with a copy to the 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. The 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 the Surety.

8. Amounts owed by the OWNER to the CONTRACTOR under the Contract shall be used for the performance of the Contract and to satisfy claims, if any, under any Performance Bond. By the CONTRACTOR furnishing and the OWNER accepting this Bond, they agree that all funds earned by the CONTRACTOR in the performance of the Contract are dedicated to satisfy obligations of the CONTRACTOR and the Surety under this Bond, subject to the OWNER's priority to use the funds for the completion of the Work.

9. The Surety shall not be liable to the OWNER, Claimants or others for obligations of the CONTRACTOR that are unrelated to the Contract. The 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. The 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 the Surety, the OWNER or the CONTRACTOR shall be mailed or delivered to the addresses shown on the signature page. Actual receipt of notice by Surety, the OWNER or the 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 or other legal requirement in the location where the Contract was to be performed, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal 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, the 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 the CONTRACTOR or with a Subcontractor of the 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 the CONTRACTOR and the CONTRACTOR's Subcontractors, and all other items for which a mechanic's lien may be asserted in the jurisdiction where the labor, materials or equipment were furnished.

15.2. Contract: The agreement between the OWNER and the CONTRACTOR identified on the signature page, including all Contract Documents and changes thereto.

15.3. OWNER Default: Failure of the OWNER, which has neither been remedied nor waived, to pay the 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)
AGENCY or BROKER: OWNER'S REPRESENTATIVE (Engineer or other party):

Maintenance Bond

Instructions:

Successful Bidder must use this form or other form containing the same material conditions and provisions as approved in advance by OWNER.

Date of Bond must not be prior to date of Contract. If CONTRACTOR is a Partnership, all partners should execute bond.

Surety company executing this bond shall appear on the most current list of "Surety Companies Acceptable on Federal Bonds," as specified in the U.S. Treasury Department Circular 570, as amended, and be authorized to transact business in the State of Indiana.

KNOW ALL MEN BY THESE PRESENTS: that

"CONTRACTOR": _____

and

"SURETY": [Name] _____

[Address] _____

a corporation chartered and existing under the laws of the State of _____, and authorized to do business in the State of Indiana,

are held and firmly bound unto the Board of Public Works and Safety, City of West Lafayette, Indiana hereinafter called OWNER, in the penal sum of _____ Dollars, ($ _____) in lawful money of the United States, for the payment of which sum well and truly to be made, together with interest at the maximum legal rate from date of demand and any attorney fees and court costs incurred by Obligee to enforce this instrument, we bind ourselves, successors, and assigns, jointly and severally, firmly by these presents.

WHEREAS, the CONTRACTOR has entered into a certain Agreement with the OWNER, dated as of the _____ day of _____, 20___, by which CONTRACTOR has agreed to perform and furnish certain Work for or in furtherance of construction of public improvements described generally as

West Lafayette, Indiana
Sheraton and Fairway Knolls Lift Station Improvements

which Agreement, and the "Contract Documents" as referred to therein, are hereby incorporated herein by reference;

WHEREAS, CONTRACTOR has installed and completed and met all improvements, installations and requirements applicable to the above described Work, but said improvements and installations have not yet been accepted for public maintenance; and

WHEREAS, the OWNER requires a guarantee from the CONTRACTOR against defective materials and workmanship in connection with such maintenance.

NOW, THEREFORE, CONTRACTOR warrants the workmanship and all materials used in the construction, installation and completion of said Work, including all improvements and installations thereof, to be of good quality and constructed and completed in a workmanlike manner in accordance with the Agreement and Contract Documents and all local, state and federal laws, ordinances, rules, standards and regulations applicable to said Work;

FURTHERMORE, the conditions of the Surety's obligation hereunder are such that if CONTRACTOR at his own expense, for a period of 3 years after said Work, improvements and installations are accepted for public maintenance by the OWNER, shall make all repairs or replacements thereto which may become necessary by reason of improper or defective workmanship or materials, or any failure thereof to conform to the provisions of the Agreement or Contract Documents, then Surety's obligation is to be null and void; otherwise such obligation shall remain in full force and effect. Any repairs or replacements made under this Bond shall in like manner be subject to the terms and conditions hereof.

CONTRACTOR and Surety covenant that all action required by law to be taken by them to authorize the execution and delivery of this Bond have been previously taken, that the officers whose signatures appear below have been fully empowered to execute and deliver this instrument and that once executed and delivered, it shall represent the lawful and binding obligation of the parties.

IN WITNESS WHEREOF, this instrument is executed in _____ (number) counterparts, each of which shall be deemed an original, this the _____ day of _____, 20___.

CONTRACTOR: [Name] _____

By: _____ _____
[Signature] [Printed]

ATTEST:

_____ , _____
[Signature] [Title]

SURETY: [Name] _____

By: _____ , Attorney-in-Fact
[Signature]

_____ _____
[Printed] [Address]

NOTICE TO PROCEED

Dated _____

TO: _____
(CONTRACTOR)

ADDRESS[1]: _____

_____

_____

Contract: Sheraton and Fairway Knolls Lift Station Improvements

Project:_____

OWNER'S CONTRACT NO. _____

You are notified that the Contract Times under the above contract will commence to run on _____. By that date, you are to start performing your obligations under the Contract Documents. In accordance with Article 4 of the Agreement the date of Substantial Completion is _____ and the date of readiness for final payment is_____.

Before you may start any Work at the Site, paragraph 2.05.C of the General Conditions provides that you and Owner must each deliver to the other (with copies to Engineer and other identified additional insureds) certificates of insurance which each is required to purchase and maintain in accordance with the Contract Documents.

Also, before you may start any Work at the Site, you must comply with all requirements within the contract documents.

City of West Lafayette, Indiana
(OWNER)

By: _____
(AUTHORIZED SIGNATURE)

_____
(TITLE)

Copy to ENGINEER

[1](Use Certified Mail, Return Receipt Requested)

EJCDC No. 1910-23 (1996 Edition)
Prepared by the Engineers Joint Contract Documents Committee and endorsed by The Associated General Contractors of America and the Construction Specifications Institute.

(NO TEXT FOR THIS PAGE)

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

Prepared by

ENGINEERS JOINT CONTRACT DOCUMENTS COMMITTEE

and

Issued and Published Jointly By

AMERICAN CONSULTING ENGINEERS COUNCIL

National Society of Professional Engineers
Professional Engineers in Private Practice

AMERICAN SOCIETY OF CIVIL ENGINEERS

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

AMERICAN CONSULTING ENGINEERS COUNCIL

AMERICAN SOCIETY OF CIVIL ENGINEERS

This document has been approved and endorsed by

The Associated General Contractors of America

Construction Specifications Institute

Advancement of Construction Technology

These General Conditions have been prepared for use with the Owner-Contractor Agreements (No. 1910-8-A-1 or 1910-8-A-2) (1996 Editions). 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 User's Guide (No. 1910-50). For guidance in the preparation of Supplementary Conditions, see Guide to the Preparation of Supplementary Conditions (No. 1910-17) (1996 Edition).

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GENERAL CONDITIONS

ARTICLE 1 - DEFINITIONS AND TERMINOLOGY

1.01 *Defined Terms*

A. Wherever used in the Contract Documents and printed with initial or all capital letters, the terms listed below will have the meanings indicated which are applicable to both the singular and plural thereof.

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

2. *Agreement*--The written instrument which is evidence of the agreement between OWNER and CONTRACTOR covering the Work.

3. *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.

4. *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.

5. *Bid*--The offer or proposal of a bidder submitted on the prescribed form setting forth the prices for the Work to be performed.

6. *Bidding Documents*--The Bidding Requirements and the proposed Contract Documents (including all Addenda issued prior to receipt of Bids).

7. *Bidding Requirements*--The Advertisement or Invitation to Bid, Instructions to Bidders, Bid security form, if any, and the Bid form with any supplements.

8. *Bonds*--Performance and payment bonds and other instruments of security.

9. *Change Order*--A document recommended by ENGINEER which is signed by CONTRACTOR and OWNER and authorizes an addition, deletion, or revision in the Work or an adjustment in the Contract Price or the Contract Times, issued on or after the Effective Date of the Agreement.

10. *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.

11. *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.

12. *Contract Documents*--The Contract Documents establish the rights and obligations of the parties and include the Agreement, Addenda (which pertain to the Contract Documents), CONTRACTOR's Bid (including documentation accompanying the Bid and any post Bid documentation submitted prior to the Notice of Award) when attached as an exhibit to the Agreement, the Notice to Proceed, the Bonds, these General Conditions, the Supplementary Conditions, the Specifications and the Drawings as the same are more specifically identified in the Agreement, together with all Written Amendments, Change Orders, Work Change Directives, Field Orders, and ENGINEER's written interpretations and clarifications issued on or after the Effective Date of the Agreement. Approved Shop Drawings and the reports and drawings of subsurface and physical conditions are not Contract Documents. Only printed or hard copies of the items listed in this paragraph are Contract Documents. Files in electronic media format of text, data, graphics, and the like that may be furnished by OWNER to CONTRACTOR are not Contract Documents.

13. *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).

14. *Contract Times*--The number of days or the dates stated in the Agreement to: (i) achieve Substantial Completion; and (ii) complete the Work so that it is ready for final payment as evidenced by ENGINEER's written recommendation of final payment.

15. *CONTRACTOR*--The individual or entity with whom OWNER has entered into the Agreement.

16. *Cost of the Work*--See paragraph 11.01.A for definition.

17. *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.

18. *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.

19. *ENGINEER*--The individual or entity named as such in the Agreement.

20. *ENGINEER's Consultant*--An individual or entity having a contract with ENGINEER to furnish services as ENGINEER's independent professional associate or consultant with respect to the Project and who is identified as such in the Supplementary Conditions.

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 apparent successful bidder stating that upon timely compliance by the apparent 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, entity, public body, or authority with whom CONTRACTOR has entered into the Agreement and for whom the Work is to be performed.

31. *Partial Utilization*--Use by OWNER of a substantially completed part of the Work for the purpose for which it is intended (or a related purpose) prior to Substantial Completion of all the Work.

32. *PCBs*--Polychlorinated biphenyls.

33. *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.

34. *Project*--The total construction of which the Work to be performed under the Contract Documents may be the whole, or a part as may be indicated elsewhere in the Contract Documents.

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. *Resident Project Representative*--The authorized representative of ENGINEER who may be assigned to the Site or any part thereof.

38. *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.

39. *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.

40. *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.

41. *Specifications*--That part of the Contract Documents consisting of written technical descriptions of materials, equipment, systems, standards, and workmanship as applied to the Work and certain administrative details applicable thereto.

42. *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.

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

44. *Supplementary Conditions*--That part of the Contract Documents which amends or supplements these General Conditions.

45. *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.

46. *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.

47. *Unit Price Work*--Work to be paid for on the basis of unit prices.

48. *Work*--The entire completed 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.

49. *Work Change Directive*--A written statement to CONTRACTOR issued on or after the Effective Date of the Agreement and signed by OWNER and recommended by 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.

50. *Written Amendment*--A written statement modifying the Contract Documents, signed by OWNER and CONTRACTOR on or after the Effective Date of the Agreement and normally dealing with the nonengineering or nontechnical rather than strictly construction-related aspects of the Contract Documents.

1.02 *Terminology*

A. *Intent of Certain Terms or Adjectives*

1. Whenever in the Contract Documents the terms "as allowed," "as approved," or terms of like effect or import are used, or 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 action or determination will be solely to evaluate, in general, the completed 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 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 9.10 or any other provision of the Contract Documents.

B. *Day*

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

C. *Defective*

1. The word "defective," when modifying the word "Work," refers to Work that is unsatisfactory, faulty, or deficient in that it does not conform to the Contract Documents or does not meet the requirements of any inspection, reference standard, test, or approval referred to in the Contract Documents, or 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).

D. *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.

E. 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*

A. When CONTRACTOR delivers the executed Agreements to OWNER, CONTRACTOR shall also deliver to OWNER such Bonds as CONTRACTOR may be required to furnish.

2.02 *Copies of Documents*

A. OWNER shall furnish to CONTRACTOR up to ten copies of the Contract Documents. 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. In no event will the Contract Times commence to run later than the sixtieth day after the day of Bid opening or the thirtieth day after the Effective Date of the Agreement, whichever date is earlier.

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. *CONTRACTOR's Review of Contract Documents:* 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; however, 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. *Preliminary Schedules:* Within ten days after the Effective Date of the Agreement (unless otherwise specified

in the General Requirements), CONTRACTOR shall submit to ENGINEER for its timely review:

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

2. a preliminary schedule of Shop Drawing and Sample submittals which will list each required submittal and the times for submitting, reviewing, and processing such submittal; 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.

C. *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.

2.06 *Preconstruction Conference*

A. Within 20 days after the Contract Times start to run, but before any Work at the Site is started, a conference attended by CONTRACTOR, ENGINEER, and others as appropriate will be held to establish a working understanding among the parties as to the Work and to discuss the schedules referred to in paragraph 2.05.B, procedures for handling Shop Drawings and other submittals, processing Applications for Payment, and maintaining required records.

2.07 *Initial Acceptance of Schedules*

A. Unless otherwise provided in the Contract Documents, at least ten 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.B. CONTRACTOR shall have an additional ten 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 any specified Milestones and 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 Shop Drawing and Sample 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 called for by one is as binding as if called for 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, nor shall any such provision or instruction be effective to assign to OWNER, ENGINEER, or any of ENGINEER's Consultants, agents, or employees 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. 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 report it to ENGINEER in writing at once. 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; provided, however, that CONTRACTOR shall not be liable to OWNER or ENGINEER for failure to report any such conflict, error, ambiguity, or discrepancy 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 in one or more of the following ways: (i) a Written Amendment; (ii) a Change Order; or (iii) 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: (i) a Field Order; (ii) ENGINEER's approval of a Shop Drawing or Sample; or (iii) ENGINEER's written interpretation or clarification.

3.05 *Reuse of Documents*

A. CONTRACTOR and any Subcontractor or Supplier or other individual or entity performing or furnishing any of the Work under a direct or indirect contract with OWNER: (i) shall not 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 Consultant, including electronic media editions; and (ii) shall not 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 adaption by ENGINEER. This prohibition will survive final payment, completion, and acceptance of the Work, or termination or completion of the Contract. Nothing herein shall preclude CONTRACTOR from retaining copies of the Contract Documents for record purposes.

ARTICLE 4 - AVAILABILITY OF LANDS; SUBSURFACE AND PHYSICAL 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, 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, ENGINEER, or any of ENGINEER's Consultants 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 9.08 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 in respect of 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 within the time and 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, ENGINEER, and ENGINEER's Consultants 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 of 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, ENGINEER or any of ENGINEER's Consultants 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); 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, ENGINEER, ENGINEER's Consultants and the officers, directors, partners, employees, agents, other 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.E 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, ENGINEER, ENGINEER's Consultants, and the officers, directors, partners, employees, agents, other 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.F 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 are not intended to 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 CONTRACTOR's obligations under the Contract Documents. These Bonds shall remain in effect at least until one year after the date when final payment becomes due, 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 such 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 within 20 days thereafter substitute 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. 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: (i) by any person as a result of an offense directly or indirectly related to the employment of such person by CONTRACTOR, or (ii) 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 so required by this paragraph 5.04 to be purchased and maintained 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 in respect of professional liability) OWNER, ENGINEER, ENGINEER's Consultants, 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, and other 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 6.07, 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 thirty 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 (and 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, OWNER shall purchase and maintain property insurance upon the Work at the Site in the amount of the full replacement cost thereof (subject to such deductible amounts as may be provided in the Supplementary Conditions or required by Laws and Regulations). This insurance shall:

1. include the interests of OWNER, CONTRACTOR, Subcontractors, ENGINEER, ENGINEER's Consultants, and any other individuals or entities identified in the Supplementary Conditions, and the officers, directors, partners, employees, agents, and other 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 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, false work, 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, 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. OWNER 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, ENGINEER, ENGINEER's Consultants, and any other individuals or entities identified in the Supplementary Conditions, 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.

E. If CONTRACTOR requests in writing that other special insurance be included in the property insurance policies provided under paragraph 5.06, OWNER shall, if possible, include such insurance, and the cost thereof will be charged to CONTRACTOR by appropriate Change Order or Written Amendment. Prior to commencement of the Work at the Site, OWNER shall in writing advise CONTRACTOR whether or not such other insurance has been procured by OWNER.

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, ENGINEER, ENGINEER's Consultants, 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, and other 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, and other 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, ENGINEER, ENGINEER's Consultants, 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, and other 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 OWNER as trustee or otherwise payable under any policy so issued.

B. OWNER waives all rights against CONTRACTOR, Subcontractors, ENGINEER, ENGINEER's Consultants, and the officers, directors, partners, employees, agents, and other 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 peril 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, ENGINEER, or ENGINEER's Consultants and the officers, directors, partners, employees, agents, and other 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 OWNER and made payable to OWNER 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. OWNER 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, and the Work and the cost thereof covered by an appropriate Change Order or Written Amendment.

B. OWNER 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 OWNER's exercise of this power. If such objection be made, OWNER 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, OWNER as fiduciary shall adjust and settle the loss with the insurers and, if required in writing by any party in interest, OWNER 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 2.05.C. 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, but 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. CONTRACTOR shall be responsible to see that the completed Work complies accurately with the Contract Documents.

B. At all times during the progress of the Work, CONTRACTOR shall assign a competent resident superintendent thereto 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, lay out, and construct the Work 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, and CONTRACTOR will not permit overtime work or the performance of Work on 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 General Requirements, 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 warranties and guarantees specifically called for 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. 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 (or Milestones). Such adjustments will conform generally to the progress schedule then in effect and additionally will comply with any provisions of the General Requirements applicable thereto.

2. Proposed adjustments in the progress schedule that will change the Contract Times (or Milestones) shall be submitted in accordance with the requirements of Article 12. Such adjustments may only be made by a Change Order or Written Amendment in accordance with Article 12.

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: (i) it is at least equal in quality, durability, appearance, strength, and design characteristics; (ii) it will reliably perform at least equally well the function imposed by the design concept of the completed Project as a functioning whole, and;

b. CONTRACTOR certifies that: (i) there is no increase in cost to the OWNER; and (ii) it will conform substantially, even with deviations, 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 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 first 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 shall certify that the proposed substitute item will perform adequately the functions and achieve the results called for by the general design, be similar in substance to that specified, and be suited to the same use as that specified. The application will state the extent, if any, to which the use of the proposed substitute item will prejudice CONTRACTOR's achievement of Substantial Completion on time, 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 work on the Project) to adapt the design to the proposed substitute item and 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. All variations of the proposed substitute item from that specified will be identified in the application, and available engineering, sales, maintenance, repair, and replacement services will be indicated. The application will also 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, all of which will be considered by ENGINEER in evaluating the proposed substitute item. ENGINEER may require CONTRACTOR to furnish additional data about the proposed substitute item.

B. *Substitute Construction Methods or Procedures:* If a specific means, method, technique, sequence, or procedure of construction is shown or indicated in and 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 procedure for review by ENGINEER will be similar to that provided in subparagraph 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 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 time required by ENGINEER and ENGINEER's Consultants in evaluating substitute proposed or submitted by CONTRACTOR pursuant to paragraphs 6.05.A.2 and 6.05.B and in making changes in the Contract Documents (or in the provisions of any other direct contract with OWNER for work on the Project) occasioned thereby. Whether or not ENGINEER approves a substitute item so proposed or submitted by CONTRACTOR, CONTRACTOR shall reimburse OWNER for the charges of ENGINEER and ENGINEER's Consultants for evaluating each such 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 or Written Amendment signed. 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 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 shall it 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, ENGINEER, ENGINEER's Consultants, 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, and other 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. To the fullest extent permitted by Laws and Regulations, CONTRACTOR shall indemnify and hold harmless OWNER, ENGINEER, ENGINEER's Consultants, and the officers, directors, partners, employees or agents, and other consultants 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. CONTRACTOR shall pay all charges of utility owners for connections to the Work, and OWNER shall pay all charges of such utility owners for capital costs related thereto, such as plant investment fees.

6.09 *Laws and Regulations*

A. CONTRACTOR shall give all notices and 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 may 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, ENGINEER, ENGINEER's Consultant, and the officers, directors, partners, employees, agents, and other consultants 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 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, Written Amendments, 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. 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 ENGINEER's Consultant, 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). 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 to ENGINEER for review and approval in accordance with the acceptable schedule of Shop Drawings and Sample submittals. All submittals will be identified as ENGINEER may require and in the number of copies specified in the General Requirements. The 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.E.

B. CONTRACTOR shall also submit Samples to ENGINEER for review and approval in accordance with the acceptable schedule of Shop Drawings and Sample

submittals. Each Sample will be identified clearly as to material, Supplier, pertinent data such as catalog numbers, and the use for which intended and otherwise as ENGINEER may require to enable ENGINEER to review the submittal for the limited purposes required by paragraph 6.17.E. The numbers of each Sample to be submitted will be as specified in the Specifications.

C. Where a Shop Drawing or Sample is required by the Contract Documents or the schedule of Shop Drawings and Sample submittals acceptable to ENGINEER as required by paragraph 2.07, 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.

D. *Submittal Procedures*

1. Before submitting each Shop Drawing or Sample, CONTRACTOR shall have determined and verified:

a. all field measurements, quantities, dimensions, specified performance criteria, installation requirements, materials, catalog numbers, and similar information with respect thereto;

b. 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 means, methods, techniques, sequences, and procedures of construction and safety precautions and programs incident thereto; and

d. CONTRACTOR 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 indication that CONTRACTOR has satisfied CONTRACTOR's obligations under the Contract Documents with respect to CONTRACTOR's review and approval of that submittal.

3. At the time of each submittal, CONTRACTOR shall give ENGINEER specific written notice of such variations, if any, that the Shop Drawing or Sample submitted may have from the requirements of the Contract Documents, such notice to be in a written communication separate from the submittal; and, in addition, shall cause a specific notation to be made on each Shop Drawing and Sample submitted to ENGINEER for review and approval of each such variation.

E. *ENGINEER's Review*

1. ENGINEER will timely review and approve Shop Drawings and Samples in accordance with the schedule of Shop Drawings and Sample 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 of Shop Drawings or Samples shall not relieve CONTRACTOR from responsibility for any variation from the requirements of the Contract Documents unless CONTRACTOR has in writing called ENGINEER's attention to each such variation at the time of each submittal as required by paragraph 6.17.D.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 approval; nor will any approval by ENGINEER relieve CONTRACTOR from responsibility for complying with the requirements of paragraph 6.17.D.1.

F. *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, ENGINEER, and ENGINEER's Consultants that all Work will be in accordance with the Contract Documents and will not be defective. 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.

B. 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 acceptance by OWNER or any failure to do so;

6. any review and approval of a Shop Drawing or Sample submittal or the issuance of a notice of acceptability by ENGINEER;

7. any inspection, test, or approval by others; or

8. 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, ENGINEER, ENGINEER's Consultants, and the officers, directors, partners, employees, agents, and other 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:

1. 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; and

2. is caused in whole or in part 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, regardless of whether or not caused in part by any negligence or omission of an individual or entity indemnified hereunder or whether liability is imposed upon such indemnified party by Laws and Regulations regardless of the negligence of any such individual or entity.

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 Consultants or to the officers, directors, partners, employees, agents, and other consultants and subcontractors of each and any of them 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.

ARTICLE 7 - OTHER WORK

7.01 *Related Work at Site*

A. OWNER may perform other work related to the Project at the Site by OWNER's employees, or let 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 and each utility owner (and OWNER, if OWNER is performing the other work with OWNER's employees) proper and safe access to the Site and 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. Unless otherwise provided in the Contract Documents, 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. If the proper execution or results of any part of CONTRACTOR's Work depends upon work performed by others under 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.

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 Promptly When Due*

A. OWNER shall make payments to CONTRACTOR promptly 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 9.10, and 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 responsibilities and authority and limitations thereon of any such Resident Project Representative and assistants will be as provided in paragraph 9.10 and in the Supplementary Conditions. 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 *Clarifications and Interpretations*

A. ENGINEER will issue with reasonable promptness such written clarifications or interpretations of the requirements of the Contract Documents as ENGINEER may determine necessary, which shall be consistent with the intent of and reasonably inferable from the Contract Documents. Such written clarifications and interpretations will be binding on OWNER and CONTRACTOR. 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, that should be allowed as a result of a written clarification or interpretation, a Claim may be made therefor as provided in paragraph 10.05.

9.05 *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 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, as a result of a Field Order, a Claim may be made therefor as provided in paragraph 10.05.

9.06 *Rejecting Defective Work*

A. ENGINEER will have authority to disapprove or 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.

9.07 *Shop Drawings, Change Orders and Payments*

A. In connection with ENGINEER's authority as to Shop Drawings and Samples, see paragraph 6.17.

B. In connection with ENGINEER's authority as to Change Orders, see Articles 10, 11, and 12.

C. In connection with ENGINEER's authority as to Applications for Payment, see Article 14.

9.08 *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.

9.09 *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. Claims, disputes and other matters relating to the acceptability of the Work, the quantities and classifications of Unit Price Work, the interpretation of the requirements of the Contract Documents pertaining to the performance of the Work, and Claims seeking changes in the Contract Price or Contract Times will be referred initially to ENGINEER in writing, in accordance with the provisions of paragraph 10.05, with a request for a formal decision.

B. When functioning as interpreter and judge under this paragraph 9.09, 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. The rendering of a decision by ENGINEER pursuant to this paragraph 9.09 with respect to any such Claim, dispute, or other matter (except any which have been waived by the making or acceptance of final payment as provided in paragraph 14.07) will be a condition precedent to any exercise by OWNER or CONTRACTOR of such rights or remedies as either may otherwise have under the Contract Documents or by Laws or Regulations in respect of any such Claim, dispute, or other matter.

9.10 *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 9.10 shall also apply to ENGINEER's Consultants, Resident Project Representative, and assistants.

ARTICLE 10 - CHANGES IN THE WORK; CLAIMS

10.01 *Authorized Changes in the Work*

A. Without invalidating the Agreement and without notice to any surety, OWNER may, at any time or from time to time, order additions, deletions, or revisions in the Work by a Written Amendment, 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 (or Written Amendments) 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 and Disputes*

A. *Notice:* Written notice stating the general nature of each Claim, dispute, or other matter 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. Notice of the amount or extent of the Claim, dispute, or other matter 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, dispute, or other matter). 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).

B. *ENGINEER's Decision:* ENGINEER will render a formal decision in writing within 30 days after receipt of the last submittal of the claimant or the last submittal of the opposing party, if any. ENGINEER's written decision on such Claim, dispute, or other matter will be final and binding upon OWNER and CONTRACTOR unless:

1. an appeal from ENGINEER's decision is taken within the time limits and in accordance with the dispute resolution procedures set forth in Article 16; or

2. if no such dispute resolution procedures have been set forth in Article 16, a written notice of intention to appeal from ENGINEER's written decision is delivered by OWNER or CONTRACTOR to the other and to ENGINEER within 30 days after the date of such decision, and a formal proceeding is instituted by the appealing party in a forum of competent jurisdiction within 60 days after the date of such decision or within 60 days after Substantial Completion, whichever is later (unless otherwise agreed in writing by OWNER and CONTRACTOR), to exercise such rights or remedies as the appealing party may have with respect to such Claim, dispute, or other matter in accordance with applicable Laws and Regulations.

C. If ENGINEER does not render a formal decision in writing within the time stated in paragraph 10.05.B, a decision denying the Claim in its entirety shall be deemed to have been issued 31 days after receipt of the last submittal of the claimant or the last submittal of the opposing party, if any.

D. No Claim for an adjustment in Contract Price or Contract Times (or Milestones) will be valid if not submitted in accordance with this paragraph 10.05.

ARTICLE 11 - COST OF THE WORK; CASH 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 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, expressage, and similar petty cash items in connection with the Work.

i. When the Cost of the Work is used to determine the value of a Change Order or of a Claim, the cost of premiums for additional Bonds and insurance required because of the changes in the Work or caused by the event giving rise to the Claim.

j. When all the Work is performed on the basis of cost-plus, 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, engineers, architects, estimators, attorneys, auditors, accountants, purchasing and contracting agents, expediters, timekeepers, clerks, and other personnel employed by CONTRACTOR, whether at the Site or in CONTRACTOR's principal or branch office for general administration of the Work and not specifically included in the agreed upon schedule of job classifications referred to in paragraph 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 *Cash 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 as may be acceptable to OWNER and ENGINEER. CONTRACTOR agrees that:

1. the allowances include the cost to CONTRACTOR (less any applicable trade discounts) of materials and equipment required by the allowances to be delivered at the Site, and all applicable taxes; and

2. CONTRACTOR's costs for unloading and handling on the Site, labor, installation costs, overhead, profit, and other expenses contemplated for the 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.

B. 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. 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 9.08.

B. 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.

C. OWNER or CONTRACTOR may make a Claim for an adjustment in the Contract Price in accordance with paragraph 10.05 if:

1. the quantity of any item of Unit Price Work performed by CONTRACTOR differs materially and significantly from the estimated quantity of such item indicated in the Agreement; and

2. there is no corresponding adjustment with respect any other item of Work; and

3. if 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 or by a Written Amendment. 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 (or Milestones) may only be changed by a Change Order or by a Written Amendment. Any Claim for an adjustment in the Contract Times (or Milestones) 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 (or Milestones) covered by a Change Order or of any Claim for an adjustment in the Contract Times (or Milestones) will be determined in accordance with the provisions of this Article 12.

12.03 *Delays Beyond CONTRACTOR's Control*

A. Where CONTRACTOR is prevented from completing any part of the Work within the Contract Times (or Milestones) due to delay beyond the control of CONTRACTOR, the Contract Times (or Milestones) 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.

12.04 *Delays Within CONTRACTOR's Control*

A. The Contract Times (or Milestones) will not be extended due to 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.

12.05 *Delays Beyond OWNER's and CONTRACTOR's Control*

A. Where CONTRACTOR is prevented from completing any part of the Work within the Contract Times (or Milestones) due to delay beyond the control of both OWNER and CONTRACTOR, an extension of the Contract Times (or Milestones) in an amount equal to the time lost due to such delay shall be CONTRACTOR's sole and exclusive remedy for such delay.

12.06 *Delay Damages*

A. In no event shall OWNER or ENGINEER be liable to CONTRACTOR, any Subcontractor, any Supplier, or any other person or organization, or to any surety for or employee or agent of any of them, for damages arising out of or resulting from:

1. delays caused by or within the control of CONTRACTOR; or

2. delays beyond the control of both OWNER and CONTRACTOR including but not limited to fires, floods, epidemics, abnormal weather conditions, acts of God, or acts or neglect by utility owners or other contractors performing other work as contemplated by Article 7.

B. Nothing in this paragraph 12.06 bars a change in Contract Price pursuant to this Article 12 to compensate CONTRACTOR due to delay, interference, or disruption directly attributable to actions or inactions of OWNER or anyone for whom OWNER is responsible.

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, ENGINEER's Consultants, 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.B; 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. If it is found that such 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. If, however, such 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 Milestones), 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. 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).

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 Laws or Regulations or 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: (i) repair such defective land or areas, or (ii) correct such defective Work or, if the defective Work has been rejected by OWNER, remove it from the Project and replace it with Work that is not defective, and (iii) 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. If CONTRACTOR does not promptly comply with the terms of such 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, and 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.

B. 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 or by Written Amendment.

C. 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.

D. 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 and remedy any such deficiency.

B. In exercising the rights and remedies under this paragraph, OWNER shall proceed expeditiously. In connection with such corrective and 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 (or Milestones) 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 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 9.08, 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: (i) 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 (ii) 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 to supervise, direct, or control the Work or for the means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for CONTRACTOR's failure to comply with Laws and Regulations applicable to CONTRACTOR's performance of the Work. Additionally, said review or recommendation will not impose responsibility on ENGINEER to make any examination to ascertain how or for what purposes CONTRACTOR has used the moneys paid on account of the Contract Price, or 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 referred to 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 Written Amendment or 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. there are other items entitling OWNER to a set-off against the amount recommended; or

d. 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 must 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. Promptly thereafter, OWNER, CONTRACTOR, and ENGINEER shall make an inspection of the Work to determine the status of completion. If ENGINEER does not consider the Work substantially complete, ENGINEER will notify CONTRACTOR in writing giving the reasons therefor. If ENGINEER considers the Work substantially complete, ENGINEER will prepare and 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. 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 responsibili-

ties 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.

B. OWNER shall have the right to exclude CONTRACTOR from the Site after the date of Substantial Completion, but OWNER shall allow CONTRACTOR reasonable access to complete or correct items on the tentative list.

14.05 *Partial Utilization*

A. Use by OWNER at OWNER's option of 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, may be accomplished prior to Substantial Completion of all the Work subject to the following conditions.

1. OWNER at any time may request CONTRACTOR in writing to permit OWNER to use any such part of the Work which OWNER believes to be ready for its intended use and substantially complete. If 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. 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. 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.

2. No 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 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: (i) all documentation called for in the Contract Documents, including but not limited to the evidence of insurance required by subparagraph 5.04.B.7; (ii) consent of the surety, if any, to final payment; and (iii) 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. *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 will become due and, when due, 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 and recommendation of ENGINEER, and without terminating the Agreement, 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.

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 writing which are 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 allowed 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 the surety, if any) seven days written notice, terminate

the services of CONTRACTOR, 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), 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 finish the Work as OWNER may deem expedient. In such case, CONTRACTOR shall not be entitled to receive any further payment until the Work is finished. 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.

C. 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.

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, elect to terminate the Contract. In such case, CONTRACTOR shall be paid (without duplication of any items):

1. for 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. for 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. for 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. for 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, the Work is suspended for more than 90 consecutive days by OWNER or under an order of court or other public authority, or ENGINEER fails to act on any Application for Payment within 30 days after it is submitted, or 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. 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. Dispute resolution methods and procedures, if any, shall be as set forth in the Supplementary Conditions. If no method and procedure has been set forth, and subject to the provisions of paragraphs 9.09 and 10.05, OWNER and CONTRACTOR may exercise such rights or remedies as either may otherwise have under the Contract Documents or by Laws or Regulations in respect of any dispute.

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 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 if 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, and 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 Agreement.

17.05 *Controlling Law*

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

SECTION 00800

SUPPLEMENTARY CONDITIONS

These Supplementary Conditions amend or supplement the Standard General Conditions of the Construction Contract (No. 1910-8, 1996 Edition) and other provisions of the Contract Documents as indicated below. All provisions which are not so amended or supplemented remain in full force and effect.

The terms used in these Supplementary Conditions which are defined in the Standard General Conditions of the Construction Contract (No. 1910-8, 1996 Edition) have the meaning assigned to them in the General Conditions.

SUPPLEMENTARY CONDITIONS TO ARTICLE 1. DEFINITIONS AND TERMINOLOGY

SC-1.01A.7. In the first sentence of the paragraph 1.01.A.7. of the General Conditions delete "Advertisement or Invitation to Bid" and substitute "Notice to Bidders" therefore.

SC-1.01A.51. Add new paragraph 1.01.A.51., immediately after paragraph 1.01.A.50. of the General Conditions which shall read as follows:

51. "Additional Insureds", except where otherwise expressly defined, shall mean:

Board of Public Works and Safety, City of West Lafayette, Indiana
Greeley and Hansen LLC
Butler Fairman & Seufert, Inc.
Patriot Engineering and Environmental, Inc.
Fink, Roberts, and Petrie, Inc.
RW South, Inc.

SUPPLEMENTARY CONDITIONS TO ARTICLE 2. PRELIMINARY MATTERS

SC-2.02.A. Amend the first sentence of paragraph 2.02.A. of the General Conditions by striking out "ten" and inserting “five”, and as so amended paragraph remains in effect.

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

The Contract Time will commence to run on the day indicated in the Notice to Proceed. In no event will the Contract Time commence to run later than 30 days after the Effective Date of the Agreement.

SUPPLEMENTARY CONDITIONS TO ARTICLE 4. AVAILABILITY OF LANDS; SUBSURFACE AND PHYSICAL CONDITIONS; REFERENCE POINTS

SC-4.02 In the preparation of Drawings and Specifications, ENGINEER relied upon:

4.02.A.1. The following drawings of physical conditions in or relating to existing surface and subsurface structures which are at or contiguous to the site of the work:

West Lafayette, Indiana – Normandy Park Sanitary Sewer dated 1973

The following reports of explorations and tests of subsurface conditions at the site of the work:

A reported dated August 8, 2013, titled "Geotechnical Engineering Investigation - Sheraton & Fairway Lift Station Improvements", prepared by Patriot Engineering and Environmental, Inc., Indianapolis, Indiana.

A reported dated November 18, 2013, titled "Geotechnical Engineering Investigation - Sheraton & Fairway Lift Station Improvements Addendum No. 1", prepared by Patriot Engineering and Environmental, Inc., Indianapolis, Indiana.

A reported dated January 10, 2014, titled "Geotechnical Engineering Investigation - Sheraton & Fairway Lift Station Improvements Addendum No. 2", prepared by Patriot Engineering and Environmental, Inc., Indianapolis, Indiana.

The reports listed above 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.B. of the General Conditions and as identified and established above are incorporated therein by reference. Bidder is not entitled to rely upon other information and data utilized by ENGINEER in the preparation of Drawings and Specifications. These reports may be examined at the office of

Greeley and Hansen, Indianapolis during regular business hours.

SUPPLEMENTARY CONDITIONS TO ARTICLE 5. BONDS AND INSURANCE

SC-5.01 Add the following language at the end of paragraph 5.01A of the General Conditions:

CONTRACTOR shall, as a condition to OWNER's obligation to make final payment, supply a three (3) year Maintenance Bond executed by a surety meeting the qualifications set forth in paragraph 5.01 B of the General Conditions and in such form as prescribed by the Contract Documents, which bond shall secure the obligations contained in paragraph 13.07 of the General Conditions, beginning on the date of Final Acceptance in an amount equal to ten (10) percent of the Contract Price.

SC-5.04 The limits of liability for the insurance required by paragraph 5.04 of the General Conditions shall provide the following coverages for not less than the following amounts or greater where required by Laws and Regulations:

5.04.A.1. and 5.04.A.2. Workers' Compensation, etc. under paragraphs 5.04.A.1. and 5.04.A.2. of the General Conditions:

(1)	State:	Statutory
(2)	Applicable Federal (e.g., Longshoreman's):	Statutory
(3)	Employer's Liability:	$ 1,000,000

5.04.A.3., 5.04.A.4., and 5.04.A.5. Contractor's Liability Insurance under paragraphs 5.04.A.3. through 5.04.A.5. of the General Conditions which shall also include completed operations and product liability coverages and eliminate the exclusion with respect to property under the care, custody and control of CONTRACTOR:

(1)	General Aggregate (Except Products – Completed Operations)	$ 2,000,000
(2)	Products – Completed Operations Aggregate	$ 2,000,000
(3)	Personal and Advertising Injury (Per Person/ Organization)	$ 1,000,000

(4) Each Occurrence (Bodily Injury and Property Damage) $ 1,000,000

(5) Property Damage Liability Insurance will provide Explosion, Collapse and Underground coverage where applicable.

(6) Excess Liability

General Aggregate	$ 6,000,000
Each Occurrence	$ 2,000,000

5.04.A.6. Automobile Liability:

(1) Bodily Injury:

Each Person	$ 500,000
Each Accident	$ 1,000,000
Property Damage:	
Each Accident	$ 500,000

Or

(2) Combined Single Limit (Bodily Injury and Property Damage): $ 1,000,000
Each Accident $ 1,000,000

5.04.B.1. Include on polices as additional insureds:

Board of Public Works and Safety, City of West Lafayette, Indiana
Greeley and Hansen LLC
Butler Fairman & Seufert, Inc.
Patriot Engineering and Environmental, Inc.
Fink, Roberts, and Petrie, Inc.
RW South, Inc.

5.04.B.2. The limits of liability for the insurance required by paragraph 5.04.B.4 of the General Conditions shall provide the following coverages for not less than the following amounts or greater where required by Laws and Regulations:

Contractural Liability:

General Aggregate	$ 2,000,000
Each Occurrence	$ 1,000,000

SC-5.05 Delete paragraph 5.05 of the General Conditions in its entirety and insert the following in its place:

5.05 Contractor shall purchase and maintain until the date of final acceptance, Owners and Contractor's Protective Liability Insurance to protect OWNER, including its employees, officers and agents against claims which may arise from the operations of the Contractor, or his subcontractors. The coverage shall be for not less than the following amounts or greater where required by law or regulation:

Limits per Occurrence	
Bodily Injury/Property Damage	$1,000,000
Personal/Advertising Injury	$1,000,000
General Aggregate Limit per Policy Year except Products/Completed Operations	$3,000,000

This insurance shall also cover the Engineers, Greeley and Hansen, Greeley and Hansen's subconsultants or such other engineer or engineers as may act under the contract, against similar claims.

SC-5.06 Delete paragraph 5.06 of the General Conditions in its entirety and insert the following in its place:

5.06 Property Insurance

A. CONTRACTOR shall purchase and maintain property insurance on the Work in the amount of the full replacement cost thereof (subject to such deductible amounts as may be provided in these Supplementary Conditions or required by Laws and Regulations). This insurance shall:

1. include the interests of OWNER, CONTRACTOR, Subcontractors, ENGINEER, ENGINEER's Consultants and any other persons or entities identified in the Supplementary Conditions, 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 and damage to the Work, temporary buildings, falsework and Work in transit and shall insure against at least the following perils: fire, lightning, extended coverage, theft, vandalism and malicious mischief, earthquake, collapse, debris removal, demolition occasioned by enforcement of Laws and Regulations, water damage, and such

other perils 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 in transit for incorporation in the Work or 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 thirty days written notice to each other additional insured to whom a certificate of insurance has been issued.

The policies of insurance required to be purchased and maintained by CONTRACTOR in accordance with this paragraph 5.06A 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 of the General Conditions.

SUPPLEMENTARY CONDITIONS TO ARTICLE 6. CONTRACTOR'S RESPONSIBILITIES

SC-6.02.B. Add the following after paragraph 6.02.B. of the General Conditions:

1. Work Hours: Perform work between 7:00 a.m. and 7:00 p.m. Mondays through Fridays only. Emergency work may be performed anytime without the OWNER's written consent required in paragraph 6.3

2. Work After Hours: Night work may be established by CONTRACTOR as regular procedure with written consent of OWNER. Such consent, however, may be revoked at any time by

OWNER if CONTRACTOR fails to maintain adequate equipment and supervision for proper prosecution and control of night work.

SC-6.02.C. Add the following after paragraph 6.02.B. of the General Conditions:

1. Overtime Pay for Resident Project Representative:

It is not anticipated that construction observation will exceed 40 hours per week. However, CONTRACTOR shall be responsible for overtime pay (in excess of 40 hours per week) for Resident Project Representative when the overtime is directly related to observation of the construction.

Whenever CONTRACTOR is working on any part of the project, Construction Observation will be required and the appropriate number of Observers must work to properly observe CONTRACTOR's Work. Time spent by Observers in report writing, office work, time sheets and other work not related to actual construction observation will NOT be considered the responsibility of CONTRACTOR.

Compute overtime pay at a rate of one and one-half of the regular rate of pay for Resident Project Representative based on the actual hours worked. Overtime payments will be accumulated monthly and deducted from CONTRACTOR's monthly partial payment estimates.

SC-6.02.D. Add the following after paragraph 6.02.C. of the General Conditions:

1. Payment of Resident Project Representative beyond Construction Contract Completion Time:

CONTRACTOR shall be responsible for both regular and overtime pay for Resident Project Representatives for observation of construction beyond the Contract Completion Time. This requirement is in effect during the time period from the Contract expiration date to the date on which OWNER receive written certification of completion from ENGINEER. CONTRACTOR shall NOT be responsible for Resident Project Representatives pay for authorized time extensions granted by OWNER.

Compute overtime pay at a rate of one and one-half of the regular rate of pay for Resident Project Representatives on actual hours worked. Regular and overtime payments will be accumulated monthly and deducted from CONTRACTOR's monthly partial payment estimates.

SC-6.06.B. Add the following after paragraph 6.06.B. of the General Conditions:

1. Within 15 days after the effective date of the Agreement, CONTRACTOR shall submit to ENGINEER for review a list in duplicate of the names of proposed manufacturers, materialmen, suppliers and subcontractors. Obtain approval of this list by OWNER prior to submission of any shop drawings or product data.

SC-6.08 Add the following 6.08.B, 6.08.C after paragraph 6.08.A. of the General Conditions:

SC-6.08.B. OWNER has obtained the following permits:

1. Indiana Department of Environmental Management Construction Permit

2. Tippecanoe County Soil and Water Conservation District / IDEM Rule 5 General Storm Water Runoff Permit

3. Tippecanoe County Petition to Encroach on a Regulated Drain

SC-6.08.C. CONTRACTOR shall comply with all permit conditions that apply to the Work or execution thereof. Conditions that apply include:

1. Deposition of excavated materials and all earthwork operations will be carried out in such a manner that soil erosion and sediment runoff to any nearby watercourse are controlled and minimized.

2. Compliance with Federal and State laws that require Work to stop and the following offices to be notified if any archaeological artifacts are uncovered during construction:

   Division of Historic Preservation
   (317-232-1646)

   Department of the Army Corps of Engineers
   (313-226-2222)

3. The CONTRACTOR shall not impede the navigation of such waters, nor injure, damage, impair or endanger any bridge, highway, railroad, public work or utility, or the property of a riparian owner, adjoining proprietor or adjacent permittee, nor endanger the safety of the public or lives of individuals.

SC-6.09.D. Add the following new paragraph after paragraph 6.09.C. of the General Conditions which shall read as follows:

D. Financing of this project will be through the State Revolving Fund administered by the Indiana Finance Authority.

SC-6.10 Add the following language at the end of paragraph 6.10 of the General Conditions:

Materials and equipment that are purchased for this project that will become the property of the OWNER are exempt from sales tax. CONTRACTORS purchasing materials or equipment for the project shall register with the Indiana Department of Revenue for the sales tax exemption. To register, a federal tax ID number, a business address and a fee are required.

SC-6.13 Add the following new paragraphs 6.13.A.4., 6.13.A.5., 6.13.A.6., and 6.13.A.7. after paragraph 6.13.A.3. of the General Conditions which shall read as follows:

4. No Duty. The duty of the OWNER or ENGINEER to observe CONTRACTOR's performance does not include any review of the adequacy of CONTRACTOR's safety measures in, on, or near the Work site or sites. ENGINEER has not been retained or compensated to provide design and construction review services relating to CONTRACTOR's safety precautions required for CONTRACTOR to perform the Work.

5. No Liability. Neither the OWNER, nor any official or employee of the OWNER, nor the ENGINEER, or any authorized assistant or agent of any of them, shall be responsible for safety precautions and programs in connection with the Work or any liability arising therefrom.

6. Protection of OWNER’s Operations. The CONTRACTOR shall take all necessary precautions so as to cause no unauthorized interruption in any essential part of the wastewater sewer system. Sewer system operations must be maintained at the same level during construction as existed prior to construction.

Shutdowns for construction Work shall be scheduled in advance (minimum 14 days advance notice), carefully planned, and shall be carried out in close cooperation with the OWNER.

The OWNER shall retain the authority to require the cessation of construction activities and return to service of any component of the wastewater collection system should the need arise.

7. Special Requirements for Structural Design. All structures to be provided by the CONTRACTOR, (except those structures for which details are shown on the Drawings), that require structural design shall be designed and constructed under the observation of a structural engineer, registered in the State of the Project, acting for and retained by the CONTRACTOR. Drawings and calculations for such structures shall be prepared and sealed by the structural engineer and submitted to the ENGINEER for record. A clear outline of the proposed construction procedure shall be shown on the drawings. A statement in writing by the structural engineer attesting that said engineer has visited the Work site or sites, that the design does satisfy the conditions as actually encountered and that the actual construction conforms to the drawings and calculations, as submitted, must be submitted to the ENGINEER before the Work related to such structures will be considered complete.

   All temporary structures, including sheeting and bracing for excavations, that affect the safety of the public, workmen, inspectors, or OWNER's or ENGINEER's personnel shall be regarded as structures that require structural design.

SC-6.17.E Add a new paragraph 6.17.E.4. immediately after paragraph 6.17.E.3. of the General Conditions which is to read as follows:

4. ENGINEER, generally, will process shop drawings and return them to the CONTRACTOR in not more than 10 working days from day of receipt. If the nature of the shop drawing is such that the review cannot be completed in 10 working days, ENGINEER will advise the CONTRACTOR giving a schedule for performing the review.

SC-6.21 Add a new paragraph 6.21 immediately after paragraph 6.20 of the General Conditions which is to read as follows:

6.21 Confined Space Entry

CONTRACTOR shall be responsible for establishing and implementing a confined space entry program in accordance with 29 CFR 1910 and other pertinent laws or regulations. CONTRACTOR shall require all subcontractors to implement and comply with CONTRACTOR’s confined space entry program.

SUPPLEMENTARY CONDITIONS TO ARTICLE 7. OTHER WORK

SC-7.02 Add a new paragraph 7.02.C. immediately after paragraph 7.02.B. of the General Conditions which shall read as follows:

C. Should CONTRACTOR cause damage to the Work or property of any separate CONTRACTOR at the site, or should any claim arising out of CONTRACTOR's performance of the Work at the site be made by any separate contractor against CONTRACTOR, OWNER, ENGINEER, ENGINEER's Consultants, or any other person, CONTRACTOR shall promptly attempt to settle with such other contractor by agreement, or to otherwise resolve the dispute by arbitration or at law. CONTRACTOR shall, to the fullest extent permitted by Laws and Regulations, indemnify and hold OWNER, ENGINEER, and ENGINEER's Consultants harmless from and against all claims, damages, losses and expenses (including, but not limited to, fees of engineers, architects, attorneys and other professionals and court and arbitration costs) arising directly, indirectly or consequentially out of any action, legal or equitable, brought by any separate contractor against OWNER, ENGINEER, or ENGINEER's Consultants to the extent based on a claim arising out of CONTRACTOR's performance of the Work. Should a separate contractor cause damage to the Work or property of CONTRACTOR or should the performance of Work by any separate contractor at the site give rise to any other claim, CONTRACTOR shall not institute any action, legal or equitable, against OWNER, ENGINEER, or ENGINEER's Consultants or permit any action against any of them to be maintained and continued in its name or for its benefit in any court or before any arbiter which seeks to impose liability on or to recover damages from OWNER, ENGINEER, or ENGINEER's Consultants on account of any such damage or claim. If CONTRACTOR is delayed at any time in performing or furnishing Work by any act or neglect of a separate contractor and OWNER and CONTRACTOR are unable to agree as to the extent of any adjustment in Contract Times attributable thereto, CONTRACTOR may make a claim for an extension of times in accordance with Article 12. An extension of the Contract Times shall be CONTRACTOR's exclusive remedy with respect to OWNER, ENGINEER, and ENGINEER's Consultants for any delay, disruption, interference or hindrance caused by any separate contractor. This paragraph does not prevent recovery from OWNER, ENGINEER, or ENGINEER's consultant for activities that are their respective responsibilities.

SUPPLEMENTARY CONDITIONS TO ARTICLE 9. ENGINEER'S STATUS DURING CONSTRUCTION

SC-9.04 Delete the first sentence of paragraph 9.04A of the General Conditions and insert the following in its place:

A. ENGINEER will issue, within five working days of receipt, such written clarifications or interpretations of the requirement of the Contract Documents (in the form of Drawings or otherwise) as ENGINEER may determine necessary, which shall be consistent with the intent of and reasonably inferable from Contract Documents. If ENGINEER determines, based upon the nature of the requested clarification or interpretation, that the response cannot be furnished in five working days, ENGINEER will advise the CONTRACTOR giving a schedule for furnishing the information.

SUPPLEMENTARY CONDITIONS TO ARTICLE 11. COST OF WORK; CASH ALLOWANCES; UNIT PRICE WORK

SC-11.03 Delete paragraph 11.03.C of the General Conditions in its entirety and insert the following in its place:

C. The unit price of an item of Unit Price Work shall be subject to re-evaluation and adjustment under the following conditions:

1. If the total cost of a particular item of Unit Price Work amounts to 5 percent or more 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. If there is no corresponding adjustment with respect to any other item of Work; and

3. If CONTRACTOR believes that CONTRACTOR has incurred additional expense as a result thereof; or if OWNER believes that the quantity variation entitles OWNER to an adjustment in the unit price, either OWNER or CONTRACTOR may make a claim for an adjustment in the Contract Price in accordance with Paragraph 10.05 if the parties are unable to agree as to the effect of any such variations in the quantity of Unit Price Work performed.

SUPPLEMENTARY CONDITIONS TO ARTICLE 12. CHANGE OF CONTRACT PRICE; CHANGE OF CONTRACT TIMES

SC-12.06 Delete paragraph 12.06 of the General Conditions in its entirety and insert the following in its place:

12.06 Delay Damages

A. No claim for payment, compensation or adjustment of any kind (other than the extensions of time provided for herein) shall be made or asserted against the OWNER or ENGINEER by the CONTRACTOR for damages caused by hindrances or delays from any cause, whether such hindrances or delays be avoidable or unavoidable, and the CONTRACTOR shall make no claim for damages by reason of any such hindrances or delays, and will accept in full satisfaction of such hindrances or delays an extension of time to complete the performance of the Work as specified.

SUPPLEMENTARY CONDITIONS TO ARTICLE 13. TESTS AND INSPECTIONS; CORRECTION, REMOVAL OR ACCEPTANCE OF DEFECTIVE WORK

SC-13.03 Delete paragraph 13.03.B of the General Conditions in its entirety and insert the following in its place:

B. Contractor 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 as otherwise specifically provided in the Contract Documents.

SUPPLEMENTARY CONDITIONS TO ARTICLE 14. PAYMENTS TO CONTRACTOR AND COMPLETION

SC-14.05 Add a new paragraph immediately after paragraph 14.05.A.2. of the General Conditions, which is to read as follows:

3. OWNER may at any time request CONTRACTOR in writing to permit OWNER to take over operation of any such part of the Work although it is not substantially complete. A copy of such request will be sent to ENGINEER and within a reasonable time thereafter OWNER, CONTRACTOR and ENGINEER shall make an inspection of that part of the Work to determine its status of completion and will prepare a list of the items remaining to be completed or corrected thereon before final payment. If CONTRACTOR does not object in

writing to OWNER and ENGINEER that such part of the Work is not ready for separate operation by OWNER, ENGINEER will finalize the list of items to be completed or corrected and will deliver such lists to OWNER and CONTRACTOR together with a written recommendation as to the division of responsibilities pending final payment between OWNER and CONTRACTOR with respect to security, operation, safety, maintenance, utilities, insurance warranties and guarantees for that part of the Work which will become binding upon OWNER and CONTRACTOR at the time when OWNER takes over such operation (unless they shall have otherwise agreed in writing and so informed ENGINEER). During such operation and prior to Substantial Completion of such part of the Work, OWNER shall allow CONTRACTOR reasonable access to complete or correct items on said list and to complete other related Work.

SC-14.10 Add a new paragraph immediately after paragraph 14.09 of the General Conditions, which is to read as follows:

14.10 Audits, Access to Records

A. The Contractor shall maintain books, records, documents, and other evidence directly pertinent to performance of work under this agreement in accordance with generally accepted accounting principles and practices consistently applied in effect on the date of execution of this agreement. The Contractor shall also maintain the financial information and data used by the Contractor in the preparation or support of the cost submission required for any negotiated change order and a copy of the cost summary submitted to the OWNER.

B. The OWNER or any of its authorized representatives shall have access to all such books, records, documents, and other evidence for the purpose of inspection, audit and copying during normal business hours. The Contractor will provide proper facilities for such access and inspection.

C. The Contractor agrees to make paragraphs A. through C. of this clause applicable to all negotiated change orders and agreement amendments affecting the agreement price.

D. Audits conducted under this provision shall be in accordance with generally accepted auditing standards.

SUPPLEMENTARY CONDITIONS TO ARTICLE 17. MISCELLANEOUS

SC-17.06 Add a new paragraph immediately after paragraph 17.05 of the General Conditions, which is to read as follows:

17.06 Wage Rates

Wage rates for the Work shall not be less than the prescribed United States Department of Labor, General Decision No. IN140006 attached as **Exhibit A** to these Supplementary Conditions, as modified and in effect on the date of receipt of sealed Bids provided in Section 00100 Notice to Bidders.

Bidders may obtain the wage rates from the following website:

http://www.wdol.gov/dba.aspx
1) Browse All Determinations By State
2) Click on Indiana
3) Select Tippecanoe County – Heavy or Highway

SC-17.07 Add a new paragraph immediately after paragraph 17.06 of the General Conditions, which is to read as follows:

17.07 Disadvantaged Business Enterprise:

The CONTRACTOR shall take all necessary affirmative steps to assure that minority and women's business enterprises are used when possible. Affirmative steps shall include taking the following actions for all of these three (3) types of enterprises:

A. Placing qualified enterprises on solicitation lists.
B. Assuring that these enterprises are solicited whenever they are potential sources.
C. Dividing total requirements, when economically feasible, into smaller tasks or quantities to permit maximum participation by these enterprises.
D. Establishing delivery schedules, where the requirement permits, which encourage participation by these enterprises.
E. Using the services and assistance of the Small Business Administration and the Minority Business Development Agency of the Department of Commerce.
F. Requiring each subcontractor to take the affirmative steps A. through E. above.

Disadvantaged Business Enterprise forms and guidance are attached as **Exhibit B** to the Supplementary Conditions.

SC-17.08 Add a new paragraph immediately after paragraph 17.07 of the General Conditions, which is to read as follows:

17.08 Prohibition of Discrimination

The CONTRACTOR agrees:

A. That in the hiring of employees for the performance of work under this Contract or any subcontract hereunder, no contractor, or subcontractor, nor any person acting on behalf of such contractor or subcontractor, shall, by reason of race, religion, color, sex, national origin or ancestry, discriminate against any citizen of the state of Indiana who is qualified and available to perform the work to which the employment relates;

B. That no contractor, subcontractor, or any person on his behalf shall in any manner, discriminate against or intimidate any employee hired for the performance of work under this contract on account of race, religion, color, sex, national origin or ancestry;

C. That there may be deducted from the amount payable to the contractor under this contract, a penalty of five dollars [$5.00] for each person for each calendar day during which such person was discriminated against or intimidated in violation of the provisions of the Contract; and

D. That this Contract may be canceled or terminated by the OWNER and all money due to become due hereunder may be forfeited, for a second or any subsequent violation of the terms or conditions of this section of the Contract.

SC-17.09 Add a new paragraph immediately after paragraph 17.08 of the General Conditions, which is to read as follows:

17.09 Severability

A. If any portion of the Contract Documents is invalid or unenforceable pursuant to applicable law, such portion shall be void in the jurisdiction where it is invalid or unenforceable, and the remainder of the Contract Documents shall remain binding upon the parties hereto.

SC-17.10 Add a new paragraph immediately after paragraph 17.09 of the General Conditions, which is to read as follows:

17.10 Compliance With E-Verify Program.

A. Pursuant to IC 22-5-1.7, CONTRACTOR shall enroll in and verify the work eligibility status of all newly hired employees of CONTRACTOR through the E-Verify Program ("Program"). CONTRACTOR is not required to verify the work eligibility status of all newly hired employees through the Program if the Program no longer exists.

B. CONTRACTOR and its Subcontractors shall not knowingly employ or contract with an unauthorized alien or retain an employee or contract with a person that CONTRACTOR or its Subcontractor subsequently learns is an unauthorized alien. If CONTRACTOR violates this Section 17.10, OWNER shall require CONTRACTOR to remedy the violation not later than thirty (30) days after OWNER notifies CONTRACTOR. If CONTRACTOR fails to remedy the violation within the thirty (30) day period, OWNER shall terminate the contract for breach of contract. If OWNER terminates the contract, CONTRACTOR shall, in addition to any other contractual remedies, be liable to OWNER for actual damages. There is a rebuttable presumption that CONTRACTOR did not knowingly employ an unauthorized alien if CONTRACTOR verified the work eligibility status of the employee through the Program.

C. If CONTRACTOR employs or contracts with an unauthorized alien but OWNER determines that terminating the contract would be detrimental to the public interest or public property, OWNER may allow the contract to remain in effect until OWNER procures a new contractor.

D. CONTRACTOR shall, prior to performing any work, require each Subcontractor to certify to CONTRACTOR that the Subcontractor does not knowingly employ or contract with an unauthorized alien and has enrolled in the Program. CONTRACTOR shall maintain on file a certification from each Subcontractor throughout the duration of the Project. If CONTRACTOR determines that a Subcontractor is in violation of this Section 17.10, CONTRACTOR may terminate its contract with the Subcontractor for such violation. Such termination may not be considered a breach of contract by CONTRACTOR or the Subcontractor.

E. CONTRACTOR and its Subcontractors shall, prior to performing any work, submit executed affidavits which state they will not knowingly employ illegal aliens. An affidavit (approved by the State Board of Accounts) can be obtained from the following website: http://www.citiesandtowns.org/egov/docs.

END OF SECTION

EXHIBIT A

WAGE RATES

EXHIBIT B

SRF DOCUMENTS

U.S. ENVIRONMENTAL PROTECTION AGENCY

CERTIFICATION OF NONSEGREGATED FACILITIES

(Applicable to federally assisted construction contracts and related subcontracts exceeding $10,000 which are not exempt from the Equal Opportunity clause.)

The federally assisted construction contractor certifies that he does not maintain or provide for his employees any segregated facilities at any of his establishments, and that he does not permit his employees to perform their services at any location, under his control, where segregated facilities are maintained. The federally assisted construction contractor certifies further that he will not maintain or provide for his employees any segregated facilities at any of his establishments, and that he will not permit his employees to perform their services at any location, under his control, where segregated facilities are maintained. The federally assisted construction contractor agrees that a breach of this certification is a violation of the Equal Opportunity clause in this contract. As used in this certification, the term segregated facilities means any waiting rooms, work areas, rest 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 nation origin, because of habit, local custom, or otherwise. The federally assisted construction contractor agrees that (except where he has obtained identical certifications from proposed subcontractors for specific time periods) he 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, and that he will retain such certification in his files.

_____

Signature Date

_____

Name and Title of Signer (Please type)

_____

Firm Name

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

OEE-1 (11/79)

NOTICE TO LABOR UNIONS OR OTHER ORGANIZATIONS OF WORKERS

NONDISCRIMINATION IN EMPLOYMENT

TO:_____
(Name of union or organization of workers)

The undersigned currently holds contract(s) with _____
(Name of Applicant)
involving funds or credit of the U.S. Government or (a) subcontract(s) with a prime contractor holding such contract(s).

You are advised that under the provisions of the above contract(s) or subcontract(s) and in accordance with Executive Order 11246, as amended, dated September 24, 1965, as amended, the undersigned is obliged not to discriminate against any employee or applicant for employment because of race, color, creed, or national origin. This obligation not to discriminate in employment includes, but is not limited to, the following:

> HIRING, PLACEMENT, UPGRADING, TRANSFER, OR DEMOTION, RECRUITMENT, ADVERTISING, OR SOLICITATION FOR EMPLOYMENT, TRAINING DURING EMPLOYMENT, RATES OF PAY OR OTHER FORMS OF COMPENSATION, SELECTION FOR TRAINING INCLUDING APPRENTICESHIP, LAYOFF OR TERMINATION.

This notice is furnished you pursuant to the provisions of the above contract(s) or subcontract(s) and Executive Order 11246, as amended.

Copies of this notice will be posed by the undersigned in conspicuous places available to employees or applicants for employment.

_____
(Contractor or Subcontractor)

_____
(Date)

OEE-2 (11/79)

INDIANA STATE REVOLVING FUND LOAN PROGRAM
DBE PACKET

This packet lists required contract conditions that apply to all Clean Water and Drinking Water State Revolving Fund projects and contains forms that must be used in the procurement process. This packet must be physically included in all bidding and contract documents.

This project is being financed in whole or in part by the Indiana State Revolving Fund Loan Programs. The loan recipient is required to comply with the following federal and state laws, rules and regulations and must ensure that their contractor(s) also comply with these regulations, laws and rules.

1. Title VI of the Civil Rights Act of 1964 (P.L 88-352), the Rehabilitation Act of 1973 (P.L. 93-1123, 87 Stat. 355, 29 U.S.C. Sec. 794), the Older Americans Amendments of 1975 (P.L. 94-135 Sec. 303, 89 Stat. 713, 728, 42 U.S.C. Sec. 6102), and subsequent regulations, ensures access to facilities or programs regardless of race, color, national origin, sex, age or handicap.

2. Executive Orders 11246, as amended by Executive Orders 11375 and 12086 and subsequent regulations. Prohibits employment discrimination on the basis of race, color, religion, sex or national origin. Inclusion of the seven clauses in Section 202 of E. O. 11246 as amended by E. O. 11375 and 12086 are required in all project related contracts and subcontracts over $10,000.

3. Executive Orders 11625, 12138 and 12432; 40 CFR part 33; Section 129 of P. L. 100-590 Small Businesses Reauthorization & Amendment Act of 1988; Public Law 102-389 (42 U.S.C. 437d); a 1993 appropriations act ("EPA's 8% statute"); Public Law 101-549, Title X of the Clean Air Acts Amendments of 1990 (42 U.S.C. 7601 note) ("EPA's 10% statute"). Encourages recipients to award construction, supply and professional service contracts to minority and women's business enterprises (MBE/WBE) and small businesses and requires recipients to utilize affirmative steps in procurement.

4. 40 CFR Part 33 Participation by Disadvantaged Business Enterprises in Procurement under Environmental Protection Agency (EPA) Financial Assistance Agreements

5. Executive Order 12549, 3 CFR, 189 and 40 CFR Part 32, Subparts B and C. Prohibits entering into contracts or sub-contracts with individuals or businesses who are debarred or suspended. Borrowers are required to check the status of all contractors (construction and professional services) and must require contractors to check the status of subcontractors for contracts expected to be equal to or over $25,000 via this Internet address: http://epls.arnet.gov/.

6. Indiana Code 36-1-12-12, Requires the board to withhold final payment to contractor until the contractor has paid the subcontractors, material suppliers, laborers, or those furnishing services.

7. Indiana Code 36-1-12-13.1, requires performance and payments bonds equal to 100% of the contract price if the cost of the public work is estimated to be more than $200,000.

8. Indiana Code 5-16-7-1, requires that contractors of a public work, and any subcontractor of the construction, shall pay for each class of work described in subsection (c)(1) on the project a scale of wages that may not be less than the common construction wage.

Equal Employment

Inclusion of these seven clauses (excerpt from Executive Order No. 11246, Section 202 as amended by Executive Order 11375 and 12086) is required in all CWSRF and DWSRF project related contracts and subcontracts over $10,000:

During the performance of this contract, the contractor agrees as follows:

(1) The contractor will not discriminate against any employee or applicant for employment because of race, color, religion, sex or national origin. The contractor will take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without regard to their race, color, religion, sex, or national origin. Such action shall include, but not be limited to the following: employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided by the contracting officer setting forth the provisions of this nondiscrimination clause.

(2) The contractor will, in all solicitations or advertisements for employees placed by or on behalf of the contractor, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, or national origin.

(3) The contractor will send to each labor union or representative of workers with which he has a collective bargaining agreement or other contract or understanding, a notice, to be provided by the agency contracting officer, advising the labor union or worker's representative of the contractor's commitments under Section 202 of Executive Order No. 11246 of September 24, 1965, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

(4) The contractor will comply with all provisions of Executive Order No. 11246 of Sept. 24, 1965, and all of the rules, regulations, and relevant orders of the Secretary of Labor.

(5) The contractor will furnish all information and reports required by Executive Order No. 11246 of Sept. 24, 1965, and by the rules, regulations and orders of the Secretary of Labor, or pursuant thereto, and will permit access to his books, records, and accounts by the contracting agency and the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations, and orders.

(6) In the event of the contractor's noncompliance with the nondiscrimination clauses of this contract or with any of such rules, regulations, or orders, this contract may be cancelled, terminated or suspended in whole or in part and the contractor may be declared ineligible for

further Government contracts in accordance with procedures authorized in Executive Order No. 11246 of Sept. 24, 1965, and such other sanctions may be imposed and remedies invoked as provided in Executive Order No. 11246 of Sept. 24, 1965, or by rule, regulation, or order of the Secretary of Labor, or as otherwise provided by law.

(7) The contractor will include the provisions of paragraphs (1) through (7) in every subcontract or purchase order unless exempted by rules, regulations, or orders of the Secretary of Labor issued pursuant to Section 204 of Executive Order No. 11246 of Sept. 24, 1965, so that such provisions will be binding upon each subcontractor or vendor. The contractor will take such action with respect to any subcontract or purchase order as may be directed by the Secretary of Labor as a means of enforcing such provisions including sanctions for noncompliance: *Provided, however*, that in the event the contractor becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of such direction, the contractor may request the United States to enter into such litigation to protect the interests of the United States.

Disadvantaged Business Enterprises (DBE)

Good Faith Efforts

Borrowers and their prime contractors must follow, document, and maintain documentation of their good faith efforts to meet the MBW/WBE goals as listed below to ensure that Disadvantage Business Enterprises (DBEs) have the opportunity to participate in the project by increasing DBE awareness of procurement efforts and outreach. In order to become a certified DBE under this rule, an eligible entity must submit an application that can be found by visiting: www.in.gov/indot/div/legal/dbe.

The fair share goal of contracts and subcontracts to be awarded to MBEs and WBEs and their participation in the Contractor's aggregate workforce in each trade on all construction work for the subject project are as follows:

MBEs	7 %
WBEs	5 %

1. Ensure DBEs are made aware of contracting opportunities to the fullest extent practicable through outreach and recruitment activities; including placing DBEs on solicitation lists and soliciting them whenever they are potential sources.

2. Make information on forthcoming opportunities available to DBEs and arrange time frames for contracts and establish delivery schedules, where the requirements permit, in a way that encourages and facilitates participation by DBEs in the competitive process. This includes, whenever possible, posting solicitation for bids or proposals for a minimum of 30 calendar days before the bid or proposal closing date.

3. Consider in the contracting process whether firms competing for large contracts could be subcontracted with DBEs. This will include dividing total requirements when economically feasible into smaller tasks or quantities to permit maximum participation by DBEs in the competitive process.

4. Encourage contracting with a consortium of DBEs when a contract is too large for one of these firms to handle individually.

5. Use the services and assistance of the Small Business Administration and the Minority Business Development Agency of the U. S. Department of Commerce.

6. If the prime contractor awards subcontracts, require the prime contractor to take the steps in numbers 1 through 5 above.

Required Contract Conditions

These conditions must be included in all procurement contracts entered into by the loan recipient for all DWSRF and CWSRF projects:

1. The prime contractor must pay its subcontractor for satisfactory performance no more than 30 days from the prime contractor's receipt of payment from the loan recipient.

2. The prime contractor must notify the loan recipient in writing prior to the termination of any DBE subcontractor for convenience by the prime contractor.

3. If a DBE subcontractor fails to complete work under the subcontract for any reason, the prime contractor must employ the six good faith efforts if soliciting a replacement subcontractor.

4. The prime contractor must employ the six good faith efforts even if the prime contractor has achieved its fair share objectives.

5. Each procurement contract signed must include the following term and condition:

   "The contractor shall not discriminate on the basis of race, color, national origin or sex in the performance of this contract. The contractor shall carry out applicable requirements of 40 CFR Part 33 in the award and administration of contracts awarded under EPA financial assistance agreements. Failure by the contractor to carry out these requirements is a material breach of this contract which may result in the termination of this contract or other legally available remedies."

United States Environmental Protection Agency

OMB Control No: 2090-0030
Approved: 8/13/2013
Approval Expires: 8/31/2015

Disadvantaged Business Enterprise (DBE) Program
DBE Subcontractor Participation Form

An EPA Financial Assistance Agreement Recipient must require its prime contractors to provide this form to its DBE subcontractors. This form gives a DBE[1] subcontractor[2] the opportunity to describe work received and/or report any concerns regarding the EPA-funded project (e.g., in areas such as termination by prime contractor, late payments, etc.). The DBE subcontractor can, as an option, complete and submit this form to the EPA DBE Coordinator at any time during the project period of performance.

Subcontractor Name	Project Name	
Bid/ Proposal No.	Assistance Agreement ID No. (if known)	Point of Contact
Address		
Telephone No.	Email Address	
Prime Contractor Name	Issuing/Funding Entity:	

Contract Item Number	Description of Work Received from the Prime Contractor Involving Construction, Services , Equipment or Supplies	Amount Received by Prime Contractor

[1] A DBE is a Disadvantaged, Minority, or Woman Business Enterprise that has been certified by an entity from which EPA accepts certifications as described in 40 CFR 33.204-33.205 or certified by EPA. EPA accepts certifications from entities that meet or exceed EPA certification standards as described in 40 CFR 33.202.

[2] Subcontractor is defined as a company, firm, joint venture, or individual who enters into an agreement with a contractor to provide services pursuant to an EPA award of financial assistance.

United States Environmental Protection Agency

OMB Control No: 2090-0030
Approved: 8/13/2013
Approval Expires: 8/31/2015

Disadvantaged Business Enterprise (DBE) Program
DBE Subcontractor Participation Form

Please use the space below to report any concerns regarding the above EPA-funded project:

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

Subcontractor Signature	Print Name
Title	**Date**

The public reporting and recordkeeping burden for this collection of information is estimated to average three (3) hours per response. Send comments on the Agency's need for this information, the accuracy of the provided burden estimates, and any suggested methods for minimizing respondent burden, including through the use of automated collection techniques to the Director, Collection Strategies Division, U.S. Environmental Protection Agency (2822T), 1200 Pennsylvania Ave., NW, Washington, D.C. 20460. Include the OMB control number in any correspondence. Do not send the completed form to this address.

United States Environmental Protection Agency

OMB Control No: 2090-0030
Approved: 8/13/2013
Approval Expires: 8/31/2015

Disadvantaged Business Enterprise (DBE) Program
DBE Subcontractor Performance Form

This form is intended to capture the DBE[1] subcontractor's[2] description of work to be performed and the price of the work submitted to the prime contractor. An EPA Financial Assistance Agreement Recipient must require its prime contractor to have its DBE subcontractors complete this form and include all completed forms in the prime contractors bid or proposal package.

Subcontractor Name	Project Name	
Bid/ Proposal No.	Assistance Agreement ID No. (if known)	Point of Contact
Address		
Telephone No.	Email Address	
Prime Contractor Name	Issuing/Funding Entity:	

Contract Item Number	Description of Work Submitted to the Prime Contractor Involving Construction, Services , Equipment or Supplies	Price of Work Submitted to the Prime Contractor

DBE Certified By: ___ DOT ___ SBA ___ Other: _____	Meets/ exceeds EPA certification standards? ___ YES ___ NO ___ Unknown

[1] A DBE is a Disadvantaged, Minority, or Woman Business Enterprise that has been certified by an entity from which EPA accepts certifications as described in 40 CFR 33.204-33.205 or certified by EPA. EPA accepts certifications from entities that meet or exceed EPA certification standards as described in 40 CFR 33.202.

[2] Subcontractor is defined as a company, firm, joint venture, or individual who enters into an agreement with a contractor to provide services pursuant to an EPA award of financial assistance.

United States Environmental Protection Agency

OMB Control No: 2090-0030
Approved: 8/13/2013
Approval Expires: 8/31/2015

Disadvantaged Business Enterprise (DBE) Program
DBE Subcontractor Performance Form

I certify under penalty of perjury that the forgoing statements are true and correct. Signing this form does not signify a commitment to utilize the subcontractors above. I am aware of that in the event of a replacement of a subcontractor, I will adhere to the replacement requirements set forth in 40 CFR Part 33 Section 33.302 (c).

Prime Contractor Signature	Print Name
Title	**Date**

Subcontractor Signature	Print Name
Title	**Date**

The public reporting and recordkeeping burden for this collection of information is estimated to average three (3) hours per response. Send comments on the Agency's need for this information, the accuracy of the provided burden estimates, and any suggested methods for minimizing respondent burden, including through the use of automated collection techniques to the Director, Collection Strategies Division, U.S. Environmental Protection Agency (2822T), 1200 Pennsylvania Ave., NW, Washington, D.C. 20460. Include the OMB control number in any correspondence. Do not send the completed form to this address.

United States Environmental Protection Agency

OMB Control No: 2090-0030
Approved: 8/13/2013
Approval Expires: 8/31/2015

Disadvantaged Business Enterprise (DBE) Program
DBE Subcontractor Utilization Form

This form is intended to capture the prime contractor's actual and/or anticipated use of identified certified DBE[1] subcontractors[2] and the estimated dollar amount of each subcontract. An EPA Financial Assistance Agreement Recipient must require its prime contractors to complete this form and include it in the bid or proposal package. Prime contractors should also maintain a copy of this form on file.

Prime Contractor Name		Project Name
Bid/ Proposal No.	Assistance Agreement ID No. (if known)	Point of Contact
Address		
Telephone No.		Email Address
Issuing/Funding Entity:		

I have identified potential DBE certified subcontractors	___ YES	___ NO
If yes, please complete the table below. If no, please explain:		

Subcontractor Name/ Company Name	**Company Address/ Phone/ Email**	**Est. Dollar Amt**	**Currently DBE Certified?**

Continue on back if needed

[1] A DBE is a Disadvantaged, Minority, or Woman Business Enterprise that has been certified by an entity from which EPA accepts certifications as described in 40 CFR 33.204-33.205 or certified by EPA. EPA accepts certifications from entities that meet or exceed EPA certification standards as described in 40 CFR 33.202.

[2] Subcontractor is defined as a company, firm, joint venture, or individual who enters into an agreement with a contractor to provide services pursuant to an EPA award of financial assistance.

United States Environmental Protection Agency

OMB Control No: 2090-0030
Approved: 8/13/2013
Approval Expires: 8/31/2015

Disadvantaged Business Enterprise (DBE) Program
DBE Subcontractor Utilization Form

I certify under penalty of perjury that the forgoing statements are true and correct. Signing this form does not signify a commitment to utilize the subcontractors above. I am aware of that in the event of a replacement of a subcontractor, I will adhere to the replacement requirements set forth in 40 CFR Part 33 Section 33.302 (c).

Prime Contractor Signature	Print Name
Title	**Date**

The public reporting and recordkeeping burden for this collection of information is estimated to average three (3) hours per response. Send comments on the Agency's need for this information, the accuracy of the provided burden estimates, and any suggested methods for minimizing respondent burden, including through the use of automated collection techniques to the Director, Collection Strategies Division, U.S. Environmental Protection Agency (2822T), 1200 Pennsylvania Ave., NW, Washington, D.C. 20460. Include the OMB control number in any correspondence. Do not send the completed form to this address.

BIDDER'S LIST FORM

OWNER _____ **LOAN NO:**_____

PROJECT TITLE_____ **BID DATE:**_____

Instructions:
1. This list must include all firms that bid or quote on prime or subcontracts under EPA assisted projects (i.e. SRF Projects), included both MBE/WBE's and non MBE/WBE's
2. SRF loan participants must keep the Bidder's List until the project period for the identified loan has ended and no funds are remianing.
3. This list must be submitted to Doris Roberson, along with the post-bid documents. Contract Award Approval cannot be given until this form has been received by SRF.
4. The following information must be obtained from all prime and sub-contractor's. Please complete the form below:

ENTITY'S NAME	MAILING ADDRESS	CONTACT PERSON	Phone#	E-MAIL ADDRESS	M/WBE?

SRF ADDENDUM

Attachment A: Form WH-347
Attachment B: Required Contract Provisions Related to Davis-Bacon Act and Related Acts
Attachment C: Required Contract Provisions Related to Wage-Fringe Benefit Certification
Attachment D: IFA Wage-Fringe Benefit Certification Form
Attachment E: Required Contract Provision Related to Suspension and Debarment
Attachment F: Required Bid Instruction Related to GPR Components
Attachment G: GPR Bid Breakdown
Attachment H: GPR Final Bid Summary
Attachment I: Required Contract Provisions Related to American Iron and Steel
Attachment J: Required Certification from Contract Related to American Iron and Steel

Attachment A

U.S. Department of Labor
Wage and Hour Division

PAYROLL

(For Contractor's Optional Use; See Instructions at www.dol.gov/whd/forms/wh347instr.htm)

Persons are not required to respond to the collection of information unless it displays a currently valid OMB control number.

U.S. Wage and Hour Division

Rev. Dec. 2008

NAME OF CONTRACTOR ☐ OR SUBCONTRACTOR ☐

ADDRESS

OMB No.: 1215-0149
Expires: 12/31/2011

PAYROLL NO.

FOR WEEK ENDING

PROJECT AND LOCATION

PROJECT OR CONTRACT NO.

(1) NAME AND INDIVIDUAL IDENTIFYING NUMBER (e.g., LAST FOUR DIGITS OF SOCIAL SECURITY NUMBER) OF WORKER	(2) NO. OF WITHHOLDING EXEMPTIONS	(3) WORK CLASSIFICATION	OT. OR ST.	(4) DAY AND DATE / HOURS WORKED EACH DAY							(5) TOTAL HOURS	(6) RATE OF PAY	(7) GROSS AMOUNT EARNED	(8) DEDUCTIONS FICA	WITH-HOLDING TAX			OTHER	TOTAL DEDUCTIONS	(9) NET WAGES PAID FOR WEEK
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While completion of Form WH-347 is optional, it is mandatory for covered contractors and subcontractors performing work on Federally financed or assisted construction contracts to respond to the information collection contained in 29 C.F.R. §§ 3.3, 5.5(a). The Copeland Act (40 U.S.C. § 3145) contractors and subcontractors performing work on Federally financed or assisted construction contracts to "furnish weekly a statement with respect to the wages paid each employee during the preceding week." U.S. Department of Labor (DOL) regulations at 29 C.F.R. § 5.5(a)(3)(ii) require contractors to submit weekly a copy of all payrolls to the Federal agency contracting for or financing the construction project, accompanied by a signed "Statement of Compliance" indicating that the payrolls are correct and complete and that each laborer or mechanic has been paid not less than the proper Davis-Bacon prevailing wage rate for the work performed. DOL and federal contracting agencies receiving this information review the information to determine that employees have received legally required wages and fringe benefits.

Public Burden Statement

We estimate that is will take an average of 55 minutes to complete this collection, including time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. If you have any comments regarding these estimates or any other aspect of this collection, including suggestions for reducing this burden, send them to the Administrator, Wage and Hour Division, U.S. Department of Labor, Room S3502, 200 Constitution Avenue, N.W. Washington, D.C. 20210

(over)

Date _____

I, _____ _____
(Name of Signatory Party) (Title)

do hereby state:

(1) That I pay or supervise the payment of the persons employed by

_____ on the
(Contractor or Subcontractor)

_____; that during the payroll period commencing on the
(Building or Work)

_____ day of _____, _____, and ending the _____ day of _____, _____,

all persons employed on said project have been paid the full weekly wages earned, that no rebates have been or will be made either directly or indirectly to or on behalf of said

_____ from the full
(Contractor or Subcontractor)

weekly wages earned by any person and that no deductions have been made either directly or indirectly from the full wages earned by any person, other than permissible deductions as defined in Regulations, Part 3 (29 C.F.R. Subtitle A), issued by the Secretary of Labor under the Copeland Act, as amended (48 Stat. 948, 63 Start. 108, 72 Stat. 967; 76 Stat. 357; 40 U.S.C. § 3145), and described below:

_____

_____

_____

_____

(2) That any payrolls otherwise under this contract required to be submitted for the above period are correct and complete; that the wage rates for laborers or mechanics contained therein are not less than the applicable wage rates contained in any wage determination incorporated into the contract; that the classifications set forth therein for each laborer or mechanic conform with the work he performed.

(3) That any apprentices employed in the above period are duly registered in a bona fide apprenticeship program registered with a State apprenticeship agency recognized by the Bureau of Apprenticeship and Training, United States Department of Labor, or if no such recognized agency exists in a State, are registered with the Bureau of Apprenticeship and Training, United States Department of Labor.

(4) That:

(a) WHERE FRINGE BENEFITS ARE PAID TO APPROVED PLANS, FUNDS, OR PROGRAMS

☐ – in addition to the basic hourly wage rates paid to each laborer or mechanic listed in the above referenced payroll, payments of fringe benefits as listed in the contract have been or will be made to appropriate programs for the benefit of such employees, except as noted in section 4(c) below.

(b) WHERE FRINGE BENEFITS ARE PAID IN CASH

☐ – Each laborer or mechanic listed in the above referenced payroll has been paid, as indicated on the payroll, an amount not less than the sum of the applicable basic hourly wage rate plus the amount of the required fringe benefits as listed in the contract, except as noted in section 4(c) below.

(c) EXCEPTIONS

EXCEPTION (CRAFT)	EXPLANATION

REMARKS:

NAME AND TITLE	SIGNATURE

THE WILLFUL FALSIFICATION OF ANY OF THE ABOVE STATEMENTS MAY SUBJECT THE CONTRACTOR OR SUBCONTRACTOR TO CIVIL OR CRIMINAL PROSECUTION. SEE SECTION 1001 OF TITLE 18 AND SECTION 231 OF TITLE 31 OF THE UNITED STATES CODE.

Attachment B

Required Contract Provisions Related to Davis-Bacon Act and Related Acts

Provisions substantially like the following shall be included in each procurement contract for the actual construction, attention and/or repair, including painting and decorating. The SRF Applicant shall remain responsible for compliance with applicable law (including Davis Bacon and related Acts). Such SRF Applicant has been encouraged to consult with its advisors and counsel regarding such matters and, in any event, understands that the use of the following does not relieve the SRF Applicant from its obligation to comply with applicable law (including Davis Bacon and related Acts) and related provisions of any financial assistance agreement entered into with the Indiana Finance Authority, nor will the State Revolving Fund Loan Programs, the Indiana Finance Authority or the State of Indiana be responsible for or limited by any SRF Applicant's use of the following provision.

(1) Minimum wages.

(i) All laborers and mechanics employed or working upon the site of the work will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act (29 CFR part 3)), the full amount of wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the contractor and such laborers and mechanics.

Contributions made or costs reasonably anticipated for bona fide fringe benefits under section 1(b)(2) of the Davis-Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of paragraph (1)(iv) of this section; also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period. Such laborers and mechanics shall be paid the appropriate wage rate and fringe benefits on the wage determination for the classification of work actually performed, without regard to skill, except as provided in Section (4). Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein: Provided, That the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classification and wage rates conformed under paragraph (1)(ii) of this section) and the Davis-Bacon poster (WH-1321) shall be posted at all times by the contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers.

(ii)(A) The **[SRF Applicant]**, on behalf of EPA, shall require that any class of laborers or mechanics, including helpers, which is not listed in the wage determination and which is to be employed under the contract shall be classified in conformance with the wage determination.

The EPA award official shall approve an additional classification and wage rate and fringe benefits therefore only when the following criteria have been met:

(1) The work to be performed by the classification requested is not performed by a classification in the wage determination; and

(2) The classification is utilized in the area by the construction industry; and

(3) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.
(B) If the contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the **[SRF Applicant]** agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), a report of the action taken shall be sent by the **[SRF Applicant]** to the State award official. The State award official will transmit the report, to the Administrator of the Wage and Hour Division, Employment Standards Administration, U.S. Department of Labor, Washington, DC 20210. The Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification action within 30 days of receipt and so advise the State award official or will notify the State award official within the 30-day period that additional time is necessary.

(C) In the event the contractor, the laborers or mechanics to be employed in the classification or their representatives, and the and the **[SRF Applicant]** do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the award official shall refer the questions, including the views of all interested parties and the recommendation of the State award official, to the Administrator for determination. The Administrator, or an authorized representative, will issue a determination within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

(D) The wage rate (including fringe benefits where appropriate) determined pursuant to paragraphs (1)(ii)(B) or (C) of this section, shall be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.

(iii) Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the contractor shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly cash equivalent thereof.

(iv) If the contractor does not make payments to a trustee or other third person, the contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program, provided, that the Secretary of Labor has found, upon the written request of the contractor, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.

(2) Withholding. The **[SRF Applicant]**, shall upon written request of the EPA Award Official or an authorized representative of the Department of Labor, withhold or cause to be withheld from the contractor under this contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to Davis-Bacon prevailing wage requirements, which is held by the same prime contractor, so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees, and helpers, employed by the contractor or any subcontractor the full amount of wages required by the contract. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee, or helper, employed or working on the site of the work, all or part of the wages required by the contract, the (Agency) may, after written notice to the contractor, sponsor, applicant, or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

(3) Payrolls and basic records.

(i) Payrolls and basic records relating thereto shall be maintained by the contractor during the course of the work and preserved for a period of three years thereafter for all laborers and mechanics working at the site of the work. Such records shall contain the name, address, and social security number of each such worker, his or her correct classification, hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in section 1(b)(2)(B) of the Davis-Bacon Act), daily and weekly number of hours worked, deductions made and actual wages paid. Whenever the Secretary of Labor has found under 29 CFR 5.5(a)(1)(iv) that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in section 1(b)(2)(B) of the Davis-Bacon Act, the contractor shall maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits. Contractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of the apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs.

(ii)(A) The contractor shall submit weekly, for each week in which any contract work is performed, a copy of all payrolls to the **[SRF Applicant]**, that is, the entity that receives the sub-grant or loan from the State capitalization grant recipient. Such documentation shall be available on request of the State recipient or EPA. As to each payroll copy received, the **[SRF Applicant]** shall provide written confirmation in a form satisfactory to the State indicating whether or not the project is in compliance with the requirements of 29 CFR 5.5(a)(1) based on the most recent payroll copies for the specified week. The payrolls shall set out accurately and completely all of the information required to be maintained under 29 CFR 5.5(a)(3)(i), except that full social security numbers and home addresses shall not be included on the weekly payrolls. Instead the payrolls shall only need to include an individually identifying number for each employee (e.g., the last four digits of the employee's social security number). The required weekly payroll information may be submitted in any form desired. Optional Form WH-347 is available for this purpose from the Wage and Hour Division Web site at http://www.dol.gov/esa/whd/forms/wh347instr.htm or its successor site. The prime contractor is responsible for the submission of copies of payrolls by all subcontractors. Contractors and

subcontractors shall maintain the full social security number and current address of each covered worker, and shall provide them upon request to the **[SRF Applicant]** for transmission to the State or EPA if requested by EPA, the State, the contractor, or the Wage and Hour Division of the Department of Labor for purposes of an investigation or audit of compliance with prevailing wage requirements. It is not a violation of this section for a prime contractor to require a subcontractor to provide addresses and social security numbers to the prime contractor for its own records, without weekly submission to the **[SRF Applicant]**.

(B) Each payroll submitted shall be accompanied by a "Statement of Compliance," signed by the contractor or subcontractor or his or her agent who pays or supervises the payment of the persons employed under the contract and shall certify the following:

(1) That the payroll for the payroll period contains the information required to be provided under § 5.5(a)(3)(ii) of Regulations, 29 CFR part 5, the appropriate information is being maintained under § 5.5 (a)(3)(i) of Regulations, 29 CFR part 5, and that such information is correct and complete;

(2) That each laborer or mechanic (including each helper, apprentice, and trainee) employed on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in Regulations, 29 CFR part 3; and

(3) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification of work performed, as specified in the applicable wage determination incorporated into the contract.

(C) The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 shall satisfy the requirement for submission of the "Statement of Compliance" required by paragraph (3)(ii)(B) of this section.

(D) The falsification of any of the above certifications may subject the contractor or subcontractor to civil or criminal prosecution under section 1001 of title 18 and section 231 of title 31 of the United States Code.

(iii) The contractor or subcontractor shall make the records required under paragraph (3)(i) of this section available for inspection, copying, or transcription by authorized representatives of the State, EPA or the Department of Labor, and shall permit such representatives to interview employees during working hours on the job. If the contractor or subcontractor fails to submit the required records or to make them available, the Federal agency or State may, after written notice to the contractor, sponsor, applicant, or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to **[SRF Applicant]**.

(4) Apprentices and trainees.

(i) Apprentices. Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Office of Apprenticeship Training, Employer and Labor Services, or with a State Apprenticeship Agency recognized by the Office, or if a person is employed in his or her first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Office of Apprenticeship Training, Employer and Labor Services or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice. The allowable ratio of apprentices to journeymen on the job site in any craft classification shall not be greater than the ratio permitted to the contractor as to the entire work force under the registered program. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated above, shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where a contractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman's hourly rate) specified in the contractor is or subcontractor's registered program shall be observed. Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeymen hourly rate specified in the applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination. In the event the Office of Apprenticeship Training, Employer and Labor Services, or a State Apprenticeship Agency recognized by the Office, withdraws approval of an apprenticeship program, the contractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(ii) Trainees. Except as provided in 29 CFR 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification by the U.S. Department of Labor, Employment and Training Administration. The ratio of trainees to journeymen on the job site shall not be greater than permitted under the plan approved by the Employment and Training Administration. Every trainee must be paid at not less than the rate specified in the approved program for the trainee's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed on the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding journeyman wage rate on the wage determination which provides for less than full fringe benefits for apprentices. Any employee listed on the payroll at a trainee rate who is not registered and participating in a training plan approved by the Employment and Training Administration shall be paid not less than the applicable wage rate on the wage determination for the classification of

work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. In the event the Employment and Training Administration withdraws approval of a training program, the contractor will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(iii) Equal employment opportunity. The utilization of apprentices, trainees and journeymen under this part shall be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended, and 29 CFR part 30.

(5) Compliance with Copeland Act requirements. The contractor shall comply with the requirements of 29 CFR part 3, which are incorporated by reference in this contract.

(6) Subcontracts. The contractor or subcontractor shall insert in any subcontracts the clauses contained in 29 CFR 5.5(a)(1) through (10) and such other clauses as the governing federal agency may by appropriate instructions require, and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for the compliance by any subcontractor or lower tier subcontractor with all the contract clauses in 29 CFR 5.5.

(7) Contract termination: debarment. A breach of the contract clauses in 29 CFR 5.5 may be grounds for termination of the contract, and for debarment as a contractor and a subcontractor as provided in 29 CFR 5.12.

(8) Compliance with Davis-Bacon and Related Act requirements. All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 CFR parts 1, 3, and 5 are herein incorporated by reference in this contract.

(9) Disputes concerning labor standards. Disputes arising out of the labor standards provisions of this contract shall not be subject to the general disputes clause of this contract. Such disputes shall be resolved in accordance with the procedures of the Department of Labor set forth in 29 CFR parts 5, 6, and 7. Disputes within the meaning of this clause include disputes between the contractor (or any of its subcontractors) and Subrecipient(s), State, EPA, the U.S. Department of Labor, or the employees or their representatives.

(10) Certification of eligibility.

(i) By entering into this contract, the contractor certifies that neither it (nor he or she) nor any person or firm who has an interest in the contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(ii) No part of this contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(iii) The penalty for making false statements is prescribed in the U.S. Criminal Code, 18 U.S.C. 1001.

(11) Overtime requirements. No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers, mechanics, watchmen and guards shall require or permit any such laborer, mechanic, watchman or guard in any workweek in which he or she is employed on such work to work in excess of forty hours in such workweek unless such laborer, mechanic, watchman or guard receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek.

(12) Violation; liability for unpaid wages; liquidated damages. In the event of any violation of the clause set forth in the above paragraph (11) of this section the contractor and any subcontractor responsible therefor shall be liable for the unpaid wages. In addition, such contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer, mechanic, watchman or guard employed in violation of the clause set forth in the above paragraph (11) of this section, in the sum of $10 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty hours without payment of the overtime wages required by the clause set forth in the above paragraph (11) of this section.

(13) Withholding for unpaid wages and liquidated damages. The **[SRF Applicant]**, upon written request of the EPA Award Official or an authorized representative of the Department of Labor, shall withhold or cause to be withheld, from any moneys payable on account of work performed by the contractor or subcontractor under any such contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same prime contractor, such sums as may be determined to be necessary to satisfy any liabilities of such contractor or subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in the above paragraph (12) of this section.

(14) Subcontracts. The contractor or subcontractor shall insert in any subcontracts the clauses set forth in paragraphs (11) through (14) of this section and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in paragraphs (11) through (14) of this section.

(b) In addition to the clauses contained in paragraph (13), above, in any contract subject only to the Contract Work Hours and Safety Standards Act and not to any of the other statutes cited in 29 CFR 5.1, the **[SRF Applicant]** shall insert a clause requiring that the contractor or subcontractor shall maintain payrolls and basic payroll records during the course of the work and shall preserve them for a period of three years from the completion of the contract for all laborers, mechanics, watchmen and guards working on the contract. Such records shall contain the name and address of each such employee, social security number, correct classifications, hourly rates of wages paid, daily and weekly number of hours worked, deductions made, and actual wages paid. Further, the **[SRF Applicant]** shall insert in any such contract a clause providing hat the records to be maintained under this paragraph shall be made available by the contractor or subcontractor for inspection, copying, or transcription by authorized representatives

of the (write the name of agency) and the Department of Labor, and the contractor or subcontractor will permit such representatives to interview employees during working hours on the job.

[29 CFR 5.5]

Attachment C

Required Wage/Fringe Benefit Certification

A provision substantially like the following shall be included in each contract between SRF Applicant and a contractor for work related to the Project. A copy of the Wage/Fringe Benefit Certification referenced in the below provision is attached hereto. Additional copies may be obtained from the Indiana Finance Authority.

Davis-Bacon Wage/Fringe Benefit Certification

(a) Every contractor and subcontractor furnishing work on the Project shall complete a Wage/Fringe Benefit Certification on the form approved by the Indiana Finance Authority and submit this certification to the Labor Standards Administrator prior to commencing work on the Project.

(b) The Contractor shall require the substance of this provision to be included in all contracts with subcontractors.

Labor Standards Administrator **IFA**

Wage/Fringe Benefit Certification

(To be completed by contractor/subcontractor)

COMMUNITY: Click here to enter text. **PROJECT:** Click here to enter text.

This is to certify that Click here to enter text. **plans to use the following classifications of workers on the above referenced project:**

From Applicable Wage Decision				Base Wage to be paid by Contractor	Fringe Benefits to be provided by Contractor		Total package to be paid by **Contractor**
Classification	Base Wage Due	Fringe Benefits Due	Total Package Due		Benefit	Hourly Amount	

Certified by: _____ **Title:** _____ **Date:** _____

(must be certified by contractor)

Attachment E

Required Contract Provision Related to Suspension and Debarment

A provision substantially like the below shall be included in each procurement contract related to the Project. The SRF Applicant shall remain responsible for compliance with applicable law (including Suspension, Debarment, and Other Responsibility Matters). Such SRF Applicant has been encouraged to consult with its advisors and counsel regarding such matters and, in any event, understands that the use of the following does not relieve the SRF Applicant from its obligation to comply with applicable law (including Suspension, Debarment, and Other Responsibility Matters) and related provisions of any financial assistance agreement entered into with the Indiana Finance Authority, nor will the State Revolving Fund Loan Programs, the Indiana Finance Authority or the State of Indiana be responsible for or limited by any SRF Applicant's use of the following provision.

Contractor shall fully comply with Subpart C of 2 CFR Part 180 and 2 CFR Part 1532, entitled "Responsibilities of Participants Regarding Transactions (Doing Business with Other Persons)." Contractor is responsible for ensuring that any lower tier covered transaction as described in Subpart B of 2 CFR Part 180 and 2 CFR Part 1532, entitled "Covered Transactions," includes a term or condition requiring compliance with Subpart C. Contractor is responsible for further requiring the inclusion of a similar term or condition in any subsequent lower tier covered transactions. Contractor may access the Excluded Parties List System at www.epls.gov. This term and condition supersedes EPA Form 5700-49, "Certification Regarding Debarment, Suspension, and Other Responsibility matters."

Attachment F

Required Bid Instruction Related to GPR Components

A provision substantially like the following shall be included with the instructions to Bidders if U.S. EPA Green Project Reserve (GPR) components are included in this Project. The SRF Applicant shall remain responsible for compliance with applicable law. Such SRF Applicant has been encouraged to consult with its advisors and counsel regarding such matters and, in any event, understands that the use of the following does not relieve the SRF Applicant from its obligation to comply with applicable law and related provisions of any financial assistance agreement entered into with the Indiana Finance Authority, nor will the State Revolving Fund Loan Program, the Indiana Finance Authority or the State of Indiana be responsible for or limited by any SRF Applicant's use of the following provision.

U.S. EPA Green Project Reserve Program

Certain portions or components of this Project, which are described in the GPR Bid Breakdown form furnished with the Bid Documents, qualify for the U.S. EPA Green Project Reserve (GPR) Program and/or the Sustainability Incentive offered by the Indiana State Revolving Fund (SRF) Loan Program. Bidder shall complete the GPR Bid Breakdown form and submit the completed form with its Bid. This information is required by the U.S. EPA and the Indiana SRF Program and **Bidder's failure to fully and accurately complete the GPR Bid Breakdown form and submit it with its Bid may result in the Bid being rejected as non-responsive**.

Attachment G

State Revolving Fund Loan Program
Green Project Reserve (GPR) and Sustainability Incentive
GPR BID BREAKDOWN

Certain portions or components of this Project, which are described below, qualify for the U.S. EPA Green Project Reserve (GPR) Program and/or the Sustainability Incentive offered by the Indiana State Revolving Fund (SRF) Loan Program.

The Borrower's Consulting Engineer shall provide a detailed description, consistent with the SRF-approved GPR Checklist, for each GPR portion or component of the Project Contract below. Each Bidder shall provide the dollar amount that Bidder included in its total Bid for each portion or component, including all labor, materials, and equipment necessary to complete each portion or component of the Project Contract.

Non-distributed costs should be listed as its own line item below or incorporated into the price for each GPR Component/Portion.

- Non-distributed costs are defined as costs that are applied to the overall contract, but not to a specific line item/component (e.g. mobilization, demobilization, site work, bonds, insurance)

This information is required by the U.S. EPA and the Indiana SRF Loan Program and Bidder's failure to fully and accurately complete this form and submit it with its Bid may result in the Bid being rejected as non-responsive.

GPR Component Description [to be completed by Borrower's Consulting Engineer]	GPR Component Price [to be completed by Bidder]

<u>TOTAL CONSTRUCTION GPR COST:</u> $_____

Attachment H

State Revolving Fund Loan Program
Green Project Reserve (GPR) and Sustainability Incentive
GPR FINAL BID SUMMARY

Certain portions or components of the Project(s) financed by the SRF Loan qualify for the U.S. EPA Green Project Reserve (GPR) Program and/or the Sustainability Incentive offered by the Indiana State Revolving Fund (SRF) Loan Program.

In **Section I**, for each Project Contract, the Borrower's Consulting Engineer shall describe the GPR eligible portion or component in detail and provide the dollar amount that the Successful Bidder included in its Bid for each GPR eligible portion or component. The GPR component/portion should be consistent with the description provided in the SRF-approved GPR Checklist and the GPR Bid Breakdown (Attachment G).

In **Section II**, the Borrower's Engineer(s) shall provide the Planning and Design portion of the Engineering Services Agreement which governs the Project Contract(s) described in Section I. SRF reserves the right to request a copy of the Engineering Services Agreement(s).

This information is required by the U.S. EPA and the Indiana SRF Loan Program. Failure of the Borrower's Engineer to fully and accurately complete this form and promptly submit it to SRF may result in delayed SRF loan closing or stopped payments by SRF.

Project Contract Name: _____

Section I

The following descriptions of work relate to the construction portions or components of the Project that qualify for the GPR Program and/or Sustainability Incentive. Next to each description, state the amount of the total Bid that accounts for all labor, materials, and equipment necessary to complete each portion or component of the Project. **Non-distributed costs should be listed as its own line item below or incorporated into the price for each GPR Component/Portion.**

GPR Component/Portion Description	GPR Component/Portion Final Bid Amount

Total Construction GPR: $_____

[Sum of all GPR Component/Portion Bid Amounts, including non-distributed costs]

Section II

Name of Consulting Firm Providing Planning/Design Services	GPR Planning Services Contract Name	GPR Planning Services Cost	GPR Design Services Contract Name	GPR Design Services Cost

TOTAL ENGINEERING GPR: $_____

[Sum of all GPR Planning and Design Services Cost]

TOTAL CONTRACT GPR: $_____

[Construction GPR + Engineering GPR]

Attachment I

Required Contract Provisions Related to American Iron and Steel

A provision substantially like the below will be included in each procurement contract when such contract involves the procurement of iron and steel to be used in the Project . The SRF Applicant shall remain responsible for compliance with applicable law (including American Iron and Steel). Such SRF Applicant has been encouraged to consult with its advisors and counsel regarding such matters and, in any event, understands that the use of the following does not relieve the SRF Applicant from its obligation to comply with applicable law (including American Iron and Steel) and related provisions of any financial assistance agreement entered into with the Indiana Finance Authority, nor will the State Revolving Fund Loan Programs, the Indiana Finance Authority or the State of Indiana be responsible for or limited by any SRF Applicant's use of the following provision.

The Contractor hereby acknowledges to and for the benefit of the _____ ("Owner") and the Indiana Finance Authority (the "Authority") that it understands the work, goods and services under this Agreement are being funded with monies made available by the State Revolving Fund Loan Program and such appropriation contains provisions commonly known as "American Iron and Steel" (and as such is supplemented from time to time by federal rules and guidance) that requires all of the iron and steel products used in the project be produced in the United States ("American Iron and Steel Requirements") including iron and steel products provided by the Contactor pursuant to this Agreement. The Contractor hereby represents and warrants to and for the benefit of the Owner and the Authority, and agrees, that (a) the Contractor has reviewed and understands the American Iron and Steel Requirements, (b) all of the iron and steel products used in the project as provided by the Contractor under this Agreement will be and/or have been produced in the United States in a manner that complies with the American Iron and Steel Requirements and (c) the Contractor will provide any further certification or assurance of compliance with this paragraph as may be requested by the Owner or the Authority. Notwithstanding any other provision of this Agreement, any failure to comply with this paragraph by the Contractor shall permit the Owner and the Authority to recover as damages against the Contractor (and the Contractor shall indemnify and hold the Owner and the Authority harmless against) any loss, expense or cost (including without limitation attorney's fees) incurred by the Owner or the Authority resulting from any such failure (including without limitation any impairment or loss of funding, whether in whole or in part, from the Authority or any damages owed to the Authority by the Owner). While the Contractor has no direct contractual privity with the Authority, as a lender to the Owner for the funding of its project, the Owner and the Contractor agree that the Authority is a third-party beneficiary and neither this paragraph (nor any other provision of this Agreement necessary to give this paragraph force or effect) shall be amended or waived without the prior written consent of the Authority.

Attachment J

Required Certification from Contractor Related to American Iron and Steel

A certification substantially like the below will be obtained in advance of entering each procurement contract when such contract involves the procurement of iron and steel products to be used in the Project. The SRF Applicant shall remain responsible for compliance with applicable law (including American Iron and Steel). Such SRF Applicant has been encouraged to consult with its advisors and counsel regarding such matters and, in any event, understands that the use of the following does not relieve the SRF Applicant from its obligation to comply with applicable law (including American Iron and Steel) and related provisions of any financial assistance agreement entered into with the Indiana Finance Authority, nor will the State Revolving Fund Loan Programs, the Indiana Finance Authority or the State of Indiana be responsible for or limited by any SRF Applicant's use of the following certification.

CERTIFICATION

I _____, of _____
(Name and Title of Certifying Officer) (Successful Bidder)
hereby certify and agree on behalf of the Successful Bidder as its duly authorized representative (and under penalties of perjury) that the Successful Bidder understands and agrees a material term and consideration applicable to the award and entry into a contract with the Successful Bidder by the _____ related to its _____
(SRF Applicant) (Project Name)
involves the procurement and provision of work, goods and services under a procurement contract to be entered into with the SRF Applicant is the Successful Bidder's compliance with the provisions of H.R. 3547, "Consolidated Appropriations Act, 2014" commonly known as "American Iron and Steel" provisions as contained therein requiring that all of the iron and steel products used in the Project be produced in the United States ("American Iron and Steel Requirements"). The Successful Bidder hereby represents and warrants to and for the benefit of the SRF Applicant and the Indiana Finance Authority, as a lender to the SRF Applicant for the funding of its Project, and agrees, that (a) the Successful Bidder has reviewed and understands the American Iron and Steel Requirements, (b) all of the iron and steel products used in the Project as provided by the Successful Bidder under its agreement related to the Project will be produced in the United States in a manner that complies with the American Iron and Steel Requirements and (c) the procurement contract will include a provision substantially like Attachment I.

I SWEAR OR AFFIRM UNDER THE PENALTIES FOR PERJURY THAT THE ABOVE STATEMENTS ARE TRUE TO THE BEST OF MY KNOWLEDGE.

_____ _____
(Signature) (Date)

STATE OF _____)
) SS:
COUNTY OF _____)

Before me, a Notary Public in and for said County and State, personally appeared _____, the _____ of _____who, being first duly sworn, acknowledged the execution of the above and foregoing instrument for and on behalf of said entity.

Dated this ___ day of _____, 2014.

_____
_____, Notary Public
(Printed)

My commission expires:
_____

County of Residence:
_____

Public Works and Indiana Finance Authority
GOOD FAITH EFFORTS WORKSHEET

BIDDER _____ BID/PROJECT NUMBER _____

CONTRACT GOALS **7% MBE** **5% WBE**

List the M/WBEs contacted and complete the following information for each. Copies of all communications to and from each vendor should be maintained.*

Company Name and Address	MBE	WBE	Type of Contact	Date of Contact	Date Response Due	Goods Or Services Requested	Result (Include Price Quote)
	☐	☐					
	☐	☐					
	☐	☐					
	☐	☐					
	☐	☐					
	☐	☐					
	☐	☐					
	☐	☐					
	☐	☐					

Indicate **Good Faith Efforts** made to utilize MWBEs. Check and explain all that apply or should be considered. Please provide evidence of the efforts that you want to be considered. A complete description of each criteria may be found in the **Indiana Department of Administration Public Works and State Office Building Commission MWBE Participation Policy.**

MBE and WBE Barrier Assistance	Describe
Advertisement	Describe
Agency Assistance	Describe
Other Criteria	Describe

* Copies of all communication to and from each vendor should also be attached to this Worksheet and submitted to SRF for review.

TECHNICAL SPECIFICATIONS

SECTION 01110

SUMMARY OF WORK

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Description of Work

B. Constraints

C. Work by Others

D. CONTRACTOR's Use of Site

E. Work Sequence

F. Owner Occupancy

1.2 DESCRIPTION OF WORK

A. General: The Work to be done under this Contract consists of:

1. The demolition and replacement of the existing Sheraton Lift Station with a prefabricated above ground lift station. The construction of approximately 3,900 feet of 10-inch sanitary sewer force main and fittings, along Cumberland Avenue. This force main is to be installed by both open-cut and trenchless (horizontal directional drilling) construction methods as defined on the drawings. The construction of approximately 60 feet of 12-inch diameter sanitary gravity sewer.

2. The demolition and replacement of the existing Fairway Knolls Lift Station with a prefabricated above ground lift station. The construction of approximately 2,200 feet of 6-inch diameter sanitary sewer force main and fittings, along Palmer Drive and Northwestern Avenue. This force main is to be installed by both open-cut and trenchless (horizontal directional drilling) construction methods as defined on the drawings. The construction of approximately 75 feet of 10-inch diameter sanitary gravity sewer.

The Work is shown and specified in the Contract Documents entitled City of West Lafayette, Indiana, Sheraton and Fairway Knolls Lift Station Improvements.

B. The Work includes:

1. Furnishing of all labor, material, superintendence, plant, power, light, heat, fuel, water, tools, appliances, equipment, supplies, services and other means of construction necessary or proper for performing and completing the Work.

2. Sole responsibility for adequacy of plant and equipment.

3. Maintaining the Work area and site in a clean and acceptable manner.

4. Maintaining existing facilities in service at all times except where specifically provided for otherwise herein.

5. Protection of finished and unfinished Work.

6. Repair and restoration of Work damaged during construction.

7. Furnishing as necessary proper equipment and machinery, of a sufficient capacity, to facilitate the Work and to handle all emergencies normally encountered in Work of this character.

C. Implied and Normally Required Work: It is the intent of these Specifications to provide the OWNER with complete operable systems, subsystems and other items of Work. Any part or item of Work which is reasonably implied or normally required to make each installation satisfactorily and completely operable is deemed to be included in the Work and the Contract Amount. All miscellaneous appurtenances and other items of Work incidental to meeting the intent of these Specifications are included in the Work and the Contract Amount even though these appurtenances may not be specifically called for in these Specifications.

D. Quality of Work: Regard the apparent silence of the Contract Documents as to any detail, or the apparent omission from them of a detailed description concerning any Work to be done and materials to be furnished as meaning that only the best general practice is to prevail and that only materials and workmanship of the best quality are to be used. Interpretation of these specifications will be made upon this basis.

1.3 CONSTRAINTS

A. The Contract Documents are intended to allow the CONTRACTOR flexibility in construction of the Work, however, the following constraints apply:

1. Maintain flow in sanitary sewers and force mains at all times. Maintain wastewater lift stations in operation at all times. Any Work which affects the

existing wastewater facilities must be carried out so that the operation of the existing facilities will not be jeopardized or materially reduced in efficiency as a result of the Work.

2. Maintain two-way vehicular access to the city streets, businesses and private drives at all times during the Work. Prosecute the Work in such a manner that property owners and businesses will experience minimal access disruption. Maintain access to residential drives at all times where possible. At least one access must be maintained at all commercial businesses. For those drive approaches to be closed for their construction, submit notification to the business or property owner 72 hours prior to such closings. The approaches at businesses with only one access point shall be constructed one-half at a time so that traffic can be maintained at all times. If construction of an approach one-half at a time does not provide the required access, then other provisions or temporary access by other means shall be provided to the property owner or business.

3. Perform the Work in strict accordance within the right-of-way, construction limits or easements.

4. Install new sidewalk on north side of Cumberland Avenue for pedestrian detour, and install pedestrian detour, prior to installation of force main along south side of Cumberland Avenue. Maintain pedestrian traffic at all times by either existing undisturbed route, or City approved pedestrian detour.

5. Install 10" Sheraton force main between Station 15+00 and 38+00 within a 60-day calendar period. Provide adjacent property owner's with two week notice of sewer construction. Completion shall be defined as sewer pipe installation, and testing, all trenches backfilled to grade, asphalt path repaired, all detour facilities removed and all final restoration complete.

B. Coordinate in advance with the OWNER all interruptions to existing facilities.

C. Perform connections to existing facilities or operations that interfere with the operation of the existing equipment as quickly as possible and with as little delay as possible.

1.4 WORK BY OTHERS

A. Work on other projects, may take place concurrently with this CONTRACT and these are excluded from this CONTRACT. Coordinate work schedules to accommodate simultaneous projects.

1. Cattail Trail Path Extension

1.5 CONTRACTOR'S USE OF SITE

A. In addition to the requirements of Articles 6.11 of the General Conditions, limit use of site and premises for work and storage to allow for the following:

1. Coordination of the Work under this CONTRACT with the work of the other contractors where Work under this CONTRACT encroaches on the Work of other contractors.

2. OWNER occupancy and access to operate existing facilities.

3. Coordination of site use with ENGINEER.

4. Responsibility for protection and safekeeping of products under this CONTRACT.

5. Provide additional off-site storage as needed at no additional cost to OWNER.

1.6 WORK SEQUENCE

A. Construct Work in stages to accommodate OWNER's use of premises during construction period and in accordance with the limitations on the sequence of construction specified. Coordinate construction schedules and operations with ENGINEER. Coordinate Work of all Subcontractors.

B. Submit for acceptance a detailed description of the sequence of construction prior to commencing construction.

1.7 OWNER OCCUPANCY

A. Cooperate with OWNER's representative in all construction operations to minimize conflict, and to facilitate OWNER usage.

B. Conduct operations so as to inconvenience the general public in the least.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

A. Starting Work: Start Work within 10 days following the date stated in the Notice to Proceed and execute with such progress as may be required to prevent delay to other contractors or to the general completion of the project. Execute Work at such items and in or on such parts of the project, and with such forces, material and equipment, as

to complete the Work in the time established by the Contract. At all times, schedule and direct the Work so that it provides an orderly progression to completion within the specified time for completion.

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 01250

CHANGE ORDER AND WORK ORDER PROCEDURES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Definitions

B. Change Orders

C. Work Orders

1.2 DEFINITIONS

A. Change Order: Refer to the Change Order definition in Article 1 of the General Conditions.

B. Work Order: Work Order is a written directive to the CONTRACTOR issued on or after the effective date of the agreement; signed by the OWNER, recommended by the ENGINEER, ordering an addition, deletion, or revision in the Work. A Work Order will subsequently be followed by the issuance of a Change Order.

C. Overhead: Overhead is defined as the cost of administration, field office and home office costs, general superintendence, office engineering and estimating costs, other required insurance, materials used in temporary structures (not including form work), additional premiums on the performance bond of the CONTRACTOR, the use of small tools, scheduling costs, and all other costs incidental to the performance of the change or the cost of doing business.

1.3 CHANGE ORDERS

A. Initiation of Proposals:

1. From time to time, the OWNER or the ENGINEER may issue a Request for a Change Order Proposal. The Request will contain a description of the intended change with supplementary or revised Drawings and Specifications as applicable, and the projected time for accomplishing the change.

2. The CONTRACTOR may propose a change in the Work by submittal of a Change Order Request to the ENGINEER describing the proposed change with

a statement of the reason for the change and the effect on the Contract time and price, along with supporting documentation.

B. Execution of Change Order Proposal:

1. When a Proposal is requested for changed work, submit proposal within 14 days following receipt of the Request from OWNER or ENGINEER. State the increase or decrease, if any, in Contract Completion time and Contract Price.

2. Explain proposal in sufficient detail to permit review by OWNER.

3. For Omitted Work the decrease in the Contract Price will be determined by the ENGINEER and will include appropriate amounts for profit and overhead.

4. The OWNER and ENGINEER will review the Proposal and may request additional information and documentation. Provide these items upon request.

5. If the OWNER decides to proceed with the change, the OWNER will issue a Change Order for signature first by the CONTRACTOR and then by the OWNER.

6. The CONTRACTOR will promptly complete the approved change in the Work on receipt of the executed Change Order.

   a. Failure to sign the Change Order does not relieve the CONTRACTOR from performing the Work if the Change Order is signed by the OWNER.

C. Compute the cost of both additive and deductive changes in the Work in accordance with Article 12 of the General Conditions and as follows:

1. Include, the costs of labor, crew foreman and general foreman performing or directly supervising the changed Work on the site. Include travel and subsistence, but only to the extent incurred.

2. To the labor cost add all net premium for Workman's Compensation, taxes pursuant to the Federal Social Security Act, and payments required under State and Federal unemployment laws.

3. Add necessary extra materials, delivered at the site.

4. Include rent for plant and equipment at unit rental costs for similar rentals from an independent firm (i.e. a firm which is not owned in whole or in part by the CONTRACTOR). If equipment is owned by CONTRACTOR or rented from a firm in which the CONTRACTOR has an interest, calculate the rent in accordance with the applicable provisions and terms of the current "Cost Reference Guide for Construction Equipment" published by Dataquest.

5. Include Subcontractor's costs, determined by items 1 through 4 in the preceding subparagraphs, including a maximum overhead and profit to the subcontractor of 15 percent.

6. For work performed by the CONTRACTOR add 15 percent for overhead and profit to items 1 through 4 above. Add 5 percent to overhead and profit of item 5.

1.4 WORK ORDERS

A. Initiation by OWNER: OWNER may issue a Work Order with a Notice to Proceed without a prior Request for a Change Order Proposal or the CONTRACTOR's signature.

B. Payment Determination: The OWNER will designate the method of determining the amount of compensation or credit, if any, based on one of the methods contained in Article 12 of the General Conditions.

C. Timing: Proceed with the change in the Work immediately upon receipt of the Work Order.

D. Addition to Contract: The Work Order will be incorporated into the Contract Documents via a Change Order at a later date.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 01290

PAYMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Schedule of Values

B. Application for Payment

1.2 SCHEDULE OF VALUES

A. Approval of Schedule: Submit for approval a preliminary schedule of values, in duplicate, for all of the Work. Prepare preliminary schedule in accordance with paragraph 2.05 of the General Conditions. Submit preliminary schedule of values within 15 calendar days after date established in Notice to Proceed. Submit final schedule of values in accordance with Paragraph 2.07 of the General Conditions.

B. Format: Use a format similar to the Table of Contents of the Project Specifications. Identify each line item with number and title of the major specification section. Identify site mobilization, bonds and insurance. Include within each line item, a direct proportional amount of CONTRACTOR'S overhead and profit.

C. Revisions: With each Application for Payment revise schedule to list approved Change Orders.

1.3 APPLICATION FOR PAYMENT

A. Required Copies: Submit three copies of each application on a form approved by the OWNER. Present required information in typewritten form or on electronic media printout.

B. Execute certification by signature of authorized officer.

C. Use data from approved Schedule of Values.

D. Stored Materials: Only individual items with value of not less than $10,000 will be subject to payment by the OWNER as stored materials. CONTRACTOR may request payment of stored materials as approved by the OWNER, submit a separate schedule for Materials Stored showing line item, description, previous

value received, value incorporated into the work, and present value. Payment for stored materials is not guaranteed.

E. Change Orders: List each authorized Change Order as an extension on continuation sheet, listing Change Order number and dollar amount as for an original item of work.

F. Final Payment: Prepare Application for Final Payment as required in Article 14.07 of the General Conditions.

G. Record Drawings: CONTRACTOR shall keep all record drawings up to date. Recommendation for payment of pay application is subject to Engineer's review and confirmation that all record drawings are up to date.

H. Submit an updated construction schedule with each Application for Payment.

I. Submit monthly applications for payment to the ENGINEER.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01291

CONTRACT ITEMS

PART 1 GENERAL

1.1 CONTRACT ITEM 1 – MOBILIZATION AND DEMOBILIZATION

A. Description: The Work under this Contract Item includes furnishing all labor, supervision, equipment and materials necessary for the movement of personnel and equipment to and from the project site and for the establishment of all other facilities necessary to the performance of Work associated with the force main.

B. Payment: The payment for Mobilization and Demobilization shall be based on the contract lump sum price and shall not exceed five (5) percent of the total of the sum of all contract items. For the purpose of payment, the mobilization portion of this item will be limited to sixty (60) percent of the lump sum price of this item. The balance of the lump sum price will be considered demobilization and will be paid when all Work and final clean up is completed.

1.2 CONTRACT ITEM 2 – MAINTENANCE OF TRAFFIC

A. Description: The Work under this Contract Item includes furnishing all labor, materials, equipment and services for the maintenance of traffic associated with the force main, including pedestrian traffic, together with all associated and appurtenant Work as shown, specified (Section 01500) and directed.

The Work includes provision of fencing, barrels, cones, barricades, flagmen, detour signage and other associated items to protect the workmen and the public; provision of adequate means to safely direct vehicular and pedestrian traffic past the point of construction; provision of safely conducting vehicular and pedestrian traffic at all other points that are affected by the Work at all times; maintain access to all property as much as possible; coordination with property owner and/or occupant (s) when there is a loss of access; and all associated Work, materials, and equipment necessary for the maintenance of traffic in accordance with the Contract Documents.

B. Payment: Payment for Maintenance of Traffic will be made at percent complete of the Contract lump sum price for this item.

1.3 CONTRACT ITEM 3 – SHERATON LIFT STATION, ENGINE GENERATOR, STRUCTURES AND EQUIPMENT

A. Description: The Work under this Contract Item includes furnishing all labor, materials, equipment and services to construct, test and place in trouble free operation the Lift Station, Engine Generator, Structures and Equipment, together with all associated and appurtenant Work as shown, specified and directed.

The Work includes, but is not limited to demolition, erosion control measures; establishing survey control points; maintenance of traffic; site clearing as necessary; excavation – earth and rock; sheeting, shoring and bracing; dewatering; removal and disposal of surfaces and spoil where required; select fill; backfilling and compaction; constructing all structures; furnishing and installing lift station-generator, wet well, wet well lining, meter vault, air release valve and vault; station piping; process equipment and valves; influent sewers, manholes and appurtenances; testing; protection of existing structures and buried utilities; site restoration; seeding; and all general, structural, architectural, landscaping, mechanical, heating and ventilating, instrumentation, and electrical Work complete and in place as shown or specified in accordance with the Contract Documents, except for Work specifically included under other Contract Items.

B. Payment: Payment for Lift Station, Engine Generator, Structures and Equipment will be made at the Contract lump sum price.

1.4 CONTRACT ITEM 4 – FAIRWAY KNOLLS LIFT STATION, ENGINE GENERATOR, STRUCTURES AND EQUIPMENT

A. Description: The Work under this Contract Item includes furnishing all labor, materials, equipment and services to construct, test and place in trouble free operation the Lift Station, Engine Generator, Structures and Equipment, together with all associated and appurtenant Work as shown, specified and directed.

The Work includes, but is not limited to demolition, erosion control measures; establishing survey control points; maintenance of traffic; site clearing as necessary; excavation – earth and rock; sheeting, shoring and bracing; dewatering; removal and disposal of surfaces and spoil where required; select fill; backfilling and compaction; constructing all structures; furnishing and installing lift station-generator, wet well, wet well lining, meter vault, air release valve and vault; station piping; process equipment and valves; influent sewers, manholes and appurtenances; storm sewers and curb inlets; testing; protection of existing structures and buried utilities; site restoration; seeding; concrete curb and asphalt paving; and all general, structural, architectural, landscaping, mechanical, heating and ventilating, instrumentation, and electrical Work complete and in place as shown or specified in accordance with the

Contract Documents, except for Work specifically included under other Contract Items.

B. Payment: Payment for Lift Station, Engine Generator, Structures and Equipment will be made at the Contract lump sum price.

1.5 CONTRACT ITEM 5 – 10-INCH SANITARY FORCE MAIN

A. Description: The Work under this Contract Item includes furnishing all labor, materials, equipment and services to install, test, and maintain the sanitary force main, together with all associated and appurtenant Work as shown, specified and directed.

The Work includes erosion control measures, establishing survey control points, maintenance of traffic, site clearing as necessary, earth excavation, sheeting, shoring, bracing, dewatering, removal and disposal of surfaces and spoil where required, furnishing and installing sanitary force main pipe using both open-cut and trenchless construction methods as defined on the drawings, force main pipe, fittings, restrained joints and appurtenances, air release valves, air release valve vault, and appurtenances; making all pipe connections; pipe bedding; backfilling and compaction; testing; protection of existing structures and buried utilities; protection and replacement of all trees and shrubs; restoration of surfaces and structures damaged by sanitary force main construction; and all associated Work, materials, and equipment necessary to complete the construction in accordance with the Contract Documents.

B. Payment: Payment for 10-inch Sanitary Force Main will be made at the Contract unit price per lineal foot.

1.6 CONTRACT ITEM 6 - 6 INCH SANITARY FORCE MAIN

A. Description: The Work under this Contract Item includes furnishing all labor, materials, equipment and services to install, test, and maintain the sanitary force main, together with all associated and appurtenant Work as shown, specified and directed.

The Work includes erosion control measures, establishing survey control points, maintenance of traffic, site clearing as necessary, earth excavation, sheeting, shoring, bracing, dewatering, removal and disposal of surfaces and spoil where required, furnishing and installing sanitary force main pipe using both open-cut and trenchless construction methods as defined on the drawings, force main pipe, fittings, restrained joints and appurtenances; making all pipe connections; pipe bedding; backfilling and compaction; testing; protection of existing structures and buried utilities; protection and replacement of all trees and shrubs; restoration of surfaces and structures damaged by sanitary force main construction; and all associated Work, materials, and

equipment necessary to complete the construction in accordance with the Contract Documents.

B. Payment: Payment for 6-inch Sanitary Force Main will be made at the Contract unit price per lineal foot.

1.7 CONTRACT ITEM 7 – HMA PATH RESTORATION

A. Description: The Work under this Contract Item includes furnishing all labor, materials, equipment and services to restore pavement and resurface 10' wide path on the south side of Cumberland Avenue, after HMA Path Repairs are completed, together with all associated and appurtenant Work as shown, specified and directed.

Upon completion of the sanitary force main work along Cumberland Avenue, and any OWNER identified HMA Path Repairs, restore the HMA Path in accordance with the Contract Drawings. All materials shall meet the requirements of Section 604 of the Indiana Department of Transportation Standard Specification. The Work includes surface scarifying (lightly milling); prime/ tack-coat; HMA surface overlay; and all associated Work, materials, and equipment necessary to complete the construction in accordance with the Contract Documents.

B. Payment: Payment for HMA Path Restoration will be made at the Contract unit price per square yard.

1.8 CONTRACT ITEM 8 – HMA PATH REPAIR

A. Description: The Work under this Contract Item includes furnishing all labor, materials, equipment and services to repair pavement prior to resurfacing of the 10' wide path on the south side of Cumberland Avenue, together with all associated and appurtenant Work as shown, specified and directed.

Upon completion of the sanitary force main work along Cumberland Avenue, remove and restore OWNER identified HMA path repairs in accordance with the Contract Drawings. All materials shall meet the requirements of Section 604 of the Indiana Department of Transportation Standard Specification. The Work includes removal and replacement of existing HMA path and subbase prior to HMA Path Restoration, and all associated Work, materials, and equipment necessary to complete the construction in accordance with the Contract Documents.

B. Measurement for Payment: The quantity of HMA Repair to be measured for payment under this Contract Item will be the total HMA Repair, as order and approved by OWNER. HMA Path Repairs resulting from damage due to Horizontal Directional Drilling (HDD) will NOT to be measured for payment. HMA Path Repair for HDD operations will be included in the cost of the force main contract items.

C. Payment: Payment for HMA Path Repair will be made at the Contract unit price per square yard.

1.9 CONTRACT ITEM 9 – CONCRETE SIDEWALK

A. Description: The Work under this Contract Item includes furnishing all labor, materials, equipment and services to install a concrete sidewalk on the north side of Cumberland Avenue, together with all associated and appurtenant Work as shown, specified and directed.

Provide materials meeting the requirements of Section 604 of the Indiana Department of Transportation Standard Specification. The Work includes erosion control measures; establishing survey control points; site clearing as necessary; earth excavation; removal and disposal of surfaces and spoil where required; furnishing concrete and all appurtenances and materials necessary to install the concrete sidewalk; protection of existing structures and buried utilities; protection and replacement of all trees and shrubs; restoration of surfaces and structures damaged by sidewalk construction; testing and all associated Work, materials, and equipment necessary to complete the construction in accordance with the Contract Documents.

B. Payment: Payment for Concrete Sidewalk will be made at the Contract unit price per square yard.

1.10 CONTRACT ITEM 10 – 12-INCH PVC SANITARY SEWER

A. Description: The Work under this Contract Item includes furnishing all labor, materials, equipment and services to install, test, and maintain the sanitary sewer, together with all associated and appurtenant Work as shown, specified and directed.

The Work includes erosion control measures, establishing survey control points, maintenance of traffic, site clearing as necessary; earth excavation; sheeting, shoring, bracing; dewatering; removal and disposal of surfaces and spoil where required; furnishing and installing sanitary sewer pipe, fittings and appurtenances; making all pipe connections; pipe bedding; backfilling and compaction; testing; cleaning and televising; protection of existing structures and buried utilities; protection and replacement of all trees and shrubs; restoration of surfaces and structures damaged by sewer construction; and all associated Work, materials, and equipment necessary to complete the construction in accordance with the Contract Documents.

B. Payment: Payment for 12-inch PVC Sanitary Sewer will be made at the Contract unit price per lineal foot.

1.11 CONTRACT ITEM 11 – 10-INCH PVC SANITARY SEWER

A. Description: The Work under this Contract Item includes furnishing all labor, materials, equipment and services to install, test, and maintain the gravity sewer pipe, together with all associated and appurtenant Work as shown, specified and directed.

The Work includes erosion control measures, establishing survey control points, maintenance of traffic, site clearing as necessary; earth excavation; sheeting, shoring, bracing; dewatering; removal and disposal of surfaces and spoil where required; furnishing and installing sanitary sewer pipe, fittings and appurtenances; making all pipe connections; pipe bedding; backfilling and compaction; testing; cleaning and televising; protection of existing structures and buried utilities; protection and replacement of all trees and shrubs; restoration of surfaces and structures damaged by sewer construction; and all associated Work, materials, and equipment necessary to complete the construction in accordance with the Contract Documents.

B. Payment: Payment for 10-inch PVC Sanitary Sewer will be made at the Contract unit price per lineal foot.

1.12 CONTRACT ITEM 12 – 60-INCH SANITARY DOGHOUSE MANHOLE

A. Description: The Work under this Contract Item includes furnishing all labor, materials, equipment and services to install, test, and maintain precast concrete manholes, together with all associated and appurtenant Work as shown, specified and directed.

The Work includes erosion control measures; establishing survey control points; site clearing as necessary; earth excavation; sheeting, shoring, bracing; dewatering; removal and disposal of surfaces and spoil where required; furnishing and installing precast concrete manholes; manhole structure bedding; backfilling and compaction; flexible pipe to manhole connectors; external chimney seals; adjusting rings; castings and covers; making pipe connections to manholes; protection of existing structures and buried utilities; protection and replacement of all trees and shrubs; restoration of surfaces and structures damaged by manhole construction; testing and all associated Work, materials, and equipment necessary to complete the construction in accordance with the Contract Documents.

B. Payment: Payment for 60-inch Sanitary Doghouse Manhole will be made at the Contract unit price for each.

1.13 CONTRACT ITEM 13 – SEWER MANHOLE LINING

A. Description: The Work under this Contract Item includes furnishing all labor, materials, and equipment necessary for sewer manhole rehabilitation using a multi-component lining system. Wet well lining is NOT a part of this Contract Item.

The Work shall include, but not be limited to, clearing, bypass pumping/flow control (if necessary), utility support, preparatory cleaning, sewer manhole lining, pre- and post-construction photos, testing, site restoration, and all incidentals necessary to complete the Work as shown and specified in the Contract Documents.

B. Measurement for Payment: The quantity to be measured for payment shall be in vertical feet from the bench of the manhole to the casting.

C. Payment: Payment shall be made at the Contract unit price per vertical foot.

1.14 CONTRACT ITEM 14 – ADDITIONAL EARTH EXCAVATION

A. Description: The Work under this Contract Item includes furnishing all labor, materials, equipment and services to perform additional earth excavation ordered in writing.

The Work includes all clearing, protection of the structures and adjacent property; placing, maintenance, and removal of shoring, sheeting and bracing; removal of water; backfilling; disposal of surplus material excavated material; and other Work appurtenant to the additional earth excavation as specified.

B. Measurement for Payment: The quantity of Additional Earth Excavation to be measured for payment under this Contract Item will be the total excavation, as ordered and approved, beyond and outside the established lines and grades which would have controlled and been maintained had not the additional excavation been ordered. Additional earth excavation for placement as select fill material other than that for pipe bedding or to permit construction of other types of pipeline foundations will be included for payment under this Contract Item. Unauthorized additional earth excavation will not be measured or paid for.

C. Payment: Payment for Additional Earth Excavation ordered in writing will be made at the Contract unit price per cubic yard.

1.15 CONTRACT ITEM 15 – ADDITIONAL SELECT FILL MATERIAL

A. Description: The Work under this Contract Item includes furnishing all labor, materials, equipment and services to place and compact select fill material which may be required in addition to that shown or specified. Excavation for placement of additional select fill material will be paid for under other Contract Items. Provide select fill material that meets the requirements of Section 02317 Backfilling. Only

material which has been ordered in writing and approved will be paid for under this Contract Item.

B. Measurement for Payment: The quantity of Additional Select Fill Material to be measured for payment under this Contract Item will be the volume of select fill material, compacted in place, within the limiting lines shown or directed. Select fill material used to fill voids resulting from unauthorized excavation, or where required for dewatering, will not be measured for payment even though its use is ordered. Select fill material for pipe bedding will not be measured for payment under this Contract Item.

C. Payment: Payment for Additional Select Fill Material ordered in writing will be made at the Contract unit price per cubic yard.

1.16 CONTRACT ITEM 16 – WORK ALLOWANCE

A. Description: The Work under this Contract Item includes furnishing all labor, materials, equipment and services necessary to perform the additional miscellaneous work as directed by the Owner. This work is not shown on the drawings or specified, but which is subsequently identified by the Engineer as being necessary to complete the project. When work is required under this Item, the Contractor will be sent a request for proposal by the Engineer. If the proposal is accepted by the Owner, the Contractor will be notified to proceed with the required work. All work will be performed by the Contractor's own forces to the greatest extent possible. An allowance of twenty-five thousand dollars ($25,000) is included in this item. This allowance will be used to compensate the Contractor for work performed under this item. No Work will be performed under this allowance without the consent of the Owner.

B. Payment: Payment for Work Allowance will be made from the Contract lump sum price. At the completion of the Contract, all remaining funds will be deducted from the total contract price.

END OF SECTION

SECTION 01310

COORDINATION AND MEETINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Coordination

B. Preconstruction Conference

C. Progress Meetings

1.2 COORDINATION

A. General: Coordinate scheduling, submittals, and Contract work to assure efficient and orderly sequence of installation of interdependent construction elements.

1.3 PRECONSTRUCTION CONFERENCE

A. General: Prior to commencement of the Work, in accordance with paragraph 2.06 of the General Conditions, the OWNER will conduct a preconstruction conference to be held at a predetermined date and time in West Lafayette, Indiana.

B. Delineation of Responsibilities: The purpose of the conference is to designate responsible personnel, to establish a working relationship among the parties and to identify the responsibilities of the OWNER, ENGINEER and the CONTRACTOR. Matters requiring coordination will be discussed and procedures for handling such matters, established. The agenda will include:

1. Submittal procedures
2. Partial Payment procedures
3. Maintenance of Records
4. Schedules, Sequence of Construction
5. Maintenance of Traffic
6. Permits
7. Change Orders
8. Use of site
9. Housekeeping
10. Equipment delivery

C. Attendees: The preconstruction conference is to be attended by the representatives of the CONTRACTOR, the OWNER and the ENGINEER who will be associated with the project. Representatives of regulatory agencies, subcontractors, and principal suppliers may also attend when appropriate.

D. Chair and Minutes: The preconstruction conference will be chaired by the ENGINEER who will also arrange for the keeping and distribution of minutes to all attendees.

1.4 PROGRESS MEETINGS

A. Meeting Frequency and Format: Schedule progress meetings on a monthly basis or more frequently as warranted by the complexity of the Project, to review the Work, discuss changes in schedules, maintain coordination and resolve potential problems. Invite OWNER, ENGINEER and all subcontractors. Suppliers may be invited as appropriate. Meeting notes will be maintained by the ENGINEER and distributed to attendees within 10 working days after each meeting.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01325

PROGRESS SCHEDULE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Form of Schedules

B. Content of Schedules

C. Schedule Revisions

D. Submittal Requirements

1.2 FORM OF SCHEDULES

A. Prepare schedules in form of a horizontal bar chart.

1. Provide separate horizontal bar for each trade or operation.

2. Use a horizontal time scale and identify first workday of each week.

3. Use scale and spacings to allow space for notations and future revisions.

B. Use a listing format which chronologically indicates the order of start of each item of work.

C. Identify each listing by major specification section numbers.

1.3 CONTENT OF SCHEDULES

A. Completion Dates: Show the beginning and ending contract dates stated in documents. Schedules showing completion prior to the contract completion date will be accepted but in no event will they be considered basis for a claim for delay against the OWNER by the CONTRACTOR for the period between the early completion date and the completion date provided in the Contract Documents.

B. Show complete sequence of construction by activity.

C. Show dates for beginning and completion of each major element of construction for each milestone completion date. Elements shall include, but not be limited to, the following:

1. Shop drawing receipt from supplier/manufacturer submitted to ENGINEER, review and return to supplier/manufacturer

2. Material and equipment order, manufacturer, delivery, installation, and checkouts

3. Performance tests and supervisory services activity

4. Preconstruction activities – staking construction limits, installing erosion control devices and temporary fencing,

5. Site clearing

6. Structure, equipment, and piping demolition

7. Excavation, sheeting, shoring, dewatering

8. Concrete placement sequence

9. Lift Station delivery

10. Lift Station installation

11. Sewer and force main installation

12. Connection to existing sewers

13. Miscellaneous concrete placement

14. Subcontractor's items of work

15. Backfilling, grading, seeding, landscaping, sidewalk construction, and paving

16. Sewer, force main, and manhole testing

17. Final cleanup

18. Allowance for inclement weather

D. Show projected percentage of completion for each item as of first day of each month.

1.4 SCHEDULE REVISIONS

A. As a minimum, revise construction schedule every 30 calendar days to reflect changes in progress of Work for duration of Contract.

B. Indicate progress of each activity at date of submittal.

C. Show changes occurring since previous submittal of schedule.

1. Major change in scope
2. Activities modified since previous submittal
3. Revised projections of progress and completion
4. Other identifiable changes

D. Provide a written report as needed to define:

1. Problem areas, anticipated delays, and impact on schedule
2. Corrective action recommended and its effect
3. Effect of changes on schedules of other Contractors

1.5 SUBMITTAL REQUIREMENTS

A. Before Construction: Submit three copies of preliminary construction progress schedule to ENGINEER for acceptance in accordance with paragraph 2.07 of the General Conditions.

B. During Construction: Submit three copies of the monthly construction progress schedule to ENGINEER.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 01330

SUBMITTALS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Description of Requirements

B. Submittal Procedures

C. Specific Submittal Requirements

D. Action on Submittals

E. Repetitive Review

1.2 DESCRIPTION OF REQUIREMENTS

A. This section specifies procedural requirements for Shop Drawings, product data, samples, and other miscellaneous Work-related submittals.

B. Procedures concerning items such as listing of manufacturers, suppliers, subcontractors, construction progress schedule, bonds, payment applications, insurance certificates, and schedule of values are specified elsewhere.

C. Work-Related Submittals:

1. Substitution or "Or Equal" Items:

a. Includes material or equipment CONTRACTOR requests ENGINEER to accept, after Bids are received, as substitute for items specified or described in Specifications by using name of a proprietary item or name of particular supplier.

2. Shop Drawings:

a. Includes technical data and drawings specially prepared for this Project, including fabrication and installation drawings, diagrams, actual performance curves, data sheets, schedules, templates, patterns, reports, instructions, design mix formulas, measurements, and similar information not in standard printed form.

b. Standard information prepared without specific reference to the Project is not considered a Shop Drawing.

3. Product Data:

a. Includes standard printed information on manufactured products, and systems that has not been specially prepared for this Project, including manufacturer's product specifications and installation instructions, catalog cuts, printed performance curves, mill reports, and standard color charts.

4. Miscellaneous Submittals:

a. Work-related submittals that do not fit in the previous categories, such as guarantees, warranties, certifications, experience records, maintenance agreements, Operating and Maintenance Manuals, workmanship bonds, survey data and reports, physical work records, quality testing and certifying reports, copies of industry standards, record drawings, field measurement data, and similar information, devices, and materials applicable to the Work.

1.3 SUBMITTAL PROCEDURES

A. Scheduling:

1. Submit for approval, a preliminary schedule of shop drawing submittals, in duplicate, and in accordance with Article 2.05.B.2 of the General Conditions.

2. Prepare and transmit each submittal to ENGINEER sufficiently in advance of scheduled performance of related work and other applicable activities.

B. Coordination:

1. Coordinate preparation and processing of submittals with performance of the Work. Coordinate each submittal with other submittals and related activities such as substitution requests, testing, purchasing, fabrication, delivery, and similar activities that require sequential activity.

2. Coordinate submission of different units of interrelated work so that one submittal will not be delayed by ENGINEER's need to review a related submittal.

3. ENGINEER may return any submittal requiring coordination with other submittals without review and marked “Revise and Resubmit”. This type of

returned submittal will be counted as a submittal subject to the provisions of 1.6 – REPETITIVE REVIEWS of this Section.

4. The ENGINEER will not hold a submittal awaiting additional information from the CONTRACTOR.

C. Submittal Preparation:

1. Stamp and sign each submittal certifying to review of submittal, verification of products, field measurement, field construction criteria, coordination of information within submittal with requirements of the Work and the Contract Documents, coordination with all trades, and verification that product will fit in space provided.

2. Transmittal Form: In the transmittal form, forwarding each specific submittal to the ENGINEER, include the following information as a minimum.

a. Date of submittal and dates of previous submittals containing the same material.

b. Project title and number.

c. Submittal and transmittal number.

d. Contract identification.

e. Names of:

(1) Contractor
(2) Supplier
(3) Manufacturer

f. Identification of equipment and material with equipment identification numbers, model numbers, and Specification section number.

g. Variations from Contract Documents and any limitations that may impact the Work.

h. Drawing sheet and detail number as appropriate.

3. The submittal does not encompass more than one Section of the Specifications.

D. Submittal Numbering:

1. Number all submittals as follows:

(A) - (B)

Where:
(A) = Specification Section Number
(B) = Consecutive submittal number for the Specification Section Number listed in (A), with an alphabetic suffix indicating the sequential version of the submittal.

Examples:	01300-001A	indicates the initial version of submittal number 001 for Specification Section 01300.
	01300-001B	indicates the second version of submittal number 001 for Specification Section 01300.
	01300-002A	indicates the initial version of submittal number 002 for Specification Section 01300.

2. When a document(s) is resubmitted for any reason, use a new Submittal Transmittal Form with the same submittal number and a new, sequential alphabetic suffix.

E. Resubmittal Preparation:

1. Comply with the requirements described in Submittal Preparation. In addition:

a. Identify on transmittal form that submittal is a resubmission.

b. Make any corrections or changes in submittals required by ENGINEER's notations on returned submittal.

c. Respond to ENGINEER's notations:

(1) On the transmittal or on a separate page attached to CONTRACTOR's resubmission transmittal, answer or acknowledge in writing all notations or questions indicated by ENGINEER on ENGINEER's transmittal form returning review submission to CONTRACTOR.

(2) Identify each response by question or notation number established by ENGINEER.

(3) If CONTRACTOR does not respond to each notation or question, resubmission will be returned without action by ENGINEER until CONTRACTOR provides a written response to all ENGINEER's notations or questions.

d. CONTRACTOR initiated revisions or variations:

(1) On transmittal form identify variations or revisions from previously reviewed submittal, other than those called for by ENGINEER.

(2) ENGINEER's responsibility for variations or revisions is established in Section 6.17.D.3 and 6.17.E.3 of the General Conditions.

1.4 SPECIFIC SUBMITTAL REQUIREMENTS

A. Specific submittals required for individual elements of work are specified in the individual Specification sections. Except as otherwise indicated in Specification sections, comply with requirements specified herein for each indicated type of submittal.

B. Requests for Substitution or "Or Equal"

1. Collect data for items to be submitted for review as substitution into one submittal for each item of material or equipment in accordance with Section 6.05 of the General Conditions.

2. Submit with other scheduled submittals for the material or equipment allowing time for ENGINEER to evaluate the additional information required to be submitted.

3. If CONTRACTOR requests to substitute for material or equipment specified but not identified in Specifications as requiring submittals, schedule substitution submittal request in Submittal schedule and submit as scheduled.

C. Shop Drawings:

1. Submit newly prepared information, with graphic information at accurate scale. Indicate name of manufacturer or supplier. Show dimensions and clearly note which are based on field measurement; identify materials and

products that are included in the Work; identify revisions. Indicate compliance with standards and notation of coordination requirements with other work. Highlight, encircle or otherwise indicate variations from Contract Documents or previous submittals.

2. Include on each drawing or page:

   a. Submittal date and revision dates.

   b. Project name, division number and descriptions.

   c. Detailed specifications section number and page number.

   d. Identification of equipment, product or material.

   e. Name of CONTRACTOR and Subcontractor.

   f. Name of Supplier and Manufacturer.

   g. Relation to adjacent structure or material.

   h. Field dimensions, clearly identified.

   i. Standards or Industry Specification references.

   j. Identification of deviations from the Contract Documents.

   k. CONTRACTOR's stamp, initialed or signed, dated and certifying to review of submittal, certification of field measurements and compliance with Contract.

   l. Physical location and location relative to other connected or attached material at which the equipment or materials are to be installed.

3. Provide 8-inch by 3-inch blank space for CONTRACTOR and ENGINEER stamps.

4. Submittals:

   a. Submit 6 copies. One copy may be submitted electronically in lieu of 6 hard copies if the nominal size of the documents are no larger than 11”x17”.

5. Distribution:

a. Do not proceed with installation of materials, products or systems until copy of applicable product data showing only approved information is in possession of installer.

b. Maintain one set of shop drawing (for each submittal) at Project site, available for reference by ENGINEER and others.

D. Product Data:

1. Preparation:

a. Collect required data into single submittal for each element of work or system. Where product data has been printed to include information on several similar products, some of which are not required for use on Project or are not included in submittal, mark copies to clearly show such information is not applicable.

b. Where product data must be specially prepared for required products, materials or systems, because standard printed data are not suitable for use, submit data as a Shop Drawing and not as product data.

2. Submittals:

a. Submittal is for information and record, and to determine that products, materials, and systems comply with Contract Documents. Submittal is final when returned by ENGINEER marked "Approved" or "Approved as Noted".

b. Submit 6 copies.

3. Distribution:

a. Do not proceed with installation of materials, products or systems until copy of applicable product data showing only approval information is in possession of installer.

b. Maintain one set of product data (for each submittal) at Project site, available for reference by ENGINEER and others.

E. Miscellaneous Submittals:

1. Inspection and Test Reports:

a. Classify each inspection and test report as being either "Shop Drawings" or "Product Data", depending on whether report is

specially prepared for Project or standard publication of workmanship control testing at point of production. Process inspection and test reports accordingly.

2. Guarantees, Warranties, Maintenance Agreements, and Workmanship Bonds:

   a. Refer to Specification sections for specific requirements. Submittal is final when returned by ENGINEER marked "Approved" or "Approved as Noted".

   b. In addition to copies desired for CONTRACTOR's use, furnish 2 executed copies. Provide 2 additional copies where required for maintenance data.

3. Survey Data:

   a. Refer to Specification sections for specific requirements on property surveys, building or structure condition surveys, field measurements, quantitative records of actual Work, damage surveys, photographs, and similar data required by Specification sections. Copies will not be returned.

      (1) Survey Copies: Furnish 2 copies. Provide 5 copies of final property survey (if any).

      (2) Condition Surveys: Furnish 2 copies.

4. Certifications:

   a. Refer to Specification sections for specific requirement on submittal of certifications. Submit 6 copies. Certifications are submitted for review of conformance with specified requirements and information. Submittal is final when returned by ENGINEER marked "Approved".

F. General Distribution:

1. Unless required elsewhere, provide distribution of submittals to subcontractors, suppliers, governing authorities, and others as necessary for proper performance of work.

1.5 ACTION ON SUBMITTALS

A. ENGINEER's Action:

1. General:

a. Except for submittals for record and similar purposes, where action and return on submittals are required or requested, ENGINEER will review each submittal, mark with appropriate action, and return. Where submittal must be held for coordination, ENGINEER will also advise CONTRACTOR without delay.

b. ENGINEER will stamp each submittal with uniform, self-explanatory action stamp, appropriately marked with submittal action.

B. Action Stamp:

1. Approved:

a. Final Unrestricted Release: Where submittals are stamped "Approved", Work covered by submittal may proceed PROVIDED IT COMPLIES WITH CONTRACT DOCUMENTS. Acceptance of Work will depend upon that compliance.

2. Approved As Noted:

a. When submittals are stamped "Approved as Noted", Work covered by submittal may proceed PROVIDED IT COMPLIES WITH BOTH ENGINEER'S NOTATIONS OR CORRECTIONS ON SUBMITTAL AND WITH CONTRACT DOCUMENTS. Acceptance of Work will depend on that compliance. Resubmittal is not required.

3. Revise and Resubmit:

a. When submittals are stamped "Revise and Resubmit", do not proceed with Work covered by submittal. Do not permit Work covered by submittal to be used at Project site or elsewhere where Work is in progress.

b. Revise submittal or prepare new submittal in accordance with ENGINEER's notations in accordance with Paragraph 1.3.D of this section. Resubmit submittal without delay. Repeat if necessary to obtain different action marking.

4. Acknowledgements of Information Submittals

a. When Information Submittals conform to the format requirements in the Contract Documents ENGINEER will acknowledge such submittals via a response transmittal.

b. If an Information Submittal does not conform to the format requirements of the Contract Documents, ENGINEER will return the submittal with comments or questions. Do not proceed with Work covered by the submittal and do not permit Work covered by the submittal to be used at Project site or elsewhere where Work is in progress. Resubmit the Information Submittal until the ENGINEER acknowledges that the submittal conforms to the format required.

1.6 REPETITIVE REVIEW

A. Cost of Subsequent Reviews: Shop Drawings and Operation and Maintenance Manuals submitted for each item will be reviewed no more than twice at the OWNER's expense. All subsequent reviews will be performed at times convenient to the ENGINEER and at the CONTRACTOR's expense based on the ENGINEER's then prevailing rates including all direct and indirect costs and fees. Reimburse the OWNER for all such fees invoiced to the OWNER by the ENGINEER.

B. Time Extension: Any need for more than one resubmission, or any other delay in ENGINEER's review of submittals, will not entitle CONTRACTOR to extension of the Contract Time.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01450

QUALITY CONTROL

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Inspection Services

B. Quality Control

C. Costs of Inspection

D. Acceptance Tests

E. Failure to Comply with Contract

1.2 RELATED SECTIONS

A. Section 01330 - Submittals

1.3 SUBMITTALS

A. General: Provide all submittals, including the following, as specified in Division 1.

B. Certificate Submittals: Furnish the ENGINEER authoritative evidence in the form of Certificates of Manufacture that the materials and equipment to be used in the Work have been manufactured and tested in conformity with the Contract Documents. Include copies of the results of physical tests and chemical analyses, where necessary, that have been made directly on the product or on similar products of the manufacturer.

1.4 INSPECTION SERVICES

A. OWNER's Access: At all times during the progress of the Work and until the date of final completion, afford the OWNER and ENGINEER every reasonable, safe, and proper facility for inspecting the Work at the site. The observation and inspection of any work will not relieve the CONTRACTOR of any obligations to perform proper and satisfactory work as specified. Replace work rejected due to faulty design, inferior, or defective materials, poor workmanship, improper installation, excessive wear, or nonconformity with the requirements of the Contract Documents, with satisfactory work at no additional cost to the OWNER.

Replace as directed, finished or unfinished work found not to be in strict accordance with the Contract, even though such work may have been previously approved and payment made therefor.

B. Rejection: The OWNER and the OWNER's Authorized Representatives have the right to reject materials and workmanship which are defective or require correction. Promptly remove rejected work and materials from the site.

C. Inferior Work Discoveries: Failure or neglect on the part of the OWNER or the OWNER's Authorized Representatives to condemn or reject bad or inferior work or materials does not imply an acceptance of such work or materials. Neither is it to be construed as barring the OWNER or the OWNER's Authorized Representatives at any subsequent time from recovering damages or a sum of money needed to build anew all portions of the Work in which inferior work or improper materials were used.

D. Removal for Examination: Should it be considered necessary or advisable by the OWNER or the OWNER's Authorized Representatives, at any time before final acceptance of the Work, to make examinations of portions of the Work already completed, by removing or tearing out such portions, promptly furnish all necessary facilities, labor, and material, to make such an examination. If such Work is found to be defective in any respect, defray all expenses of such examination and of satisfactory reconstruction. If, however, such work is found to meet the requirements of the Contract, the cost of examination and restoration of the Work will be considered a change in the Work to be paid for in accordance with applicable provisions of the Contract.

E. Operation Responsibility: Assume full responsibility for the proper operation of equipment during tests and instruction periods. Make no claim for damage which may occur to equipment prior to the time when the OWNER accepts the Work.

F. Rejection Prior to Warranty Expiration: If at anytime prior to the expiration of any applicable warranties or guarantees, equipment is rejected by the OWNER, repay to the OWNER all sums of money received for the rejected equipment on progress certificates or otherwise on account of the Contract lump sum prices, and upon the receipt of the sum of money, OWNER will execute and deliver a bill of sale of all its rights, title, and interest in and to the rejected equipment. Do not remove the equipment from the premises of the OWNER until the OWNER obtains from other sources, equipment to take the place of that rejected. The OWNER hereby agrees to obtain other equipment within a reasonable time and the CONTRACTOR agrees that the OWNER may use the equipment furnished by the CONTRACTOR without rental or other charge until the other new equipment is obtained.

1.5 QUALITY CONTROL

A. Testing

1. Field and Laboratory

a. Engage an independent firm to perform the following periodic observation and associated services.

(1) Soils: Observe and test excavations, placement and compaction of soils. Determine suitability of excavated material. Observe subgrade soils and foundations.

(2) Concrete: Observe forms and reinforcement; observe concrete placement and facilitate concrete cylinder preparation and prepare test results.

b. When specified in Divisions 2 through 16 of the Contract Documents, provide an independent laboratory testing facility to perform required testing. Qualify the laboratory as having performed previous satisfactory work. Prior to use, submit to the ENGINEER for approval.

c. Cooperate with the ENGINEER and laboratory testing representatives. Provide at least 24 hours notice prior to when specified testing is required. Provide labor and materials, and necessary facilities at the site as required by the ENGINEER and the testing laboratory.

d. Provide an independent testing agency, a member of the National Electrical Testing Association, to perform inspections and tests specified in Division 16 of these Specifications.

2. Equipment: Coordinate and demonstrate test procedures as specified in the Contract Documents or as otherwise required during the formal tests.

3. Pipeline and Other Testing: Conform to test procedures and requirements specified in the appropriate Specification Section.

B. Reports

1. Certified Test Reports: Where transcripts or certified test reports are required by the Contract Documents, meeting the following requirements:

a. Before delivery of materials or equipment submit and obtain approval of the ENGINEER for all required transcripts, certified test reports,

certified copies of the reports of all tests required in referenced specifications or specified in the Contract Documents. Perform all testing in an approved independent laboratory or the manufacturer's laboratory. Submit for approval reports of shop equipment tests within thirty days of testing. Transcripts or test reports are to be accompanied by a notarized certificate in the form of a letter from the manufacturer or supplier certifying that tested material or equipment meets the specified requirements and the same type, quality, manufacture and make as specified. The certificate shall be signed by an officer of the manufacturers or the manufacturer's plant manager.

2. Certificate of Compliance: At the option of the ENGINEER, or where not otherwise specified, submit for approval a notarized Certificate of Compliance. The Certificates may be in the form of a letter stating the following:

   a. Manufacturer has performed all required tests

   b. Materials to be supplied meet all test requirements

   c. Tests were performed not more than one year prior to submittal of the certificate

   d. Materials subjected to the tests are of the same quality, manufacture and make as those specified

   e. Identification of the materials

1.6 COSTS OF INSPECTION

A. CONTRACTOR's Obligation: Include in the Contract Price, the cost of all shop and field tests of materials specifically called for in the Contract Documents. The OWNER may perform tests on any material furnished under this Contract at any time during the Contract. If tests performed by the OWNER result in failure or rejection for noncompliance, reimburse the OWNER for expenditures incurred in making such tests. Tests performed by the OWNER shall prevail in determining compliance with Contract requirements.

B. Reimbursements to OWNER:

1. Materials submitted by the CONTRACTOR as the equivalent to those specifically named in the Contract Documents may be tested by the OWNER for compliance. Reimburse the OWNER for expenditures incurred in making such tests on materials which are rejected for noncompliance.

1.7 ACCEPTANCE TESTS

A. Final Field Tests: Upon completion of the Work and prior to final payment, subject all piping and associated system installed under this Contract to specified acceptance tests to demonstrate compliance with the Contract Documents.

1. Furnish all labor, fuel, energy, water and other materials, equipment, instruments and services necessary for all acceptance tests. Conduct field tests in the presence of the ENGINEER.
2. Conduct field tests in the presence of the ENGINEER. Perform the field tests to demonstrate that under all conditions of operation each equipment item:

    a. Has not be damaged by transportation or installation
    b. Has been properly installed
    c. Has been properly lubricated
    d. Has no electrical or mechanical defects
    e. Is in proper alignment
    f. Has been properly connected
    g. Is free of overheating any parts
    h. Is free of all objectionable vibration
    i. Is free of overloading of any parts
    j. Operates as intended

3. Operate work or portions of work for a minimum of 100 hours or 14 days continuous service, whichever comes first. Conduct test on those systems which require load produced by weather (heating or cooling) exercise only when weather will produce proper load.

B. Failure of Tests: If the acceptance tests reveal defects in material or equipment, or if the material or equipment in any way fails to comply with the requirements of the Contract Documents, then promptly correct such deficiencies. Failure or refusal to correct the deficiencies, or if the improved materials, when tested again, fail to meet the guarantees or specified requirements, the OWNER, notwithstanding its partial payment for work and materials, may reject said Work and materials and may order the CONTRACTOR to remove the defective work from the site at no addition to the Contract Price, and replace it with material which meets the Contract Documents.

1.8 FAILURE TO COMPLY WITH CONTRACT

A. Unacceptable Materials: If it is ascertained by testing or inspection that the material or equipment does not comply with the Contract Documents, do not deliver said material, or if delivered remove it promptly from the site or from the Work and replace it with acceptable material without additional cost to the OWNER. Fulfill all obligations under the terms and conditions of the Contract

even though the OWNER or the OWNER's Authorized Representatives fail to ascertain noncompliance or notify the CONTRACTOR of noncompliance.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01500

CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. General Requirements

B. Damage Survey and Correction

C. Temporary Utilities

D. Temporary Construction

E. Barricades and Enclosures

F. Fences

G. Mailboxes

H. Security

I. Temporary Controls

J. Maintenance of Traffic

K. Field Offices and Sheds

1.2 SUBMITTAL REQUIREMENTS

A. General: Provide all submittals, including the following, as specified in Division 1. In addition to other submittals required under this specification section, specific attention is called to the pedestrian detour specified under Maintenance of Traffic.

1.3 GENERAL REQUIREMENTS

A. Plant and Facilities: Furnish, install, maintain and remove all false work, scaffolding, ladders, hoistways, braces, pumping plants, shields, trestles, roadways, sheeting, centering forms, barricades, drains, flumes, and the like, any of which may be needed in the construction of any part of the Work and which are not

herein described or specified in detail. Accept responsibility for the safety and efficiency of such works and for any damage that may result from their failure or from their improper construction, maintenance or operation.

B. First Aid: Maintain a readily accessible, completely equipped first aid kit at each location where work is in progress.

C. Safety Responsibility: Accept sole responsibility for safety and security at the site. Indemnify and hold harmless the OWNER and the OWNER's Authorized Representatives, including Greeley and Hansen, for any safety violation, or noncompliance with governing bodies and their regulations, and for accidents, deaths, injuries, or damage at the site during occupancy or partial occupancy of the site by CONTRACTOR's forces while performing any part of the Work.

D. Permits: Obtain and pay for any and all permits, approvals and licenses required by all local, state and federal agencies having jurisdiction at no addition to the Contract Price. All work to be performed under these specifications shall conform to the requirements of all local, state and federal agencies having jurisdiction and the requirements of these specifications.

E. Hazard Communication: Furnish two copies of the CONTRACTOR's Hazard Communication Program required under OSHA regulations before beginning on site activities. Furnish two copies of amendments to Hazard Communications Program as they are prepared.

1.4 DAMAGE SURVEY

A. Requirements: Conduct a damage survey of the Work site and adjacent properties prior to commencing the Work and before making application for final payment for the Work. Notify OWNER and Resident Project Representative in advance of videotaping so that OWNER and Resident Project Representative may choose to be present. Provide OWNER with two copies of a video cassette recording of all planned construction areas, material storage areas, areas adjacent to these areas, including but not limited to, streets, driveways, sidewalks, curbs, ditches, fencing, railing, visible utilities, retaining structures, landscaping and trees, and adjacent building structures. The purpose of the video is to document existing site conditions and to provide a fair measure of required restoration. Care should be taken to record all existing conditions which exhibit deterioration, imperfections, structural failures, or situations that would be considered substandard. The video image shall be of sufficient detail to delineate important features and conditions of the project area including public right-of-way and adjacent private property. Submit copies of the videos to the OWNER prior to commencing construction.

Provide videos that are high quality, color and in DVD format. No recording shall be performed during periods of precipitation, mist, fog or when the

ground is covered in snow. The recording shall only be done when sufficient sunlight is present to properly illuminate the subjects of recording. The video portion of the recording shall reproduce bright, sharp, clear pictures with accurate colors and shall be free from distortion, tearing, rolling, or any other form of imperfection. The audio portion of the recording shall reproduce precise and concise explanatory notes by the camera operator with proper volume, clarity and freedom from distortion.

At the start of production and at the beginning of a new street or easement, an identification summary shall be read into the record while using a wide-angle view of the video to display numeric displays for visual record. This summary shall include: (1) DVD number; (2) project name; (3) job location (intersection / street name, project station numbers); (4) positional location at start of job; (5) date and time; (6) weather; (7) direction of camera; (8) any other notable conditions.

No separate payment will be made for the damage survey, but shall be included in the cost of other Contract Items.

1.5 TEMPORARY UTILITIES

A. Water: Provide all necessary and required water without additional cost, unless otherwise specified. If necessary, provide and lay water lines to the place of use; secure all necessary permits; pay for all taps to water mains and hydrants and for all water used at the established rates.

B. Light and Power: Provide without additional cost to the OWNER temporary lighting and power facilities required for the proper construction and inspection of the Work. Maintain temporary lighting and power until the Work is accepted.

C. Heat: Provide temporary heat, whenever required, for work being performed during cold weather to prevent freezing of concrete, water pipes, and other damage to the Work or existing facilities.

D. Sanitary Facilities: Provide sufficient sanitary facilities for construction personnel. Prohibit and prevent nuisances on the site of the Work or on adjoining property. Discharge any employee who violates this rule. Abide by all environmental regulations or laws applicable to the Work.

E. Connections to Existing Utilities:

1. Unless otherwise specified or indicated, make all necessary connections to existing facilities including structures, drain lines, and utilities such as water, sewer, gas, telephone, and electricity. In each case, obtain permission from

the OWNER or the owning utility prior to undertaking connections. Protect facilities against deleterious substances and damage.

2. Thoroughly plan in advance all connections to existing facilities. Have on hand at the time of undertaking the connections, all material, labor and required equipment. Proceed continuously to complete connections in minimum time. Arrange for the operation of valves or other appurtenances on existing utilities, under the direct supervision of the owning utility.

F. Temporary Removal: All existing utility systems which conflict with the construction of the work herein which can be temporarily removed and replaced shall be accomplished at the expense of the CONTRACTOR. Work shall be done by the utility unless the utility approves in writing that the work may be done by the CONTRACTOR.

G. Permanent Relocation of Utilities: Water mains, storm sewer inlets, gas lines, wire lines, service connections, water and gas meter boxes, water and gas valve boxes, light and traffic standards, cable ways, signals, and other utility appurtenances located in the public right of-way which would permanently interfere with the proposed improvements will be moved and paid for by the utility involved, except as otherwise provided for in the general requirements.

1. It is understood and agreed that the CONTRACTOR has considered in the bid all of the permanent and temporary utility appurtenances shown or otherwise indicated on the plans in their present positions and that no additional compensation will be allowed for any delays, inconvenience, or damage sustained due to any interference from said utility appurtenances or the operation of moving them either by the utility company or by CONTRACTOR.

2. It shall also be understood that any utilities located in private easements granted by the OWNER or municipality for the specific location of the utilities and utility appurtenances will be moved by the utility involved but shall be paid for by the OWNER as part of the project.

1.6 TEMPORARY CONSTRUCTION

A. Bridges: Design and place suitable temporary bridges where necessary for the maintenance of vehicular and pedestrian traffic. Assume responsibility for the sufficiency and safety of all such temporary work or bridges and for any damage which may result from their failure or their improper construction, maintenance, or operation. Indemnify and save harmless the OWNER and the OWNER's representatives, including Greeley and Hansen, from all claims, suits or actions, and damages or costs of every description arising by reason of failure to comply with the above provisions.

1.7 BARRICADES AND ENCLOSURES

A. Protection of Workmen and Public: Effect and maintain at all times during the prosecution of the Work, barriers and lights necessary for the protection of Workmen and the Public. Provide suitable barricades, lights, "danger" or "caution" or "street closed" signs and watchmen at all places where the Work causes obstructions to normal traffic, excavation sites, or constitutes in any way a hazard to the public.

B. Barricades and Lights:

1. Protect all streets, roads, highways, excavations and other public thoroughfares which are closed to traffic; use effective barricades which display acceptable warning signs. Locate barricades at the nearest public highway or street on each side of the blocked section.

2. Statutory Requirements: Install and maintain all barricades, signs, lights, and other protective devices within highway rights-of-way in strict conformity with applicable statutory requirements by the authority having jurisdiction.

1.8 FENCES

A. Existing Fences: Obtain written permission from the OWNER prior to relocating or dismantling fences which interfere with construction operations. Reach agreements with the fence owner as to the period the fence may be left relocated or dismantled. Install adequate gates where fencing must be maintained. Keep gates closed and locked at all times when not in use.

B. Restoration: Restore all fences to their original or better condition and to their original location on completion of the Work. If replacing fence, provide materials that match the existing fence style, type, height and post spacing.

1.9 MAILBOXES

If mailboxes need to be temporarily removed, obtain approval of mailbox owner before relocating any mailbox. Coordinate the removal of the mailboxes with the local post office to insure mail delivery can be continued. The mailboxes shall be reset as soon as possible following construction in the area. Reinstall mailboxes to preconstruction conditions in accordance with INDOT Standard Specification Section 6.11.

1.10 SECURITY

A. Preservation of Property:

1. Preserve from damage, all property along the line of the Work, in the vicinity of or in any way affected by the Work, the removal or destruction of which is not called for by the Drawings. Preserve from damage, public utilities, trees, lawn areas, building monuments, fences, pipe and underground structures, and public streets. Note: Normal wear and tear of streets resulting from legitimate use by the CONTRACTOR are not considered as damage. Whenever damages occur to such property, immediately restore to its original condition. Costs for such repairs are incidental to the Contract.

2. In case of failure on the part of the CONTRACTOR to restore property or make good on damage or injury, the OWNER may, upon 24 hours written notice, proceed to repair, rebuild, or otherwise restore such property as may be deemed necessary, and the cost thereof will be deducted from any moneys due or which may become due the CONTRACTOR under this Contract. If removal, repair or replacement of public or private property is made necessary by alteration of grade or alignment authorized by the OWNER and not contemplated by the Contract Documents, the CONTRACTOR will be compensated, in accordance with the General Conditions, provided that such property has not been damaged through fault of the CONTRACTOR or the CONTRACTOR's employees.

B. Public Utility Installations and Structures:

1. Public utility installations and structures include all poles, tracks, pipes, wires, conduits, vaults, manholes, and other appurtenances and facilities, whether owned or controlled by public bodies or privately owned individuals, firms or corporations, used to serve the public with transportation, gas, electricity, telephone, storm and sanitary sewers, water, or other public or private utility services. Facilities appurtenant to public or private property which may be affected by the Work are deemed included hereunder.

2. The Contract Documents contain data relative to existing public utility installations and structures above and below the ground surface. Existing public utility installations and structures are indicated on the Drawings only to the extent such information was made available to, or found by, the ENGINEER in preparing the Drawings. These data are not guaranteed for completeness or accuracy, and the CONTRACTOR is responsible for making necessary investigations to become fully informed as to the character, condition, and extent of all public utility installations and

structures that may be encountered and that may affect the construction operations.

3. Contact utility locating service sufficiently in advance of the start of construction to avoid damage to the utilities and delays to the completion date.

4. Remove, replace, relocate, repair, rebuild, and secure any public utility installations and structures damaged as a direct or indirect result of the Work under this Contract. Costs for such work are incidental to the Contract. Be responsible and liable for any consequential damages done to or suffered by any public utility installations or structures. Assume and accept responsibility for any injury, damage, or loss which may result from or be consequent to interference with, or interruption or discontinuance of, any public utility service.

5. Repair or replace any water, sanitary, storm, gas, electric, telecommunications or other service connection damaged during the Work with no addition to the Contract price.

6. At all times in performance of the Work, employ proven methods and exercise reasonable care and skill to avoid unnecessary delay, injury, damage, or destruction to public utility installations and structures. Avoid unnecessary interference with, or interruption of, public utility services. Cooperate fully with the owners thereof to that end.

7. Give written notice to the owners of all public utility installations and structures affected by proposed construction operations, sufficiently in advance of breaking ground in any area or on any unit of the Work, to obtain their permission before disrupting the lines and to allow them to take measures necessary to protect their interests. Advise the Chiefs of Police, Fire and Rescue Services of any excavation in public streets or the temporary shut-off of any water main. Provide at least 24 hours notice to all affected property owners whenever service connections are taken out of service.

C. Work on Private Property: Work on this project will require operations on private property, rights of way or easements. The OWNER has secured the appropriate easements or rights of entry from the affected property owners. Comply with all easement or rights of entry provisions.

Conduct operations along rights-of-way and easements through private property to avoid damage to the property and to minimize interference with its ordinary use. Upon completion of the Work through such property, restore the surface and all fences or other structures disturbed by the construction to the preconstruction

conditions. Do not remove any material from private property without the consent of the property owner or responsible party in charge of such property. Save the OWNER harmless from any claim or damage arising out of or in connection with the performance of work across and through private property.

D. Miscellaneous Structures: Assume and accept responsibility for all injuries or damage to culverts, building foundations and walls, retaining walls, or other structures of any kind met with during the prosecution of the Work. Assume and accept liability for damages to public or private property resulting therefrom. Adequately protect against freezing all pipes carrying liquid.

E. Protection of Trees and Lawn Areas:

1. Protect with boxes, trees and shrubs, except those ordered to be removed. Do not place excavated material so as to cause injury to such trees or shrubs. Replace trees or shrubs destroyed by accident or negligence of the CONTRACTOR or CONTRACTOR's employees with new stock of similar size and age, at the proper season, at no additional cost to the OWNER.

2. Leave lawn areas in as good condition as before the start of the Work.

1.11 TEMPORARY CONTROLS

A. During Construction:

1. Keep the site of the Work and adjacent premises free from construction materials, debris, and rubbish. Remove this material from any portion of the site if such material, debris, or rubbish constitutes a nuisance or is objectionable.

2. Remove from the site all surplus materials and temporary structures when they are no longer needed.

3. Neatly stack construction materials such as concrete forms and scaffolding when not in use. Promptly remove splattered concrete, asphalt, oil, paint, corrosive liquids, and cleaning solutions from surfaces to prevent marring or other damage.

4. Properly store volatile wastes in covered metal containers and remove from the site daily.

5. Do not bury or burn on the site or dispose of into storm drains, sanitary sewers, streams, or waterways, any waste material. Remove all wastes from the site and dispose of in a manner complying with applicable ordinances and laws.

B. Monitoring Flow and Bypassing:

1. Monitor flow in the sanitary sewers and/or at the lift station affected by construction and provide bypassing operations to prevent sewage back-up or surcharge that may cause public or private property damage. Make restitution with any affected property owner(s) for any damage incurred as a result of sewage back-up or surcharge an interruption to wastewater facilities due to construction of the Work.

2. Provide continuous on-site supervision of any bypassing operations that occur during construction and non-construction work hours. Proposed bypassing operations to be approved by the OWNER at least three full working days in advance of initiating bypass operations.

C. Smoke Prevention:

1. Strictly observe all air pollution control regulations.

2. Open fires will be allowed only if permitted under current ordinances.

D. Noises:

1. Maintain acceptable noise levels in the vicinity of the Work. Limit noise production to acceptable levels by using special mufflers, barriers, enclosures, equipment positioning, and other approved methods.

2. Supply written notification to the OWNER sufficiently in advance of the start of any work which violates this provision. Proceed only when all applicable authorizations and variances have been obtained in writing.

E. Hours of Operation:

1. Operate construction equipment between the hours of 7:00 a.m. and 7:00 p.m. Monday through Friday. OWNER may give written permission to operate construction equipment outside these hours of operation if justified to facilitate short duration construction activities such as connections or at specific locations where public inconvenience can be reduced.

2. Do not carry out nonemergency work, including equipment moves, on Sundays without prior written authorization by the OWNER.

F. Dust Control:

1. Take measures to prevent unnecessary dust. Keep earth surfaces exposed to dusting moist with water or a chemical dust suppressant. Cover materials in piles or while in transit to prevent blowing or spreading dust.

2. Adequately protect buildings or operating facilities which may be affected adversely by dust. Protect machinery, motors, instrument panels, or similar equipment by suitable dust screens. Include proper ventilation with dust screens.

G. Temporary Drainage Provisions:

1. Provide for the drainage of stormwater and any water applied or discharged on the site in performance of the Work. Provide adequate drainage facilities to prevent damage to the Work, the site, and adjacent property.

2. Supplement existing drainage channels and conduits as necessary to carry all increased runoff from construction operations. Construct dikes as necessary to divert increased runoff from entering adjacent property (except in natural channels), to protect the OWNER's facilities and the Work, and to direct water to drainage channels or conduits. Provide ponding as necessary to prevent downstream flooding.

3. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.

H. Erosion Control: Provide erosion control in accordance with Section 02370 – Slope Protection and Erosion Control.

I. Pollution: Prevent the pollution of drains and watercourses by sanitary wastes, sediment, debris, and other substances resulting from construction activities. Do not permit sanitary wastes to enter any drain or watercourse other than sanitary sewers. Do not permit sediment, debris, or other substances to enter sanitary sewers. Take reasonable measures to prevent such materials from entering any drain or watercourse.

1.12 MAINTENANCE OF TRAFFIC

A. Traffic Facilities And Traffic Control – General:

1. The road shall be kept open to all traffic while undergoing improvements. Maintenance of traffic shall be in accordance with the details as shown on the plans or as specified. Before starting any Work on the Project, submit in writing to OWNER, a detailed plan for maintaining traffic on all streets and highways and pedestrian detour affected by this Project.

2. The portion of the roadway being used by public traffic shall be kept in such condition that traffic will be adequately accommodated. Temporary approaches to businesses, parking lots, residences, garages, farms, crossings, intersections with trails, roads and streets shall be provided in a safe condition. All traffic control devices shall be maintained at no additional cost to OWNER.

3. Prosecute the Work in such a manner that property owners and businesses will experience minimal access disruption. Maintain access to residential drives at all times where possible. At least one access must be maintained at all commercial businesses. For those drive approaches to be closed for their construction, submit notification to the business or property owner 72 hours prior to such closings. The approaches at businesses with only one access point shall be constructed one-half at a time so that traffic can be maintained at all times. If construction of an approach one-half at a time does not provide the required access, then other provisions or temporary access by other means shall be provided to the property owner or business.

4. Regulatory controls shall not be changed without prior approval. Regulatory control devices may be relocated in order to permit necessary construction, providing these control devices remain effective and convey the intended meaning after relocation to a position which complies with the requirements of the Manual of Uniform Traffic Control Devices (MUTCD). After completion of the construction, regulatory control devices which were relocated to facilitate construction shall be permanently installed with no additional payment, in accordance with the plans, or as otherwise directed. Any traffic control devices damaged, while being moved or handled, shall be replaced with no additional payment. All other traffic control devices necessary to maintain safe traffic operations and routings shall not be removed, changed, or relocated, except as authorized. Traffic control devices removed without authorization shall be replaced with no additional payment.

5. Obtain all permits required for work within public right of way, including the closure of traffic lanes, from the OWNER where applicable.

6. Construct and maintain all temporary walks, roads, bridges, culverts, and traffic control devices to facilitate vehicular and pedestrian traffic as required for the project.

7. During the progress of the Work, make ample provision for both vehicular and foot traffic on any public road and indemnify and hold harmless OWNER from any expense whatsoever due to his operations over said roadways. Organize and conduct work such that traffic can be properly maintained.

8. Provide and maintain safeguards, safety devices, and protective equipment and take any other needed actions that may be necessary to protect the public and property in connection with the Work. Restore all original pavement markings, signs, and traffic control devices.

B. Local Traffic:

1. For local traffic, provide and maintain in a safe condition, including snow and ice removal, such drives, temporary roadways, bypasses, sidewalks, or temporary structures as may be necessary to provide vehicular and pedestrian ingress and egress for the residents and facilities adjacent to the improvements. Temporary approaches and crossings of intersecting highways shall also be provided and maintained in a safe condition.

2. Provide free access to all municipal, commercial and residential entrances, fire hydrants and water and gas valves located along the line of work. Install and maintain temporary driveways, bridges, and trench crossings which in the opinion of ENGINEER are necessary to maintain access to residences and businesses and to reasonably accommodate the public at no additional cost to OWNEER.

C. Through Traffic:

1. When the street affected by Project construction is being used by through traffic including periods of suspension of the Work, maintain by the use of labor, equipment, and materials that portion of the street being used, such that it is smooth, free from holes, ruts, ridges, bumps, and dust. The street being used shall be provided with the necessary outlets to drain freely. Pipe trenches or other openings left in hard surface pavements shall be maintained with material as specified.

2. The proper authorities shall have the right to enter upon that portion of the Work where CONTRACTOR is responsible for maintaining traffic to remove snow and ice and place abrasives at their own expense, as necessary. Be responsible for the removal of abrasives placed, for which no claim for

additional compensation shall be allowed nor be relieved in any way of CONTRACTOR'S obligation for maintenance of traffic.

3. Provide and maintain temporary bridges and trench crossings such as in the opinion of ENGINEER and OWNER are necessary to accommodate through traffic and the general public. Temporary bridges and trench crossings shall be designed, signed, and sealed by a licensed professional engineer registered in the State of Indiana.

D. Traffic Control:

1. Conform installation, maintenance, and operation of all traffic controls and traffic control devices to the requirements of the INDOT Standard Specifications. Provide traffic control devices with suitable supports of sufficient strength and stability.

2. Faces of construction signs, barricades, vertical panels and drum banks shall be suitably reflectorized using sheeting complying with the requirements of the INDOT Standard Specification Section 801.04.

3. Provide traffic cones of a highly visible orange color. Provide temporary pavement markings conforming to the INDOT Standard Specification Section 801.12 unless otherwise specified.

4. Barricades and channelizing devices such as cones, vertical panels, hazard markers, and drums shall be highly visible. They shall also be protected by adequate advance warning devices and by suitable lighting or reflectorization at night (between the hours of sunset to sunrise). Detour signs, traffic control signs, barricades, construction lighting, etc. shall be replaced whenever damaged, stolen or vandalized.

5. Equipment and material stored within road right-of-way shall be marked at all times. At night any such material or equipment stored between the side ditches, or between lines 5 feet behind any raised curbs, shall be clearly outlined with dependable lighted devices. In addition, provide any other lights, barricades, etc., that may be needed for the protection of pedestrian traffic.

E. Traffic Maintained:

1. Maintain two-way traffic flow on all roadways within the construction limits at all times.

2. **The asphalt path on the south side of Cumberland Avenue will be closed during force main installation from approximately Station 15+00 to 29+00. During that time CONTRACTOR shall provide, install and maintain traffic control devices upstream and downstream of the work to allow for a pedestrian detour. Submit detailed traffic control / pedestrian detour plan to ENGINEER 30 days prior to the anticipated path closure.**

3. For a lane shift, traffic control devices may remain in place 24 hours. The lane shift will use the two-way left-turn lane as the inside southbound travel lane. Provide three (3) rows of barrels to delineate two channels for shifted southbound traffic. Post advisory "Speed Limit 30 MPH" signs during all times of traffic control.

4. Traffic Control for Long-Term Shoulder Closure: At locations determined by CONTRACTOR where work is necessary beyond 10 feet of the edge of the through lane of a roadway, provide and maintain traffic control devices upstream and downstream of the work along the shoulder of the roadway, in accordance with the latest edition of the INDOT Work Zone Safety Manual.

5. Traffic Control for Long-Term Lane Closure: At locations determined by CONTRACTOR where work is necessary within 10 feet from the edge of the through lane of a roadway, provide and maintain traffic control devices upstream and downstream of the work along the lane of the roadway, in accordance with the latest edition of the INDOT Work Zone Safety Manual.

6. Maintaining Traffic – Prosecution and Progress: Access and traffic to all businesses, residences, for all postal deliveries and all emergency traffic such as police, fire, medical, etc. within the project limits, shall be maintained at all times.

    a. The names and telephone numbers of CONTRACTOR's superintendent and two other responsible employees shall be furnished at the pre-construction conference.

    b. These employees shall be on call and available at nights, weekends, or during other non-working periods to repair or replace all traffic control devices which may become damaged or inoperative.

    c. Should CONTRACTOR propose a street closure not otherwise identified within the Contract Documents, submit a written request to OWNER for review and approval at least 3 weeks prior to the planned closure.

d. Pedestrian traffic shall also be maintained with disruptions kept to a minimum. Provide signage “Sidewalk Closed Ahead” at closest signal light at both ends of project site.

e. Any trenching areas adjacent to a sidewalk shall be barricaded. If adequate sidewalk area is not available, divert pedestrian traffic across the street and shall provide all materials necessary to provide for the crossover.

f. Trenching in the streets shall not be left open during off-working hours. The trenches shall be either backfilled with crushed stone or steel plated per current OWNER's ordinances or regulations.

g. Coordinate all construction activities with the City of West Lafayette Streets, Sanitation and Recycling Department for trash collection. Contact Dave Downey, Streets Commissioner, at 765-775-5242. If CONTRACTOR’s activities restrict access to any trash container scheduled for pickup by OWNER, be responsible for relocating the trash container(s) to an alternate location acceptable to the OWNER.

7. Where a street affected by Project construction is being used by through traffic, including periods of suspension of the Work, furnish and maintain pavement markings, lights, warning signs, road construction - traffic maintained signs and end construction signs, barricades, temporary guardrail, and such other traffic control devices, and watchmen and flaggers as may be necessary to maintain safe traffic conditions within the work limits.

8. Furnish and erect regulatory signs and guide signs within the work limits on all traffic maintained projects. The responsibility for maintenance of these signs shall rest with CONTRACTOR. The erection and removal of all regulatory signs shall be approved by ENGINEER.

9. Existing signs and traffic control devices within the work limits shall remain in use during the construction period. If there is need to relocate or modify existing signs or traffic control devices as a consequence of work sequence, provide suitable supports and modify the devices after receiving prior approval from OWNER and the maintaining agency. Routine maintenance of existing traffic control devices will remain the responsibility of the maintaining agency. The function of existing Stop or Yield signs shall be retained at all times although their position may be adjusted. Existing signs that must be relocated laterally shall be placed in accordance with the INDOT Standard Specifications. Restore all relocated or modified signs to the position and condition which existed prior to construction.

10. When an existing signal operation must be interrupted for a period, provide a temporary traffic control method approved by OWNER and the authority maintaining the signal at no additional cost to OWNER.

11. Whenever it is necessary to divert the flow of traffic from its normal channel into another channel, the channel for such diverted traffic shall be clearly marked with cones, drums, barricades, vertical panels, pavement markings, or flashing arrow panels. This method of marking shall also be used where work is being done adjacent to the part of the street or highway in use by the public or where work is being done on the shoulder where the roadway is being used by the public. During darkness hours, barricades and drums shall be supplemented with yellow flashing or steady burning electric warning lights in accordance with the INDOT Standard Specifications.

12. CONTRACTOR shall obtain the approval of OWNER and the proper authorities before closing a traffic lane or establishing a one-way traffic operation.

F. Pavement Marking Operations:

1. Perform moving marking operations by a truck equipped with necessary flashers and warning signs and protect by a similarly equipped trailing vehicle or vehicles separated a sufficient distance to provide adequate advance warning to overtaking traffic. The marking operation should use the extreme left or right lane when possible. Where 3 or more lanes exist, the operation shall allow traffic to pass on one side only.

2. Protect stationary marking operations in intersections, school zones, and other areas with traffic control devices such as advance warning signs and cones.

3. Lane striping shall be in accordance with all applicable standards of INDOT Standard Specification Section 808.

4. Temporary striping necessary for the maintenance of traffic shall be placed. The temporary striping shall comply with Section 801.13. Yellow striping shall be placed on the center line and white striping on the lane dividing lines. The temporary striping shall be placed on both intermediate and surface courses and may be painted on cold planed areas. Temporary striping will be in place prior to opening the roadway to traffic. The striping tape shall be Temporary Pavement Marking Type II. Temporary striping shall be placed to the original/existing condition.

H. General Maintenance of Traffic:

1. A minimum of one lane for emergency vehicles is to be provided at all times on all streets affected by this project.

2. All trenches and openings shall be backfilled as soon as possible or as specified, and the pavement restored.

3. Confer with OWNER, local property owners, and others who may be affected by the Project before starting any work at locations affecting said parties, and the carrying out of this work with respect to traffic maintenance shall be covered by agreements reached at such conferences.

4 The location, design, and construction of driveways, roads, and access and egress points for construction equipment vehicles to public streets which may be required by CONTRACTOR for construction on easements and other locations shall be approved by ENGINEER. All such points shall be provided with adequate warning signs.

5. No parking or standing of vehicles on streets will be permitted.

6. No parking within private business parking lots will be permitted.

1.13 FIELD OFFICES AND SHEDS

A. CONTRACTOR's Office: Have an authorized supervisor under the direct employ of the General Contractor (i.e. foreman, superintendent, or manager) present in the field at all times while the Work is in progress. Keep readily accessible copies of the Contract Documents, required record documents, and the latest approved shop drawings at the site at all times.

B. Material Sheds and Temporary Structures: Provide material sheds and other temporary structures of sturdy construction and neat appearance.

C. Location: Coordinate location of material sheds and temporary structures with ENGINEER and OWNER.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01600

MATERIAL AND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Description

B. Substitutions

C. Manufacturer's Written Instructions

D. Transportation and Handling

E. Storage, Protection and Maintenance

F. Manufacturer's Field Quality Control Services

G. Post Startup Services

H. Special Tools and Lubricating Equipment

I. Lubrication

1.2 DESCRIPTION

A. Proposed Manufacturers List: Within 15 calendar days of the date of the Notice to Proceed, submit to the ENGINEER a list of the names of proposed manufacturers, material men, suppliers and subcontractors, obtain approval of this list by OWNER prior to submission of any shop drawings. Upon request submit evidence to ENGINEER that each proposed manufacturer has manufactured a similar product to the one specified and that it has previously been used for a like purpose for a sufficient length of time to demonstrate its satisfactory performance.

B. Furnish and install Material and Equipment which meets the following:

1. Conforms to applicable specifications and standards.

2. Complies with size, make, type, and quality specified or as specifically approved, in writing, by ENGINEER.

3. Will fit into the space provided with sufficient room for operation and maintenance access and for properly connecting piping, ducts and services, as applicable. Make the clear spaces that will be available for operation and maintenance access and connections equal to or greater than those shown and meeting all the manufacturers' requirements. Make all provisions for installing equipment furnished at no increase in Contract Price.

4. Manufactured and fabricated in accordance with the following:

   a. Design, fabricate, and assemble in accordance with best engineering and shop practices.

   b. Manufacture like parts of duplicate units to standard sizes and gauges, to be interchangeable.

   c. Provide two or more items of same kind identical, by same manufacturer.

   d. Provide materials and equipment suitable for service conditions.

   e. Adhere to equipment capabilities, sizes, and dimensions shown or specified unless variations are specifically approved, in writing, in accordance with the Contract Documents.

   f. Adapt equipment to best economy in power consumption and maintenance. Proportion parts and components for stresses that may occur during continuous or intermittent operation, and for any additional stresses that may occur during fabrication or installation.

   g. Working parts are readily accessible for inspection and repair, easily duplicated and replaced.

5. Use material or equipment only for the purpose for which it is designed or specified.

1.3 SUBSTITUTIONS

A. Substitutions:

1. CONTRACTOR'S requests for changes in equipment and materials from those required by the Contract Documents are considered requests for substitutions and are subject to CONTRACTOR'S representations and review provisions of the Contract Documents when one of following conditions are satisfied:

a. Where request is directly related to an "or equal" clause or other language of same effect in Specifications.

b. Where required equipment or material cannot be provided within Contract Time, but not as result of CONTRACTOR'S failure to pursue Work promptly or to coordinate various activities properly.

c. Where required equipment or material cannot be provided in manner compatible with other materials of Work, or cannot be properly coordinated therewith.

2. CONTRACTOR'S Options:

a. Where more than one choice is available as options for CONTRACTOR'S selection of equipment or material, select option compatible with other equipment and materials already selected (which may have been from among options for other equipment and materials).

b. Where compliance with specified standard, code or regulation is required, select from among products which comply with requirements of those standards, codes, and regulations.

c. "Or Equal": For equipment or materials specified by naming one or more equipment manufacturer and "or equal", submit request for substitution for any equipment or manufacturer not specifically named.

B. Conditions Which are Not Substitution:

1. Requirements for substitutions do not apply to CONTRACTOR options on materials and equipment provided for in the Specifications.

2. Revisions to Contract Documents, where requested by OWNER or ENGINEER, are "changes" not "substitutions".

3. CONTRACTOR'S determination of and compliance with governing regulations and orders issued by governing authorities do not constitute substitutions and do not constitute basis for a Change Order, except as provided for in Contract Documents.

1.4 MANUFACTURER'S WRITTEN INSTRUCTIONS

A. Instruction Distribution: When the Contract Documents require that installation, storage, maintenance and handling of equipment and materials comply with

manufacturer's written instructions, obtain and distribute printed copies of such instructions to parties involved in installation, including six copies to ENGINEER.

1. Maintain one set of complete instructions at jobsite during storage and installation, and until completion of work.

B. Manufacturer's Requirements: Store, maintain, handle, install, connect, clean, condition, and adjust products in accordance with manufacturer's written instructions and in conformity with Specifications.

1. Should job conditions or specified requirements conflict with manufacturer's instructions, consult ENGINEER for further instructions.

2. Do not proceed with work without written instructions.

C. Performance Procedures: Perform work in accordance with manufacturer's written instructions. Do not omit preparatory steps or installation procedures, unless specifically modified or exempted by Contract Documents.

1.5 TRANSPORTATION AND HANDLING

A. Coordination with Schedule: Arrange deliveries of materials and equipment in accordance with Construction Progress Schedules. Coordinate to avoid conflict with work and conditions at site.

1. Deliver materials and equipment in undamaged condition, in manufacturer's original containers or packaging, with identifying labels intact and legible.

2. Protect bright machined surfaces, such as shafts and valve faces, with a heavy coat of grease prior to shipment.

3. Immediately upon delivery, inspect shipments to determine compliance with requirements of Contract Documents and approved submittals and that material and equipment are protected and undamaged.

B. Handling: Provide equipment and personnel to handle material and equipment by methods recommended by manufacturer to prevent soiling or damage to materials and equipment or packaging.

1.6 STORAGE, PROTECTION, AND MAINTENANCE

A. On-site storage areas and buildings:

1. Coordinate location of storage areas with ENGINEER and OWNER.

2. Arrange on site storage areas for proper protection and segregation of stored materials and equipment with proper drainage. Provide for safe travel around storage areas and safe access to stored materials and equipment.

3. Store loose granular materials in a well-drained area on solid surfaces to prevent mixing with foreign matter.

4. Store materials such as pipe, reinforcing and structural steel, and equipment on pallets, blocks or racks, off ground.

B. OWNER'S Responsibility: OWNER assumes no responsibility for materials or equipment stored in buildings or on-site. CONTRACTOR assumes full responsibility for damage due to storage of materials or equipment.

C. CONTRACTOR'S Responsibility: CONTRACTOR assumes full responsibility for protection of completed construction. Repair and restore damage to completed Work equal to its original condition.

1.7 MANUFACTURER'S FIELD QUALITY CONTROL SERVICES

A. General:

1. Provide manufacturer's field services in accordance with this subsection for those tasks specified in other sections.

2. Provide training as specified in Section 01820.

3. Include and pay all costs for suppliers' and manufacturers' services, including, but not limited to, those specified.

B. Installation Instruction: Provide instruction by competent and experienced technical representatives of equipment manufacturers or system suppliers as necessary to resolve assembly or installation procedures which are attributable to, or associated with, the equipment furnished.

C. Installation Inspection, Adjustments and Startup Participation:

1. Provide competent and experienced technical representatives of equipment manufacturers or system suppliers to inspect the completed installation as follows.

a. Verify that equipment or system is installed in accordance with the manufacturer's recommendations, approved shop drawings and the Contract Documents.

b. Verify that nothing in the installation voids any warranty.

2. Provide manufacturer's representatives to perform initial equipment and system adjustment and calibration conforming to the manufacturer's recommendations and instructions, approved shop drawings and the Contract Documents.

3. Obtain ENGINEER's approval before start-up of equipment. Execute start-up under supervision of applicable manufacturer's representative in accordance with manufacturers' instructions.

4. Furnish ENGINEER with three copies of the following. When training is specified, furnish the copies at least 24 hours prior to training.

   a. "Certificate of Installation, Inspection and Start-up Services" by manufacturers' representatives for each piece of equipment and each system specified, certifying:

      (1) That equipment is installed in accordance with the manufacturers' recommendations, approved shop drawings and the Contract Documents.

      (2) That nothing in the installation voids any warranty.

      (3) That equipment has been operated in the presence of the manufacturer's representative.

      (4) That equipment, as installed, is ready to be operated by others.

   b. Detailed report by manufacturers' representatives, for review by ENGINEER of the installation, inspection and start-up services performed, including:

      (1) Description of calibration and adjustments if made; if not in Operation and Maintenance Manuals, attach copy.

      (2) Description of any parts replaced and why replaced.

      (3) Type, brand name, and quantity of lubrication used, if any.

      (4) General condition of equipment.

      (5) Description of problems encountered and corrective action taken.

      (6) Any special instructions left with CONTRACTOR or ENGINEER.

D. Field Test Participation: Provide competent and experienced technical representatives of all equipment manufacturers and system suppliers as necessary to participate in field testing of the equipment specified in Section 01450.

E. Trouble-Free Operation: Provide competent and experienced technical representatives of all equipment manufacturers and system suppliers as necessary to place the equipment in trouble-free operation after completion of start-up and field tests.

1.8 POST START-UP SERVICES

A. General: Provide Post Start-up Services in accordance with this subsection for equipment specified in other sections.

B. Site Visit: Provide the services of an authorized service representative for each equipment manufacturer or system supplier to make a final site visit after the equipment or system has been in operation for at least 6 months, but no longer than 11 months. Furnish assistance to OWNER's operating personnel in making adjustments and calibrations required to determine that the equipment and system is operating in conformance with design, manufacturer's, and specification requirements. Instruct the personnel in a review of proper operation and maintenance procedures.

C. Certificate: Furnish "Certificate of Post Start-up Services" cosigned by ENGINEER and the manufacturer's representative, certifying that this service has been performed. Use form provided in this section, and furnish OWNER with three copies.

1.9 SPECIAL TOOLS AND LUBRICATING EQUIPMENT

A. General: Furnish, per manufacturer's recommendations, special tools required for checking, testing, parts replacement, and maintenance. Special tools are those which have been specially designed or adapted for use on parts of the equipment, and which are not customarily and routinely carried by maintenance mechanics.

B. Time of Delivery: Deliver special tools and lubricating equipment to OWNER when unit is placed into operation and after operating personnel have been properly instructed in operation, repair, and maintenance of equipment.

C. Quality: Provide tools and lubricating equipment of a quality meeting equipment manufacturer's requirements.

1.10 LUBRICATION

A. General: Where lubrication is required for proper operation of equipment, incorporate in the equipment the necessary and proper provisions in accordance with manufacturer's requirements. Where possible, make lubrication automated and positive.

B. Oil Reservoirs: Where oil is used, supply reservoir of sufficient capacity to lubricate unit for a 24-hour period.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

CERTIFICATE OF INSTALLATION, INSPECTION AND START-UP SERVICES

Project _____

Equipment _____

Specification Section _____

Contract _____

I hereby certify that the named equipment has been inspected, adjusted and operated by the Manufacturers' Representative and further certify:

1. That the equipment is installed in accordance with the manufacturer's recommendations, approved shop drawings and the Contract Documents.
2. That nothing in the installation voids any warranty.
3. That equipment has been operated in the presence of the manufacturer's representative.
4. That equipment, as installed, is ready to be operated by others.

MANUFACTURERS' REPRESENTATIVE

Signature _____ Date _____

Name (print) _____

Title_____

Representing_____

CONTRACTOR

Signature _____ Date _____

Name (print) _____

Title_____

Attach the detailed report called for by Specification Section 01600.

Complete and submit three copies of this form with the detailed report to ENGINEER as specified.

CERTIFICATE OF POST START-UP SERVICES

Project _____

Equipment_____

Specification Section_____

Contract_____

I hereby certify the Manufacturers' Representative has inspected this equipment, made adjustments and calibrations, and that it is operating in conformance with the design, specifications, and manufacturer's requirements. Detailed notation of improper operation with corresponding recommendations, if any, are made and attached to this form.

MANUFACTURERS' REPRESENTATIVE

Signature _____ Date _____

Name (print) _____

Title_____

Representing_____

CONTRACTOR

Signature _____ Date _____

Name (print) _____

Title_____

ENGINEER

Signature _____ Date _____

Name (print) _____

Title_____

COMMENTS: Complete and submit three copies of this form to OWNER upon completion of 6 to 11 months reinspection as required by Specification Section 01600.

SECTION 01722

LINES AND GRADES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. General

B. Surveys

C. Datum Plane

D. Protection of Survey Data

1.2 GENERAL

A. Construct all work in accordance with the lines and grades shown on the Drawings. Assume full responsibility for keeping all alignment and grade.

1.3 SURVEYS

A. Control Points: Base horizontal and vertical control points will be established or designated by the ENGINEER and used as datum for the Work. Perform all additional survey, layout, and measurement work.

1. Keep ENGINEER informed, sufficiently in advance, of the times and places at which work is to be performed so that base horizontal and vertical control points may be established and any checking deemed necessary by ENGINEER may be done, with minimum inconvenience to the ENGINEER and at no delay to CONTRACTOR. It is the intention not to impede the Work for the establishment of control points and the checking of lines and grades set by the CONTRACTOR. However, when necessary, suspend working operations for such reasonable time as the ENGINEER may require for this purpose. Costs associated with such suspension are deemed to be included in the Contract Price, and no time extension or additional costs will be allowed.

2. Provide an experienced survey crew including an instrument operator, competent assistants, and any instruments, tools, stakes, and other materials required to complete the survey, layout, and measurement of work performed by the CONTRACTOR.

1.4 DATUM PLANE

A. Coordinates are North American Datum, 1983 State Plane Coordinates (Indiana West Zone). Elevations shown on the drawings or specified refer to the North American Vertical Datum, 1988 and are expressed in feet and decimal parts thereof, or in feet and inches.

Butler, Fairman & Seufert, Lafayette, Indiana provided the horizontal and vertical control used to prepare the Contract Documents.

1.5 PROTECTION OF SURVEY DATA

A. General: Safeguard all points, stakes, grade marks, known property corners, monuments, and benchmarks made or established for the Work. Reestablish them if disturbed, and bear the entire expense of checking reestablished marks and rectifying work improperly installed.

B. Records: Keep neat and legible notes of measurements and calculations made in connection with the layout of the Work. Furnish copies of such data to the ENGINEER for use in checking the CONTRACTOR's layout. Data considered of value to the OWNER will be transmitted to the OWNER by the ENGINEER with other records on completion of the Work.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01732

CUTTING AND PATCHING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. General Requirements

B. Scheduling of Shutdown

1.2 RELATED SECTIONS

A. Section 01110 - Summary of Work

1.3 GENERAL REQUIREMENTS

A. Coordination: Perform all cutting, fitting or patching of the Work that may be required to make the several parts thereof join in accordance with the Contract Documents. Perform restoration with competent workmen skilled in the trade.

B. Improperly Timed Work: Perform all cutting and patching required to install improperly timed work, to remove samples of installed materials for testing, and to provide for alteration of existing facilities or for the installation of new Work in the existing construction.

C. Limitations: Except when the cutting or removal of existing construction is specified or indicated, do not undertake any cutting or demolition that may affect the structural stability of the Work or existing facilities without the ENGINEER's concurrence.

1.4 SCHEDULING OF SHUTDOWN

A. Connections to Existing Facilities: If any connections, replacement, or other work requiring the shutdown of an existing facility is necessary, schedule such work at times when the impact on the OWNER's normal operation is minimal. Overtime, night and weekend work without additional compensation from the OWNER, may be required to make these connections, especially if the connections are made at times other than those specified.

B. Request for Shutdowns: Submit a written request for each shutdown to the OWNER and the ENGINEER sufficiently in advance of any required shutdown.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.1 PREPARATION

A. Safeguards: Provide all shoring, bracing, supports, and protective devices necessary to safeguard all work and existing facilities during cutting and patching operations.

B. Material Removal: Cut and remove all materials to the extent shown or as required to complete the Work. Remove materials in a careful manner with no damage to adjacent facilities. Remove materials that are not salvageable from the site.

3.2 RESTORATION

A. Final Appearance and Finish: Restore all work and existing facilities affected by cutting operations, with new materials, or with salvaged materials acceptable to the ENGINEER, to obtain a finished installation with the strength, appearance, and functional capacity required. If necessary, patch and refinish entire surfaces.

END OF SECTION

SECTION 01783

OPERATION AND MAINTENANCE MANUALS

PART 1 GENERAL

1.1 DESCRIPTION

A. Scope: Furnish to the ENGINEER 6 (3 paper and 3 electronic) copies of an Operation and Maintenance Manual for all equipment and associated control systems furnished and installed.

1.2 QUALITY ASSURANCE

A. Reference Codes and Specifications: No current government or commercial specifications or documents apply.

1.3 SUBMITTALS

A. Prior to the Work Reaching 50 Percent Completion, submit to the ENGINEER for approval two (2) copies (one hard copy and one electronic copy) of the preliminary manual with all specified material for each piece of equipment provided as detailed in the subsequent specification sections. Submit the approval copies with the partial payment request for the specified completion. Within 30 days after the ENGINEER's approval of the preliminary manuals, furnish to the ENGINEER the remaining 6 copies of the CONTRACTOR's final project Operation and Maintenance manual. Provide space in the manual for additional material. Submit any missing material for the manual prior to requesting certification of substantial completion.

B. Prior to requesting a certificate of beneficial occupancy, the associated equipment's preliminary Operation and Maintenance manuals must be submitted and approved.

C. Provide 6 copies of the final CONTRACTOR's O&M manual complete after the submission of any missing material prior to requesting certification of substantial completion. CONTRACTOR shall ensure that <u>all</u> material required for a complete CONTRACTOR's O&M manual is included on the electronic copy. The electronic version of the final manual shall be submitted in the latest PDF file format and follow the same contents, organization and formatting as the final hardcopies of the manual

1.4 FORMAT AND CONTENTS

A. Prepare and arrange each hard copy of the manual as follows:

1. One copy of an equipment data summary (see sample form) for each item of equipment which shall include the following as a minimum:

    a. Name and contact information of manufacturer.
    b. Name and contact information of local manufacturer representative.
    c. Equipment serial numbers.
    d. Equipment warranty information, including warranty start and end dates,
    e. Equipment layout drawings complete with as-built information and dimensions.
    f. Manufacturer’s certificates of proper installation.
    g. Certified equipment test results (i.e. pump curves, load tests etc.)

2. One copy of an equipment preventive maintenance data summary (see sample form) for each item of equipment.

3. One copy of the manufacturer's operating and maintenance instructions. Operating instructions include equipment start-up, normal operation, shutdown, emergency operation and troubleshooting. Maintenance instructions include equipment installation, calibration and adjustment, preventive and repair maintenance, lubrication, troubleshooting, parts list and recommended spare parts.

4. List of electrical relay settings and control and alarm contact settings.

5. Electrical interconnection wiring diagram for equipment furnished including all control and lighting systems.

6. One valve schedule giving valve number, location, fluid, and fluid destination for each valve installed. Group all valves in same piping systems together in the schedule. Obtain a sample of the valve numbering system from the ENGINEER.

7. All information provided in the manual shall be modified so that it ONLY includes information pertaining to the approved equipment and shall accurately depict the equipment provided. All “optional” and non-pertinent materials and information shall be excluded from the manual or noted as such.

8. Furnish all O&M Manual material on 8-1/2 by 11 commercially printed or typed forms or an acceptable alternative format.

B. Organize each hardcopy manual into sections paralleling the equipment specifications. Identify each section using heavy section dividers with reinforced holes and numbered plastic index tabs. Use 3-ring, slant ring, hard-back binders Type No. AVE-VS11 as manufactured by Avery Company, or equal. Binder size shall be 3-inch maximum. Punch all loose data for binding. Arrange composition and printing so that punching does not obliterate any data. Print on the cover and binding edge of each manual the project title, and manual title, as furnished and approved by the ENGINEER.

C. Leave all operating and maintenance material that comes bound by the equipment manufacturer in its original bound state. Cross-reference the appropriate sections of the CONTRACTOR's O&M manual to the manufacturers' bound manuals.

D. Label binders Volume 1, 2, and so on, where more than one binder is required. Include the table of contents for the entire set, identified by volume number, in each binder.

1.5 CD ROM MANUALS

A. Provide CD ROM copies of the accepted complete manual.

1. Provide manual documents formatted in the latest Adobe portable document format (PDF).

2. Produce the PDF files by either direct digital conversion or optical scanning. Use only original documents if the scanning method is employed. Scanning of copied material is not acceptable.

3. Convert color documents to color PDF files.

4. Large manuals to be broken down into several linked files.

5. Save each PDF using “image and text” format so as to permit later indexing of the document.

6. Provide each PDF file with a table of contents of navigation links to major topic sections.

7. Name PDF files using equipment description identifiers along with the “PDF” filename extension.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

City of West Lafayette, Indiana

Sheraton Lift Station

Equipment Data Summary

Equipment Name: Specification Reference:

Manufacturer:

Name:

Address:

Telephone:

Number Supplied: Location/Service:

Model No: Serial No:

Type:

Size/Speed/Capacity/Range (as applicable):

Power Requirement (Phase/Volts/Hertz):

Local Representative:

Name:

Address:

Telephone:

NOTES:

City of West Lafayette, Indiana

Fairway Knolls Lift Station

Equipment Data Summary

Equipment Name: Specification Reference:

Manufacturer:

Name:

Address:

Telephone:

Number Supplied: Location/Service:

Model No: Serial No:

Type:

Size/Speed/Capacity/Range (as applicable):

Power Requirement (Phase/Volts/Hertz):

Local Representative:

Name:

Address:

Telephone:

NOTES:

City of West Lafayette, Indiana

Sheraton Lift Station

Preventive Maintenance Summary

Equipment Name: Location:

Manufacturer:

Name:

Address:

Telephone:

Model No: Serial No:

Maintenance Task	Lubricant/Part	D W M Q SA A	O&M Manual Reference

NOTES:

*D-Daily W-Weekly M-Monthly Q-Quarterly SA-Semi-Annual A-Annual

City of West Lafayette, Indiana

Fairway Knolls Lift Station

Preventive Maintenance Summary

Equipment Name: Location:

Manufacturer:

Name:

Address:

Telephone:

Model No: Serial No:

Maintenance Task	Lubricant/Part	D W M Q SA A	O&M Manual Reference

NOTES:

*D-Daily W-Weekly M-Monthly Q-Quarterly SA-Semi-Annual A-Annual

SECTION 01789

CONTRACT CLOSE OUT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Warranties and Bonds

B. Record Drawings

C. Special Tools

1.2 WARRANTIES AND BONDS

Prior to final payment deliver to the OWNER the original and one copy of all bonds, warranties, guarantees and similar documents, including those customarily provided by manufacturers and suppliers which cover a period greater than the one year correction period. Show OWNER as beneficiary of these documents.

1.3 RECORD DRAWINGS

At the site keep and maintain one record copy of all Contract Documents, reference documents and all technical documents submitted in good order. Annotate Contract Drawings to show all changes made during the construction period. Annotated drawings are to be made available to ENGINEER for reference at all times.

Provide location of all underground pipelines, if different than original drawing. All record drawings will be marked with the proper XYZ (northing, easting, elevation) information for each structure. Also indicate location and depth of buried utilities that over or undercross sanitary sewer. Use a Registered Land Surveyor registered in the State of Indiana to produce record drawing information.

At completion of the CONTRACT and before final payment is made, deliver to the ENGINEER one hard copy set and one digital set of clearly readable, reproducible Contract Drawings reflecting all changes made during construction. Mark each drawing "Record Drawing" in ink.

1.4 SPECIAL TOOLS

Special tools are considered to be those tools which, because of their limited use, are not normally available but which are necessary for maintenance of particular equipment.

For each type of equipment provided under this CONTRACT, furnish a complete set of all special tools including grease guns and other lubricating devices, which may be needed for the adjustment, operation, maintenance, and disassembly of such equipment. Furnish only tools of high grade, smooth forged alloy tool steel. Manufacture grease guns of the lever type.

Furnish and erect one or more neat and substantial steel wall cases or cabinets with flat key locks and clips or hooks to hold each special tool in a convenient arrangement.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01820

TRAINING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Training

1.2 TRAINING

A. Training: Provide the services of knowledgeable, technically competent, factory trained specialists to instruct OWNER's personnel in the operation and maintenance of the equipment and system components listed in Paragraph B. The OWNER will furnish training classroom space.

1. Coordinate services with the OWNER, with a minimum of 14 days prior notice.

2. Provide a combination of classroom and "hands-on" instruction designed to completely familiarize operating and maintenance personnel with the systems theory, standard operating procedures, safety features and emergency procedures, and general maintenance of all components.

3. Conduct all training at the lift station during regular hours on weekdays.

B. Provide training for the following:

Specification	Equipment Name	Total Minimum Hours
11210	Package Lift Station	8

C. Length of Training: The minimum lengths of training sessions are listed in Paragraph B. above.

D. Credentials: Submit for approval, credentials of equipment manufacturer representatives who are to be course instructors at least 14 days prior to a proposed training session.

E. Scheduling: Submit training outline and other information described in paragraphs G through K for approval at least 14 days prior to the proposed date for the

training sessions. Verify scheduling with the OWNER at least 14 days prior to the training sessions.

F. Number of Copies: For each training class, provide instructional material for at least ten attendees plus five extra copies, plus duplicate copies of all audio-visual aids utilized during each training course.

G. Training Outline Submission: Provide a proposed training outline including the topics presented in Paragraph K. Identify specific components and procedures in the proposed training outline.

H. Training Topic Detail: Detail specific training topics. Describe "hands-on" demonstrations planned for the training. Reference training aids to be utilized in the training (i.e. video tapes, slides, transparencies) and attach where applicable.

I. Training Handouts: Attach training handouts to the proposed training outline.

J. Training Segment Duration: Indicate the duration of each training segment.

K. Training Outline:

1. Equipment Operation

a. Describe equipment's operating (process) function.

b. Describe equipment's fundamental operating principles and dynamics.

c. Identify equipment's mechanical, electrical and electronic components and features.

d. Identify all support equipment associated with the operation of the subject equipment.

2. Detailed Component Description

a. Identify and describe in detail each component's function.

b. Where applicable, group related components into subsystems.

c. Identify, and describe in detail, equipment safety features and control interlocks.

3. Equipment Preventive Maintenance

a. Describe preventive maintenance inspection procedures required to perform and inspect the equipment in operation, and spot potential trouble symptoms (anticipate breakdowns).

b. Outline recommended routine lubrication and adjustments (preventive maintenance).

4. Equipment Troubleshooting

a. Define recommended systematic troubleshooting procedures.

b. Provide component specific troubleshooting checklists.

c. Describe applicable equipment testing and diagnostic procedures to facilitate troubleshooting.

5. Equipment Corrective Maintenance

a. Describe recommended equipment preparation requirements.

b. Identify and describe the use of special tools required for maintenance of the equipment.

c. Describe component removal/installation and disassembly/ assembly procedures.

d. Perform at least two "hands-on" demonstrations of common corrective maintenance repairs.

e. Describe recommended measuring instruments and procedures, and provide instruction on interpreting alignment measurements, as appropriate.

f. Define recommended torquing, mounting, calibration, and alignment procedures and settings, as appropriate.

g. Describe recommended procedures to check/test equipment following corrective repair.

L. Certificate: Provide "Certificate of Instructional Services" signed by ENGINEER and equipment representative, verifying that training has been accomplished to satisfaction of all parties. Use form provided in this section, and furnish ENGINEER with three copies.

M. Substantial Completion: Training provided by manufacturers' representative, ENGINEER and OWNER does <u>not</u> constitute substantial completion.

N. Equipment Use: Use of equipment for training will not void manufacturers' or contract warranties.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

CERTIFICATE OF INSTRUCTIONAL SERVICES

Project _____

Equipment _____

Specification Section _____

Contract _____

I hereby certify the equipment Manufacturers' Representative has instructed OWNER's personnel in startup operation and maintenance of this equipment as required in the Contract Documents.

MANUFACTURER'S REPRESENTATIVE

Signature _____

Name: (print) _____

Title: _____

Representing _____

CONTRACTOR

Signature _____ Date _____

Name (print) _____

Title _____

ENGINEER

Signature _____ Date _____

Name (print) _____

Title _____

COMMENTS:

Complete and submit three copies of this form to ENGINEER upon completion of training as required by Specification Section 01820.

(NO TEXT FOR THIS PAGE)

SECTION 02230

SITE CLEARING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Requirements for clearing of all areas within the limits of construction and other areas shown, including Work designated in permits and other agreements, in accordance with the requirements of Division 1.

B. Related Work Specified in Other Sections Includes:

1. Section 02316 - Earth Excavation
2. Section 02317 - Backfilling
3. Section 02900 - Landscaping Work

1.2 DEFINITIONS

A. Clearing: Clearing is the removal from the ground surface and disposal, within the designated areas, of trees, brush, shrubs, down timber, decayed wood, other vegetation, rubbish and debris as well as the removal of fences.

B. Grubbing: Grubbing is the removal and disposal of all stumps, buried logs, roots larger than 2 inches, matted roots and organic materials.

PART 2 MATERIALS

Not Used

PART 3 EXECUTION

3.1 TREE AND SHRUB REMOVAL

A. Tree and Shrub Removal Within Construction Limits: Remove trees and shrubs within the limits of construction as required to facilitate construction of the Work unless otherwise indicated.

1. Grub and remove tree stumps and shrubs felled within the limits of construction to an authorized disposal site. Fill depressions created by such removal with material suitable for backfill as specified in Section 02317.

2. Provide one tree as replacement for every tree damaged or removed within the limits of construction. Provide 1-1/2 –inch minimum caliper tree of the same species of tree damaged or removed, or from the list of acceptable tree species listed in Section 02900, subject to Owner approval. Provide one shrub as replacement for every shrub damaged or removed within the limits of construction.

B. Tree and Shrub Removal Outside Construction Limits: Do not cut or damage trees and shrubs outside the limits of construction unless shown to be removed or unless written permission has been obtained from the property owner. Furnish three copies of the written permission before removal operations commence.

C. Warranty Period for Tree Replacement: Apply the one-year warranty to all planted areas or replacement trees (damaged outside the limits of construction). Have the warranty period commence after the final acceptance of all landscaping work exclusive of all replacement plant materials.

1. Maintain all planted areas during the warranty period.

2. Replacement: Plant trees only during the specified planting seasons and warranty the replacement material for the same period of time as the original material.

3.2 CLEARING AND GRUBBING

A. Clearing: Clear all items as required to construct the Work, and remove cleared and grubbed materials from the site.

1. Do not start earthwork operations in areas where clearing and grubbing is not complete, except that stumps and large roots may be removed concurrent with excavation.

2. Comply with erosion, sediment control and storm management measures as specified in Division 1.

B. Grubbing: Clear and grub areas to be excavated, areas receiving less than 3 feet of fill and areas upon which structures are to be constructed.

1. Remove stumps and root mats in these areas to a depth of not less than 1 foot below the subgrade of sloped surfaces.

2. Fill all depressions made by the removal of stumps or roots with material suitable for backfill as specified in Section 02317.

C. Limited Clearing: Clear areas receiving more than 3 feet of fill by cutting trees and shrubs as close as practical to the existing ground. Grubbing will not be required.

D. Burning: Burning will not be allowed.

3.3 TOPSOIL

A. Stripping: Strip existing topsoil from areas that will be excavated or graded prior to commencement of excavating or grading and place in well-drained stockpiles in approved locations.

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 02251

SHORING, SHEETING AND BRACING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Work required for protection of an excavation or structure through shoring, sheeting, and bracing.

B. Related Work Specified In Other Sections Includes:

1. Section 02316 - Earth Excavation
2. Section 02317 - Backfilling

1.2 SUBMITTALS

A. General: Provide all submittals, including the following, as specified in Division 1.

B. CONTRACTOR's Submittals: Submit a CERTIFICATE (ONLY), signed and sealed by a Licensed Structural/Professional Engineer qualified to perform structural engineering of this nature and registered in the State of Indiana, that certifies that the Licensed Structural/Professional Engineer has evaluated and approved the CONTRACTOR's excavation plan and has prepared complete design calculations and working drawings for the shoring, sheeting and bracing, including that which is shown and that which is not specifically shown on the Contract Drawings, which will be used for excavation support. Provide a separate CERTIFICATION, identifying the applicable excavation, for each excavation before starting the excavation. Where commercially manufactured trench boxes are to be used, provide a CERTIFICATION from the CONTRACTOR's Licensed Structural/Professional Engineer stating the conditions under which the trench boxes will be used.

1.3 REFERENCES

A. Codes and standards referred to in this Section are:

1. All Federal, State and local laws and regulations applying to the design and construction of shoring, sheeting and bracing.

2. National Bureau of Standards Building Science Series 127 “Recommended Technical Provisions for Construction Practice in Shoring and Sloping Trenches and Excavations.”

PART 2 PRODUCTS

2.1 MANUFACTURERS AND MATERIALS

A. Use manufacturers and materials for shoring, sheeting and bracing as recommended by the CONTRACTOR’s Licensed Structural/Professional Engineer who designed the shoring, sheeting, and bracing. Where wood lagging is to be left in place use oak, treated fir or treated pine. Use only environmentally safe treatment for wood lagging.

PART 3 EXECUTION

3.1 SHORING, SHEETING AND BRACING INSTALLATION

A. General: Provide safe working conditions, prevent shifting of material, prevent damage to structures or other work, and avoid delay to the work, all in accordance with applicable laws and regulations. Properly shore, sheet, and brace all excavations that are not cut back to the proper slope, as determined by the CONTRACTOR’s Licensed Structural/Professional Engineer.

1. Take sole responsibility for the design and adequacy of shoring, sheeting and bracing not shown on the Contract Drawings.

2. Take sole responsibility for the methods of installation of the shoring, sheeting and bracing.

B. Arrange shoring, sheeting and bracing so as not to place any strain on portions of completed work until the general construction has proceeded far enough to provide ample strength.

C. If the CONTRACTOR or its Licensed Structural/Professional Engineer is of the opinion that at any time the CONTRACTOR’s excavation plan, shoring, sheeting or bracing is inadequate or unsuited for the purpose, take immediate and appropriate action. Provide a new CERTIFICATE if the CONTRACTOR’s excavation plans, shoring, sheeting or bracing require modifications.

D. Monitoring: Periodically monitor horizontal and vertical deflections of sheeting, shoring and bracing.

E. Accurately locate all underground utilities and take the required measures necessary to protect them from damage. All underground utilities shall be kept in service at all times as specified in Division 1.

F. Remove shoring, sheeting and bracing as the excavation is refilled in a manner to avoid the caving in of the bank or disturbance to adjacent areas or structures or pipe bedding.

1. Carefully fill voids left by the withdrawal of the shore, sheeting and bracing. No separate payment will be made for the filling of such voids.

2. If pipe bedding is disturbed, re-compact it to meet specified density requirements.

G. Permission for Removal: Obtain permission from the CONTRACTOR's Licensed Structural/Professional Engineer before the removal of any shoring, sheeting or bracing. Retain the responsibility for injury to structures or to other property or persons for failure to leave such shoring, sheeting and bracing in place even though permission for removal has been obtained.

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 02316

EARTH EXCAVATION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Requirements for performing open-cut excavations to the widths and depths necessary for constructing structures, pipelines and conduits including excavation of any material necessary for any purpose pertinent to the construction of the Work. Dispose of unsuitable and excess material.

B. Related Work Specified In Other Sections Includes:

1. Section 02230 - Site Clearing
2. Section 02251 - Shoring, Sheeting and Bracing
3. Section 02317 - Backfilling

1.2 DEFINITIONS

A. Earth: "Earth" includes all materials which, in the opinion of the ENGINEER, do not require blasting, barring, or wedging for their removal from their original beds. Specifically excluded are all ledge and bedrock and boulders or pieces of masonry larger than one (1) cubic yard in volume.

1.3 SUBMITTALS

A. General: Provide all submittals, including the following, as specified in Division 1.

B. Dewatering Excavation Plan: Develop an excavation dewatering plan that considers site ground and groundwater conditions, the type and arrangement of the equipment to be used and the proper method of groundwater disposal. Prepare the dewatering plan before beginning excavations below groundwater. Maintain one copy of the dewatering plan at the project site to be available for inspection while all dewatering operations are underway.

1.4 SITE CONDITIONS

A. Geotechnical Investigations: A geotechnical investigation and report was prepared by Patriot Engineering & Environmental, Inc. intended only for use by the OWNER and ENGINEER in preparing the Contract Documents.

1. The geotechnical investigation report may be examined for what ever value it may be considered to be worth. However, this information is not guaranteed as to its accuracy or completeness.

2. The geotechnical investigation report is not part of the Contract Documents.

B. Actual Conditions: Make any geotechnical investigations deemed necessary to determine actual site conditions.

C. Underground Utilities: Locate and identify all existing underground utilities prior to the commencement of Work.

D. Quality and Quantity: Make any other investigations and determinations necessary to determine the quality and quantities of earth and rock and the methods to be used to excavate these materials.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.1 GENERAL

A. Clearing: Clear open-cut excavation sites of obstructions preparatory to excavation. Clearing in accordance with Section 02230, includes removal and disposal of vegetation, trees, stumps, roots and bushes, except those specified to be protected during trench excavation.

B. Banks: Shore or slope banks to the angle of repose to prevent slides or cave-ins in accordance with Section 02251.

C. Hazardous Materials: If hazardous materials not specifically shown or noted are encountered, proceed in accordance with General Conditions Article 4.06, Hazardous Environmental Condition at Site.

3.2 STRUCTURE EXCAVATION

A. Dewatering: Keep excavation free of water and provide continuous pressure relief to prevent basal heave from water pressure in the substrate below the excavation.

B. Excavation Size: Provide excavations of sufficient size and only of sufficient size to permit the Work to be economically and properly constructed in the manner and of the size specified.

C. Excavation Shape: Shape and dimension the bottom of the excavation in earth or rock to the shape and dimensions of the underside of the structure wherever the nature of the excavated material permits.

D. Compaction: Before placing backfill, proof roll the bottom of the excavations to detect soft spots.

1. For small areas, proof roll with a smooth-faced steel roller filled with water or sand, or compact with a mechanical tamper.

2. Make one complete coverage, with overlap, of the area.

3. Overexcavate soft zones and replace with compacted select fill in accordance with Section 02317.

3.3 TRENCH EXCAVATION

A. Preparation: Properly brace and protect trees, shrubs, poles and other structures which are to be preserved. Unless shown or specified otherwise, preserve all trees and large shrubs. Hold damage to the root structure to a minimum. Small shrubs may be preserved or replaced with equivalent specimens.

B. Adequate Space: Keep the width of trenches to a minimum; however provide adequate space for workers to place, joint and backfill the pipe properly.

1. Do not allow the clear width of the trench at the level of the top of the pipe to exceed the sum of the outside diameter of the pipe barrel plus 20 inches for pipe 4 through 24 inches in diameter nor the outside diameter of the pipe barrel plus 2 feet for pipe more than 24 inches in diameter, unless otherwise approved.

2. In sheeted trenches, measure the clear width of the trench at the level of the top of the pipe to the inside of the sheeting.

3. Should the maximum trench widths specified above be exceeded without written approval, provide concrete cradle or encasement for the pipe as directed. No separate payment will be made for such concrete cradle or encasement.

C. Depth: Excavate trenches to a minimum depth of 6 inches below the bottom of the pipe unless otherwise shown, specified or directed, so that bedding material can be placed in the bottom of the trench and shaped to provide a continuous, firm bearing for pipe barrels and bells.

D. Unstable Materials: If unstable material is exposed at the level of the bottom of the trench excavation, excavate the material in accordance with the subsection headed "Authorized Additional Excavation".

1. When in the judgment of the ENGINEER the unstable material extends to an excessive depth, the ENGINEER may advise, in writing, the need for stabilization of the trench bottom with additional select fill material or a crushed stone or gravel mat or the need to provide firm support for the pipe by other suitable methods.

2. Payment for such trench stabilization will be made under the appropriate Contract Items or where no such items exist, as a change in the Work.

E. Length of Excavation: Keep the open excavated trench preceding the pipe laying operation and the unfilled trench, with pipe in place, to a minimum length which causes the least disturbance. Provide ladders for a means of exit from the trench as required by applicable safety and health regulations.

F. Water: Allow no water to rise in the trench excavation until sufficient backfill has been placed to prevent pipe flotation.

3.4 SHORT TUNNEL EXCAVATION

A. Short Tunnel Requirements: In some instances, trees, shrubs, utilities, sidewalks and other obstructions may be encountered, the proximity of which may be a hindrance to opencut trench excavation. In such cases, excavate by means of short tunnels in order to protect such obstructions against damage.

1. Construct the short tunnel by hand, auger or other approved method approximately 6 inches larger than the diameter of pipe bells.

2. Consider such short tunnel work incidental to the construction of pipelines or conduits and all appurtenances. The need for short tunnels will not be grounds for additional payment.

3.5 FINISHED EXCAVATION

A. Finish: Provide a reasonably smooth finished surface for all excavations, which is uniformly compacted and free from irregular surface changes.

B. Finish Methods: Provide a degree of finish which is ordinarily obtainable from blade-grade operations, except as otherwise specified in Section 02317.

3.6 PROTECTION

A. Traffic and Erosion: Protect newly graded areas from traffic and from erosion.

B. Repair: Repair any settlement or washing away that may occur from any cause, prior to acceptance. Re-establish grades to the required elevations and slopes.

C. Other Requirements: Conduct all Work in accordance with the environmental protection requirements specified in Division 1.

3.7 AUTHORIZED ADDITIONAL EXCAVATION

A. Additional Excavation: Carry the excavation to such additional depth and width as authorized in writing, for the following reasons:

1. In case the materials encountered at the elevations shown are not suitable.

2. In case it is found desirable or necessary to go to an additional depth, or to an additional depth and width.

B. Refill Materials: Refill such excavated space with either authorized Class D concrete or compacted select fill material.

C. Compaction: Where necessary, compact fill materials to avoid future settlement.

D. Payment: Additional earth excavations so authorized and concrete or select fill materials authorized for filling such additional excavation and compaction of select fill materials will be paid for under the appropriate Contract Item.

3.8 UNAUTHORIZED EXCAVATION

A. Stability: Refill any excavation carried beyond or below the lines and grades shown, except as specified in the subsection headed "Authorized Additional Excavation", with such material and in such manner as may be approved in order to provide for the stability of the various structures.

B. Refill Materials: Refill spaces beneath all manholes, structures, pipelines, or conduits excavated without authority with Class D concrete or compacted select fill material, as approved.

C. Payment: Refill for unauthorized excavation will not be measured and no payment will be made therefor.

3.9 SEGREGATION STORAGE AND DISPOSAL OF MATERIAL

A. Stockpiling Suitable Materials: Stockpile topsoil suitable for final grading and landscaping and excavated material suitable for backfilling or embankments separately on the site in approved locations.

B. Stockpile Locations: Store excavated and other material a sufficient distance away from the edge of any excavation to prevent its falling or sliding back into the excavation and to prevent collapse of the wall of the excavation. Provide not less

than 2 feet clear space between the top of any stockpile and other material and the edge of any excavation.

C. Excess Materials: Transport and dispose of surplus excavated material and excavated material unsuitable for backfilling or embankments at an off site disposal location. Obtain the off site disposal location.

3.10 REMOVAL OF WATER

A. Water Removal: At all times during the excavation period and until completion and acceptance of the WORK at final inspection, provide ample means and equipment with which to remove promptly and dispose of properly all water entering any excavation or other parts of the WORK.

B. Dry Excavations: Keep the excavation dry.

C. Water Contact: Allow no water to rise over or come in contact with masonry and concrete until the concrete and mortar have attained a set and, in any event, not sooner than 12 hours after placing the masonry or concrete.

D. Discharge of Water: Dispose of water pumped or drained from the Work in a safe and suitable manner without damage to adjacent property or streets or to other work under construction and in compliance with Erosion Control Permit/Rule 5.

E. Protection: Provide adequate protection for water discharged onto streets. Protect the street surface at the point of discharge.

F. Sanitary Sewers: Discharge no water into sanitary sewers.

G. Storm Sewers: Discharge no water containing settleable solids into storm sewers, drains, or other receiving waters.

H. Repair: Promptly repair any and all damage caused by dewatering the Work.

END OF SECTION

SECTION 02317

BACKFILLING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Backfill all excavation to the original surface of the ground or to such other grades as may be shown or required. For areas to be covered by topsoil, leave or stop backfill six (6) inches below the finished grade or as shown. Place site stripped topsoil, or additional off site topsoil if needed, as the final six (6) inches to finished grade. Remove from all backfill, any compressible, putrescible, or destructible rubbish and refuse and all lumber and braces from the excavated space before backfilling is started. Leave sheeting and bracing in place or remove as the Work progresses.

B. Equipment Limitations: Do not permit construction equipment used to backfill to travel against and over cast-in-place concrete structures until the specified concrete strength has been obtained, as verified by concrete test cylinders. In special cases where conditions warrant, the above restriction may be modified providing the concrete has gained sufficient strength, as determined from test cylinders, to satisfy design requirements for the removal of forms and the application of load.

C. Related Work Specified In Other Sections Includes:

1. Section 02230 - Site Clearing
2. Section 02316 - Earth Excavation

1.2 REFERENCES

A. Codes and standards referred to in this Section are:

1. ASTM D 1557 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lb/ft^3 (2,700 kN-m/m^3))

PART 2 PRODUCTS

2.1 BACKFILL MATERIAL - GENERAL

A. General: Backfill with sound materials, free from waste, organic matter, rubbish, boggy or other unsuitable materials.

B. General Materials Requirements: Conform materials used for backfilling to the requirements specified. Follow common fill requirements whenever drainage or select fill is not specified. Determine and obtain the approval of the appropriate test method where more than one compaction test method is specified.

C. Frozen Materials: Do not use frozen material for backfilling.

2.2 SELECT FILL

A. Materials for Select Fill: Use crushed stone or fractured-face aggregate as approved which can be readily and thoroughly compacted to 95 percent of the maximum dry density obtainable by ASTM D 1557. Select fill shall be No. 8 crushed stone or No. 8 fractured-faced aggregate.

1. Grade select fill between the following limits:

U.S. Standard Sieve	Percent Passing by Weight
1 inch	100
3/4 inch	75-95
1/2 inch	40-70
3/8 inch	20-50
#4	0-15
#8	0-10

2. Very fine sand, uniformly graded sands and gravels, or other materials that have a tendency to flow under pressure when wet are unacceptable as select fill.

2.3 TRENCH AND COMMON BACKFILL

A. Materials for Trench and Common Backfill – Unimproved Areas: Material from on-site excavation may be used as common fill provided that it can be readily compacted to 90 percent of the maximum dry density obtainable by ASTM D 1557, and does not contain unsuitable material. Select fill may be used as trench and common backfill at no change in the Contract Price.

B. Materials for Trench and Common Backfill – Improved Areas: Trench backfill within five (5) feet and beneath all roadways, driveways and parking areas will be No. 53 compacted aggregate stone or INDOT B-Borrow Type 1. Trench backfill

beneath all walkways will be No. 8 crushed stone or No. 8 fractured-face aggregate.

C. Granular Materials On-Site: Granular on-site material, which is fairly well graded between the following limits may be used as trench and common backfill:

U.S. Standard Sieve	Percent Passing by Weight
3 inch	100
#10	50-100
#60	20-90
#200	0-45

1. Use material passing the No. 40 sieve having a liquid limit less than or equal to 40 and plasticity index less than or equal to 20.

D. Cohesive Materials On-Site: Cohesive site material, classified as "ML", may be used as common backfill.

1. The gradation requirements do not apply to cohesive common backfill.

2. Use material having a liquid limit less than or equal to 40 and a plasticity index less than or equal to 20.

E. Material Approval: All material used as common backfill is subject to approval. If there is insufficient on-site material, import whatever additional off-site material is required which conforms to the specifications and at no additional cost.

PART 3 EXECUTION

3.1 MANHOLE BEDDING

A. Bedding Compaction: Bed all sewer manholes in well graded, compacted, select fill conforming to the requirements except as otherwise shown, specified, or required. Compact bedding thickness no less than 6 inches for sewer manhole bases.

B. Concrete Work Mats: Cast cast-in-place manhole bases and other foundations for structures against a Class D concrete work mat in clean and dry excavations, unless otherwise shown, specified or required.

C. Bedding Placement: Place select fill used for bedding beneath sewer manhole bases, in uniform layers not greater than 6 inches in loose thickness. Thoroughly compact in place with suitable mechanical or pneumatic tools to not less than 95 percent of the maximum dry density as determined by ASTM D 1557.

D. Use of Select Fill: Bed existing underground structures, tunnels, conduits and pipes crossing the excavation with compacted select fill material. Place bedding material under and around each existing underground structure, tunnel, conduit or pipe and extend underneath and on each side to a distance equal to the depth of the trench below the structure, tunnel, conduit or pipe.

3.2 PIPE BEDDING AND INITIAL BACKFILL

A. Hand Placement: Place select fill pipe bedding by hand from the bottom of the excavation to 1 foot over the top of the pipe in uniform layers not greater than 6 inches in loose thickness. Tamp under pipe haunches and thoroughly compact pipe bedding in place with suitable mechanical or pneumatic tools to not less than 95 percent of the maximum dry density as determined by ASTM D 1557 (Modified Proctor).

B. Stone Placement: Do not place large stone fragments in the pipe bedding or backfill to 1 foot over the top of pipes, nor nearer than 2 feet at any point from any pipe, conduit or concrete wall.

C. Unallowed Materials: Pipe bedding containing very fine sand, uniformly graded sands and gravels, or other materials that have a tendency to flow under pressure when wet is unacceptable.

3.3 BEDDING PLACEMENT AND BACKFILL FOR PIPE IN SHORT TUNNEL

A. Bed pipelines placed in short tunnels in select fill or Class D concrete. Completely fill the remainder of the annular space between the outside of the pipe wall and the tunnel wall with select fill, suitable job-excavated material, or Class D concrete, as approved. Suitably support pipelines or ducts in short tunnels to permit placing of backfill suitably tamped in place.

3.4 TRENCH BACKFILL

A. General: Backfill trenches from 1 foot over the top of the pipe, or as shown to the bottom of pavement base course, subgrade for lawns or lawn replacement, to the top of the existing ground surface or to such other grades as may be shown or required.

B. Materials: Provide select fill, suitable job-excavated material or other material, as specified and as approved for trench backfill.

C. Depth of Placement - General: Except under pavements, walkways, railroad tracks, parking lots, and street or highway appurtenances, or as otherwise specified, place trench backfill in uniform layers not greater than 8 inches in loose thickness and thoroughly compact in place using suitable mechanical or pneumatic equipment. Compact backfill to not less than 90 percent of the maximum dry density as determined by ASTM D 1557.

D. Depth of Placement - Traffic Areas and Under Utilities: Where pavements, walkways, railroad tracks, parking lots, and street or highway appurtenances are to be placed over trenches and under utilities or utility services crossing the trench, provide trench backfill using select fill placed in uniform layers not greater than 8 inches in loose thickness and thoroughly compacted in place with equipment as specified above. Compact backfill to not less than 95 percent of the maximum dry density as determined by ASTM D 1557.

E. Dropping of Material on Work: Do trench backfilling work in such a way as to prevent dropping material directly on top of any conduit or pipe through any great vertical distance. Do not allow backfilling material from a bucket to fall directly on a structure or pipe and, in all cases, lower the bucket so that the shock of falling earth will not cause damage.

F. Distribution of Large Materials: Break lumps up and distribute any stones, pieces of crushed rock or lumps which cannot be readily broken up, throughout the mass so that all interstices are solidly filled with fine material.

3.5 STRUCTURE BACKFILL

A. Use of Select Fill: Use select fill underneath all structures, and adjacent to structures where pipes, connections, electrical ducts and structural foundations are to be located within this fill. Use select fill beneath all pavements, walkways, and railroad tracks, and extend to the bottom of pavement base course or ballast.

1. Place backfill in uniform layers not greater than 8 inches in loose thickness and thoroughly compact in place with suitable approved mechanical or pneumatic equipment.

2. Compact backfill to not less than 95 percent of the maximum dry density as determined by ASTM D 1557.

B. Use of Common Backfill: Use common granular backfill adjacent to structures in all areas not specified above, unless otherwise shown or specified. Select fill may be used in place of common granular backfill at no additional cost.

1. Extend such backfill from the bottom of the excavation or top of bedding to the bottom of subgrade for lawns or lawn replacement, the top of previously existing ground surface or to such other grades as may be shown or required.

2. Place backfill in uniform layers not greater than 8 inches in loose thickness and thoroughly compact in place with suitable equipment, as specified above.

3. Compact backfill to not less than 90 percent of the maximum dry density as determined by ASTM D 1557.

C. Use of Clay: In unpaved areas adjacent to structures for the top 1 foot of fill directly under lawn subgrades use clay backfill placed in 6-inch lifts. Compact clay backfill to not less than 90 percent of the maximum dry density as determined by ASTM D 1557.

1. Use clay having a liquid limit less than or equal to 40 and a plasticity index less than or equal to 20.

3.6 COMPACTION EQUIPMENT

A. Equipment and Methods: Carry out all compaction with suitable approved equipment and methods.

1. Compact clay and other cohesive material with sheep's-foot rollers or similar equipment where practicable. Use hand held pneumatic tampers elsewhere for compaction of cohesive backfill material.

2. Compact low cohesive soils with pneumatic-tire rollers or large vibratory equipment where practicable. Use small vibratory equipment elsewhere for compaction of cohesionless backfill material.

3. Do not use heavy compaction equipment over or adjacent to pipelines or other structures, unless the depth of backfill is sufficient to adequately distribute the load. New concrete structures shall be complete and concrete cured to its 28 day design strength before backfilling against it.

3.7 FINISH GRADING

A. Final Contours: Perform finish grading in accordance with the completed contour elevations and grades shown and blend into conformation with remaining natural ground surfaces.

1. Leave all finished grading surfaces smooth and firm to drain.

2. Bring finish grades to elevations within plus or minus 0.10 foot of elevations or contours shown.

B. Surface Drainage: Perform grading outside of building or structure lines in a manner to prevent accumulation of water within the area. Where necessary or where shown, extend finish grading to ensure that water will be carried to drainage ditches, and the site area left smooth and free from depressions holding water.

3.8 RESPONSIBILITY FOR AFTERSETTLEMENT

A. Aftersettlement Responsibility: Take responsibility for correcting any depression which may develop in backfilled areas from settlement within one year after the work is fully completed. Provide as needed, backfill material, pavement base replacement, permanent pavement, sidewalk, curb and driveway repair or replacement, and lawn replacement, and perform the necessary reconditioning and restoration work to bring such depressed areas to proper grade as approved.

3.9 INSPECTION AND TESTING OF BACKFILLING

A. Sampling and Testing: Engage an independent testing laboratory to perform all sampling, testing, and laboratory analysis in accordance with the appropriate ASTM Standard Specification. Provide compaction testing of the following:

1. Test sub-base before placement of wet well.

2. Test sub-base before placement of new concrete pad for lift station.

3. Record all in-place backfill after every 400 feet of pipe installation.

4. Record in-place backfill compaction values at 50-foot intervals and record compaction values a minimum 10 feet and 5 feet below final surface elevation and at the surface at each location.

5. Record in-place backfill compaction values a minimum 10 feet and 5 feet below final surface elevation and at the surface at all road/driveway crossings for acceptance prior to concrete or asphalt surfacing.

6. Record in-place backfill compaction values a minimum 10 feet and 5 feet below final surface elevation and at the surface at 25-foot intervals through parking areas.

Submit copies of all backfill tests to the ENGINEER. If testing reveals non-compliance with Contract requirements, all additional testing will be made at the Contractor's expense.

B. Correction of Work: Correct any areas of unsatisfactory compaction by removal and replacement, or by scarifying, aerating or sprinkling as needed and recompaction in place prior to placement of a new lift.

END OF SECTION

SECTION 02370

SLOPE PROTECTION AND EROSION CONTROL

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: The requirements for providing slope protection and erosion control practices for all areas within the contract limits and other areas indicated, including work designated in permits and other agreements, as specified in Division 1.

B. Related Work Specified in Other Sections Includes:

1. Section 02230 - Site Clearing
2. Section 02316 - Earth Excavation
3. Section 02317 - Backfilling
4. Section 02900 - Landscaping Work

PART 2 PRODUCTS

2.1 GRASS

A. Provide grass that will not compete with grasses sown later for permanent cover to be a quick-growing species (such as ryegrass, Italian ryegrass or cereal grasses) suitable to the area providing a temporary cover to prevent erosion from areas disturbed by construction.

2.2 MULCHES

A. Mulches may be hay, straw, fiber mat, netting, bark, wood chips, or other suitable material reasonably clean and free of noxious weeds and deleterious materials.

2.3 FERTILIZER

A. Fertilizer shall be a standard 12-12-12 commercial grade and shall conform to all federal and state regulations and to the standards of the Association of Official Agricultural Chemists.

2.4 FIBER ROLLS

A. Provide temporary fiber rolls where shown or as required to prevent soil erosion at all stream or ditch crossings. Fiber rolls consist of coconut fibers rolled and bound into a tight tubular roll.

2.5 EROSION CONTROL MATS

A. Provide erosion control mats (in conjunction with final grass seed) as shown or required to prevent soil erosion and to stabilize steep-sloped areas disturbed by construction and near stream and ditch crossings.

2.6 SILT FENCING

A. Provide temporary silt fencing where shown and as required to prevent soil erosion at top-of-slope locations.

2.7 RIP RAP - BANK STABILIZATION AND SEDIMENT TRAPS

A. Provide rip rap bank stabilization and sediment traps where shown or as required to prevent soil erosion and sediment transport and to protect receiving waters.

2.8 CONSTRUCTION ENTRANCE DRIVES

A. Provide construction entrances that are stabilized using No. 2 stone wherever traffic will be leaving a construction site and traveling on paved roads. A stabilized construction entrance reduces the amount of sediment transported onto paved roads by motorized equipment at entrances to construction sites.

2.9 STORM SEWER / AREA DRAIN INLET PROTECTION

A. Protect low-lying area drains with storm inlet protection detailed on contract drawings and/or silt fence. Protect street inlets/drains with storm inlet protection detailed on contract drawings.

PART 3 EXECUTION

3.1 EROSION AND SEDIMENT CONTROL PLAN

A. General: Under Title 327 Indiana Administrative Code 15-5, a general permit from the Indiana Department of Environmental Management is required for construction activities that result in the disturbance of one (1) or more acres of land. Under 327 IAC 15-5-4(20), land-disturbing activity is defined as, “any manmade change of the land surface, including removing vegetative cover that exposes the underlying soil, excavating, filling, transporting, and grading”.

For the Contractor's convenience, the City of West Lafayette has prepared an Erosion and Sediment Control Plan to meet the requirements of the Rule 5 General Storm Water Runoff Permit. The Contractor may develop a separate Plan for approval by the Tippecanoe County Soil and Water Conservation District.

B. Availability: Keep the Erosion and Sediment Control Plan at the construction site at all times available for inspection for the entire construction period.

C. Ordinances: Comply with all erosion and siltation control ordinances in effect and required by governing bodies having jurisdiction over the construction site and provide appropriate control measures as required.

D. Payment: Include the cost of the erosion and sediment control devices in the Contract Price. No separate payment will be made for these items unless otherwise specified.

3.2 EROSION AND SEDIMENT CONTROL

A. Provide necessary precautions and facilities to protect all indicated areas within the Contract limits from discharges resulting from construction operations, excessive erosion runoff of the construction site, silting and any other contamination resulting from construction work. Provide erosion control practices conforming to the specified requirements and to include but not limited to the following provisions:

1. Place all erosion and siltation control measures prior to or as the first step in grading, clearing and grubbing.

2. Mulch and seed all sewer pipe trenches are disturbed areas associated with pipeline construction within fifteen (15) days after backfill. Do not allow more than two hundred (200) feet of trenches to be open at any one time.

3. Place all excavated material on the uphill side of trenches where possible. Do not place materials in stream beds. Temporarily seed any soil stockpile left undisturbed for greater than fifteen (15) days with annual Rye or Winter Wheat to reduce sediment runoff, regardless of location of stockpile.

4. Mulch and seed all temporary earth berms, diversions, erosion barriers and temporary stockpiles with temporary vegetative cover within ten (10) days after grading.

5. Do not stockpile or otherwise place dredged, excavated or other material, at any time, in or near a stream bed which may increase the turbidity of the water. If turbidity producing materials are present, hold surface drainage from cuts and fills within the construction limits and from borrow and waste

disposal areas in suitable sedimentation ponds or grade surface drainage to control erosion within acceptable limits. Provide and maintain temporary erosion and sediment control measures such as berms, dikes, drains, or sedimentation basins, if required to meet the above standards, until permanent drainage and erosion control facilities are completed and operative. Hold to a minimum the area of bare soil exposed at any one time by construction operations.

6. Provide temporary erosion and sediment control measures to include but not be limited to the following:

   a. Installation (and ultimate removal) of silt screens.

   b. Silt traps around construction areas for all required structures.

   c. Diked area with earth berm and silt trap for draining dredged material.

   d. Straw bales with silt traps along top of slope of fill area plus seeding and mulching of entire fill area not otherwise protected.

3.3 MAINTENANCE INSPECTION PROCEDURES

A. Inspections:

1. Inspect in place erosion control measures once a week.

2. Inspect in place erosion control measures within 24 hours after any storm event greater than 0.25 inches of rain per 24-hour period.

3. Qualified personnel shall conduct a weekly inspection of the construction site to identify areas contributing to storm water discharges associated with construction activity.

4. Disturbed areas, material storage areas, and equipment storage areas that are exposed to precipitation shall be inspected on a regular basis for evidence of, or the potential for, pollutants entering the drainage system.

5. Storm water discharge locations shall be inspected to determine if erosion control measures are effective in preventing significant impacts to receiving waters.

6. Erosion control devices installed as specified shall be observed to ensure that they are operating properly.

7. Haul routes and construction entrance to work areas shall be periodically inspected for evidence of off-site vehicle tracking of mud and dirt.

8. Contractor's staging area shall be inspected to ensure that solid and liquid wastes are being properly disposed of and not discharged into storm water runoff.

B. Maintenance: All erosion control measures shall be maintained throughout the project and until such time as the disturbed area has been completely stabilized or other provisions have altered the need for these measures. The Contractor shall:

1. Replace mulch materials to their original level when the level has been substantially reduced due to decomposition of the organic mulches and displacement or disappearance of both the organic and inorganic mulches.

2. Remove rubbish and channel obstructions from bare and vegetated channel within the project limits. The Contractor shall repair damage from scour or bank failure, rodent holes and breaching of diversion structures. Excessive wear, movement or failure of erosion control blankets shall be repaired immediately. Deposits of sediment shall be removed from the channel.

3. Repair any damage to silt fence barriers immediately and monitor barriers daily during prolonged rainfall.

4. Repair or replace any silt fence fabric that has decomposed or become ineffective prior to its expected usable life.

5. Remove sediment deposits after each storm event. Sediment must be removed when deposits reach approximately half the height of the silt fence barrier.

6. Till and smooth to match the existing grade and reseed any sediment deposits remaining in place after the silt fence barrier is no longer required.

7. Maintain the construction entrances, as shown and specified, in a condition to prevent tracking or flowing of sediment onto roads. This could require periodic top dressing with additional surface materials as required. Repair and clean out any features used to trap sediment and remove all sediment spilled, dropped, washed or tracked onto road and return to the point of likely origin. Sweep streets as required, or as directed by OWNER, to remove sediment from paved roads.

8. All temporary erosion and sediment control practices shall be removed and disposed of within thirty (30) days after site stabilization is achieved or after the temporary practices are no longer needed. Trapped sediment shall be permanently stabilized to prevent further erosion.

END OF SECTION

SECTION 02500

LAYING AND JOINTING BURIED PIPELINES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Installation of all underground pipelines (using open-cut or horizontal directional drilling installation methods). Provide pipeline materials, encasements, coatings and linings as specified and pipe of the types, sizes and classes shown or specified.

1. Use proper and suitable tools and appliances for the safe and convenient cutting, handling, and laying of the pipe and fittings.

2. Use suitable fittings where shown and at connections or where grade or alignment changes require offsets greater than those recommended and approved.

3. Lay all underground pipelines not supported on piles or concrete cradle in select fill bedding material.

4. Close off all lines with bulkheads when pipe laying is not in progress.

B. Related Work Specified in Other Sections Includes:

1. Section 02316 - Earth Excavation
2. Section 02317 - Backfilling
3. Section 02516 - Leakage Tests

1.2 REFERENCES

A. Codes and standards referred to in this Section are:

1. ASTM A 307 - Specification for Carbon Steel Bolts and Studs, 60000 psi Tensile

2. ASTM D 2321 - Practice for Underground Installation of Flexible Thermoplastic Sewer Pipe

3. ASTM D 2774 - Practice for Underground Installation of Thermoplastic Pressure Piping

4. ASTM E 165 - Practice for Liquid Penetrant Examination

5. ASTM E 709 - Practice for Magnetic Particle Examination

6. ASTM F 1962 - Standard Guide for use of Maxi-Horizontal Directional Drilling for Placement of Polyethylene Pipe or Conduit Under Obstacles, Including River Crossings

1.3 DELIVERY, STORAGE AND HANDLING

A. General: Deliver, store and handle all products and materials as specified in Division 1 and as follows:

B. Transportation and Delivery: Take every precaution to prevent injury to the pipe during transportation and delivery to the site.

C. Loading and Unloading: Take extreme care in loading and unloading the pipe and fittings.

1. Work slowly with skids or suitable power equipment, and keep pipe under perfect control at all times.

2. Under no condition is the pipe to be dropped, bumped, dragged, pushed, or moved in any way that will cause damage to the pipe or coating.

D. Sling: When handling the pipe with a crane, use a suitable sling around the pipe.

1. Under no condition pass the sling through the pipe.

2. Use a nylon canvas type sling or other material designed to prevent damage to the pipe and coating.

3. When handling reinforced concrete pipe or uncoated steel or ductile iron pipe, steel cables, chain or like slings are acceptable.

E. Damaged Piping: If in the process of transportation, handling, or laying, any pipe or fitting is damaged, replace or repair such pipe or pipes.

F. Blocking and Stakes: Provide suitable blocking and stakes installed to prevent pipe from rolling.

G. Storage for Gaskets: Store gaskets for pipe joints in a cool place and protect gaskets from light, sunlight, heat, oil, or grease until installed.

3. Do not use any gaskets showing signs of checking, weathering or other deterioration.

4. Do not use gasket material stored in excess of three months without approval.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.1 OPEN CUT INSTALLATION

A. Dry Trench Bottoms: Lay pipe only in dry trenches having a stable bottom.

1. Where groundwater is encountered, make every effort to obtain a dry trench bottom.

2. If a dry trench bottom has not been obtained due to improper or insufficient use of all known methods of trench dewatering, then excavate below grade and place sufficient select fill material, crushed stone, or Class D concrete over the trench bottom.

3. If all efforts fail to obtain a stable dry trench bottom and it is determined that the trench bottom is unsuitable for pipe foundation, obtain an order, in writing, for the kind of stabilization to be constructed.

4. Perform trench excavation and backfill in accordance with Sections 02316 and 02317.

B. Pipe Laying - General

1. Generally, lay all pipe with bells pointing ahead.

2. Carefully place each pipe and check for alignment and grade.

3. Make adjustments to bring pipe to line and grade by scraping away or filling in select fill material under the body of the pipe.

4. Wedging or blocking up the pipe barrel is not permitted.

5. Bring the faces of the spigot ends and the bells of pipes into fair contact and firmly and completely shove the pipe home.

6. As the work progresses, clean the interior of pipelines of all dirt and superfluous materials of every description.

7. Keep all lines absolutely clean during construction.

8. Lay pipelines accurately to line and grade.

C. Pipe Laying - Trenches:

1. Lay all pipelines in trench excavations on select fill bedding, Class D concrete cradle or other foundations as shown, specified or ordered in writing.

2. Properly secure the pipe against movement and make the pipe joints in the excavation as required.

3. Carefully grade and compact pipe bedding.

4. Bell Holes:

a. Cut out bell holes for each joint as required to permit the joint to be properly made and allow the barrel of the pipe to have full bearing throughout its length.

b. Thoroughly tamp bell holes full of select fill material following the making of each joint.

D. PVC Pipe Elastomeric Seal (Gasket) Joints:

1. Assembly: In making up the gasket joint, brush the gasket seat in the socket thoroughly with a brush and wipe the gasket with a cloth.

a. Apply a thin film of lubricant to the inside surface of the gasket that will come in contact with the entering pipe.

b. Brush the plain end of the pipe to be entered thoroughly with a brush and place it in alignment with the bell of the pipe to which it is to be joined.

c. Exert sufficient force on the entering pipe so that its plain end is moved past the gasket until it makes contact with the base of the socket to make the joint. Provide wood blocking to prevent metal to PVC contact.

2. Positioning: Before proceeding with backfilling, feel completely around the joint using a feeler gauge to confirm that the gasket is in its proper position.

   a. If the gasket can be felt out of position, withdraw the pipe and examine the gasket for cuts or breaks.

   b. If the gasket has been damaged, replace the pipe with a new one.

3. Field Cut Pipe: Cut pipe square. Bevel pipe end to match factory bevel. Round off all sharp edges.

E. Ductile Iron Pipe Rubber Gasket Joints:

1. Assembly: In making up the rubber gasket joint, brush the gasket seat in the socket thoroughly with a wire brush and wipe the gasket with a cloth.

   a. Place the gasket in the socket with the large round end entering first so that the groove fits over the bead in the seat.

   b. Apply a thin film of lubricant to the inside surface of the gasket that will come in contact with the entering pipe.

   c. Brush the plain end of the pipe to be entered thoroughly with a wire brush and place it in alignment with the bell of the pipe to which it is to be joined.

   d. Exert sufficient force on the entering pipe so that its plain end is moved past the gasket until it makes contact with the base of the socket to make the joint.

2. Positioning: Before proceeding with backfilling, feel completely around the joint using a feeler gauge to confirm that the gasket is in its proper position.

   a. If the gasket can be felt out of position, withdraw the pipe and examine the gasket for cuts or breaks.

   b. If the gasket has been damaged, replace it with a new one before re-installing the pipe.

3. Sealing/Repairing Field Cut Pipe: Cut pipe square. Remove any damaged lining caused by field cutting operations or handling and clean any exposed metal by sanding or scraping. After area has been cleaned and roughened, apply a coat of Protecto Joint Compound (used to repair Protecto 401 Ceramic

Epoxy Lining) in accordance with lining manufacturer recommendations. Additionally, coat the exposed metal surface of the cut pipe end. To ensure proper sealing, overlap at least one inch of the lining with this repair material. Apply Protecto Joint Compound in accordance with lining manufacturer recommendations.

F. Pipe Placement – Existing Utilities: Rebed, in compacted select fill material, other utilities which cross over the new pipe or cross under the new pipe with less than 12 inches clear vertical separation. Compact the bedding to densities required for new pipeline construction and extend bedding below the utility to undisturbed earth. Notify Engineer and utility owners if existing utilities are damaged by new pipeline construction.

G. Polyethylene Encasement: Provide loose polyethylene encasement wrapped around ductile iron pipe for corrosion protection as specified.

1. Cut a section of polyethylene (PE) tube approximately 2 feet longer than the pipe section. Slip PE tube around the pipe, starting at the spigot end. Bunch the tube accordian-fashion on the end of the pipe. Pull back the overhanging end of the tube until it clears the pipe end.

2. Dig a shallow bell hole in the trench bottom at the joint location to facilitate installation of PE tube. Lower the pipe into the trench and make up the pipe joint with the preceding section of pipe.

3. Move pipe sling to the bell end of the pipe and lift the pipe slightly to provide enough clearance to easily slide the tube. Spread the tube over the entire barrel of the pipe. Take care not to trap dirt or other bedding material between the wrap and the pipe.

4. Make the overlap of the PE tube by pulling back the bunched PE from the preceding length of pipe and securing it in place. Take up the slack in the tube along the barrel of the pipe to make a snug, but not tight fit. Fold excess PE back over the top of the pipe and secure it in place every 3 feet.

5. Repair all small rips, tears, or other tube damage with adhesive tape. If the PE is badly damaged, repair the damaged area with a sheet of PE and seal the edges of the repair with adhesive tape.

6. When making pipe-to-manhole connections, secure PE wrap over the flexible boot (not inside the boot) and secure the other end of the PE wrap over the previous wrapped portion of the pipe.

H. Concrete Cradle:

1. General: When a concrete cradle is shown, specified, or ordered in writing, lay the pipe to grade by supporting each section on concrete blocks located near each end.

   a. Shape the tops of the blocks to fit the outside diameter of the pipe.

   b. Set the blocks approximately 3/8 inch low.

   c. Place the pipe on the blocks on a layer of stiff mortar of sufficient thickness to bring the pipes to exact grade.

   d. Timber blocking, of a type approved, may be employed in place of concrete blocks.

2. Cradle: Place Class D concrete cradle, on one side only, until it has risen above the invert on the other side, after which deposit the remainder of the concrete on both sides to the pipe spring line.

   a. Prevent movement of the pipe during concrete placement.

I. Concrete Encasement: When concrete encasement is to be provided, as shown, specified, or ordered in writing, lay and block the pipeline and place concrete as specified for concrete cradle.

1. Continue the placing of concrete to provide complete encasement to the dimensions shown, specified, or ordered.

3.2 HORIZONTAL DIRECTIONAL DRILLING INSTALLATION

A. Quality Assurance:

1. Qualifications: Contractor performing HDD installation must have a minimum of 20,000 lineal feet of installed pipe experience in water/sewer construction, and show evidence and references for satisfactory service in at least 5 projects. Submit references at OWNER's request.

2. Certification: The horizontal directional drilling (HDD) Contractor must be certified as a fully trained user of the HDD system by the HDD system manufacturer. The Contractor's operation shall be in conformance with the Horizontal Directional Drilling, Good Practices Guidelines by the HDD

consortium (latest edition) and the pipe manufacturer's guidelines and recommendations except where modified within.

3. Training: Provide personnel trained by the manufacturer of the HDD system for all aspects of the Work.

4. License: The HDD Contractor must be licensed by the HDD system manufacturer.

B. Submittals:

1. Installation Procedures: Submit written description of the construction methods and equipment to be used. Include the following:

   a. Sewage flow control, if any, for horizontal directional drilling force main.

   b. Method of construction with project specific drawings and written descriptions of the construction procedures such as bore plan, entry and exist locations (proposed bore lengths), depth, alignment, sequence, excavation locations, protection of adjacent utilities, and maintenance of traffic.

   c. Method of controlling and monitoring line and grade of excavation.

   d. Details of muck removal, including equipment type, number, and disposal location.

   e. Proposed contingency plans for critical phases and areas of directional.

2. Certification of workmen training for installing restrained joint PVC pipe using HDD installation method, including the use of thermal fusion equipment.

3. Copy of HDD Contractor's installers' license from HDD system manufacturer.

4. Quality Control Methods. At least 10 days prior to the start of directional drilling, CONTRACTOR shall submit a description of his quality control methods he proposes to use in his operations to the ENGINEER. The submittal shall describe:

   a. Procedures for controlling and checking line and grade.

   b. Field forms for establishing and checking line and grade.

5. Submit proposed bypassing system (if applicable), at least one week in advance, for approval by OWNER.

C. General Requirements:

1. Sewage Flow Control: Provide bypass pumping operations as required to maintain sanitary sewer system in service. The pump and bypass lines shall be of adequate capacity and size to handle the flows without sewage backup occurring to facilities connected to the sewer system.

2. Utility Coordination and Protection: Prior to commencement of the Work, locate (pothole) and protect existing utilities as required by the affected utility companies.

3. So that piping conflicts may be avoided, Contractor shall locate the utility (vertically and horizontally) well ahead of the pipe laying operation to confirm exact locations of existing piping before installing any new piping.

4. Confine free flowing (escaping) slurry or drilling fluids at the ground surface during construction. Create sump areas or provide vacuum operations to prevent damage or hazardous conditions in surrounding areas. Install silt fence between all drilling operations and any drainage, wetland, waterway or other area designated for such protection by contract documents, state, federal and local regulations. Remove and dispose of all slurry from the surface and restore the site to preconstruction conditions. Take responsibility for restoration for any damage caused by HDD operations, at no cost to OWNER.

5. Boring Path: The CONTRACTOR shall maintain a Boring Path Report during installation recording alignment reading every five feet showing position (x, y). Azimuth reading will be provided where direct overhead readings (walkover) are not possible. The report shall also include project name, project location, street name, station identification, identification of drilling method used, and name, title, and company name of person collecting the data. A copy of this report shall be submitted to the Project Manager and ENGINEER within 14 calendar days of the completion of each bore path. As-built data will be shown on a dimensionally correct copy of the Contract Drawings indicating horizontal and vertical locations at each end of the bore and at least every 50-foot interval in between. The completed Record drawings shall be submitted to the Project Manager and ENGINEER within 30 calendar days following substantial completion and shall be produced as follows:

a. The plan view shall show the centerline location of each facility installed, or installed and placed out of service to an accuracy of 1-inch at the ends, and at other points physically observed. They should also show the

remainder of the horizontal alignment of the centerline of each facility installed, or installed and placed out of service, and note the accuracy of with which the facility was monitored.

b. A profile drawing for each bore path shall be provided showing the ground or pavement surface and the crown elevation of each facility installed, or installed and placed out of service, to an accuracy of 1-inch at the ends and at other points physically observed. It shall show the remainder of the vertical alignment of the crown of each facility installed, or installed and placed out of service, and notes the accuracy with which the facility was monitored. If the profile drawing for the bore path is not made on a copy of the contract profile or cross section sheets, a 10 to 1 vertical exaggeration shall be used.

c. If during an installation an obstruction is encountered which prevents installation of the pipe in accordance with this specification, the pipe may be taken out of service and left in place at the discretion of the ENGINEER, and shall be immediately filled with flowable fill. A new installation procedure and revised plans must be submitted to and approved by the ENGINEER before work can be resumed. If bore path is abandoned without installing a facility, the drawings shall show the abandoned bore path, and the abandoned bore hole shall be filled with flowable fill. The abandoned bore path shall be noted a as "Abandoned Bore Path." They shall also show the location and the length of the drill head and any drill stems not removed from the bore path. If conditions warrant removal of the materials installed in the abandoned bore path, as determined by the ENGINEER, then the cost to remove will be borne by the CONTRACTOR. On all drawings show crown elevation, diameter, and material type of all utilities encountered and physically observed.

D. Construction Method:

1. Site Organization: Locate equipment used to perform the Work away from buildings to minimize noise impacts. Provide silencers or other devices to reduce machine noise as required by to meet local requirements.

2. Equipment: Provide HDD equipment most suitable for the project specific application in accordance with the HDD system manufacturer's recommendations. HDD equipment should provide for drilling a pilot hole along the design centerline of the pipe profile and alignment shown on the Contract Drawings, enlargement of the pilot bore hole (backreaming as required) to accommodate product pipe, and then pulling the product pipe back through the drilled space.

3. Installation: Conduct horizontal directional drilling in accordance with the latest ASTM F 1962.

4. Pilot Hole Accuracy: Contractor is required to utilize a secondary surface tracking system that overcomes magnetic interference (standalone tracking shot survey). As-built information is to be recorded at all change in directions and in longitudinal spans of no more than 20 foot increments.

5. Operations: During the pilot bore, the position (depth and alignment) of the drilling string must be monitored using an above ground radio detection device (receiver) which picks up the continuous signals generated from a transmitter located within the drill bit head. Record position of drill string after advancement of each successive drill pipe (no greater than 10 feet) to ensure proper alignment and elevation of the bore hole.

   In order to minimize friction and to prevent collapse of the bore hole, introduce a soil stabilizing agent (drilling fluid) into the annular bore space from the trailing end of the drill bit. Ensure adequate removal of soil cuttings and stability of the bore hole by monitoring fluids such as the pumping rate, pressures, viscosity and density during the pilot bore, backreaming, and pipe installation. Pressure relief holes can be used as necessary to relieve excess pressure down hole to ensure proper disposition of drilling fluid is maintained (to prevent frac-out and surface heaving) and to ensure unnecessary inconvenience is minimized to other existing structures. Dispose of drilling fluid in a manner acceptable to the appropriate local, state, or federal regulation.

   Pilot hole shall be drilled on bore path with no deviations greater than 5% of depth over a length of 100 feet. In the event that pilot does deviate from bore path more than 5% of depth in 100 feet, 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 drilling fluid fracture, inadvertent returns or returns loss occurs during pilot hole drilling operations, CONTRACTOR shall cease drilling, wait at least 30 minutes, inject a quantity of drilling 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.

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

Pipe will be placed on pipe rollers before pulling into bore hole with rollers spaced close enough to prevent excessive sagging of pipe. After successfully reaming bore hole to the required diameter, pull the pipe through the bore hole. Once pullback operations have commenced, operations must continue without interruption until pipe is completely pulled into bore hole. During pull-back operations do not apply more than the maximum safe pipe pull pressure at any time. In the event that pipe become stuck, cease pulling operations to allow any potential hydro-lock to subside and will commence pulling operations. If pipe remains stuck, notify ENGINEER. ENGINEER and CONTRACTOR will discuss options and then work will proceed accordingly.

Follow drilling operations, de-mobilize equipment and restore the worksite to original condition. Backfill and compact all excavations to 95% of original density. Restore site to preconstruction conditions.

E. Restrained Joint PVC Pipe Joining:

1. Clean interior of coupling and pipe spigot using a clean rag. Make sure gaskets are clean and evenly seated in the gasket groove.

2. Apply manufacturer's lubricant to the exposed gasket surface and to the pipe spigot to within one inch of the groove on the pipe (spigot) end, making sure to cover the rounded edge and taper.

3. After applying lubricant, align the pipe and coupling and push the spigot end into the coupling. When pipe end seats against the stop in the coupling, spline grooves are automatically aligned for spline insertion. Insert spline through the insertion hole in the coupling and into the aligned grooves of the pipe until it is fully seated around the full circumference of the pipe.

4. When making field cuts, it is essential that cuts are square. Use a PVC pipe cutter to assure a square end.

5. Any section of pipe having defects such as a gash, abrasion, discoloration, excessive spot roughness, pitting, variable wall thickness or any other defect of manufacturing or handling as determined by the ENGINEER or his representative are to be discarded and not used.

3.3 TEMPORARY BULKHEADS

A. Provide temporary bulkheads at the ends of sections where adjoining pipelines have not been completed, and in connections built into pipelines where adjoining pipelines or structures have not been completed and are not ready to be connected.

B. Remove bulkheads encountered in connecting sewers or structures included in this Contract, or in pipelines or structures previously built, when they are no longer needed or when ordered.

3.4 PIPELINE DETECTION

A. Tracing Wire/Utility Marking Posts: Provide an insulated minimum #10 solid copper tracing wire for detection of nonmetallic pipelines. Tracing wire shall be wrapped around the pipe so that one revolution is made at least every pipe joint. Pull two tracing wires for HDD installation. Install Sewage Force Main utility marking posts every 400 feet. Posts are to be green, 3.5-inch diameter by 6-feet long plastic with testing caps. Posts are to have black lettering stating "Sewage Force Main – City of West Lafayette". Posts are to be 3'-6" above final grade. Coordinate utility marker post location and placement with the OWNER.

3.2 FIELD QUALITY CONTROL

A. Testing: Test pipelines in accordance with Section 02516.

B. Inspection: Clean, inspect, and examine each piece of pipe and special for defects before it is installed.

1. Cut away any lumps or projections on the face of the spigot end or the shoulder.

2. Do not use any cracked, broken, or defective pieces in the work.

3. If any defective piece should be discovered after having been installed, remove and replace this piece with a sound piece in a satisfactory manner at no increase in Contract Price.

3.2 CLEANING

A. General: Thoroughly clean all pipe before it is laid and keep it clean until it is accepted in the completed work.

B. Removal of Materials: Exercise special care to avoid leaving bits of wood, dirt, and other foreign particles in the pipe. If any particles are discovered before the final acceptance of the work, remove and clean the pipe.

3.3 SCHEDULE

A. Definitions: Abbreviations used in the schedule are:

1. Pipe Materials:

a.	PVC	Polyvinyl Chloride
b.	DIP	Ductile Iron Pipe
c.	RJPVC	Restrained Joint Polyvinyl Chloride

2. Joints:

a.	PO	Push-on Joint
b.	RPO	Restrained Push-on Joint
c.	SW	Solvent Welded
d.	B&S	Bell and spigot
e.	RJC	Restrained Joint Coupling
f.	RJ	Restrained Joint

3. Coatings and Linings:

a.	CE	Ceramic Epoxy (Protecto 401)
b.	PE	Polyethylene Encasement

B. Schedule: Provide products as listed in the following schedule:

BURIED PIPE SCHEDULE

Service	Size (Inches)	Pipe Material	Protective Coatings Int.	Protective Coatings Ext.	Joints	Test Pressure (psig)(1)	Wall Thickness / Pressure Class(2)
Gravity Sanitary Sewer							
Open Cut Installation	10,12	PVC	--	--	B&S	--	SDR 26
	4	PVC	--	--	SW	--	SCH 80
Sanitary Force Main							
Open Cut Installation	4,6,8,10	DIP(3)	CE	PE	RPO	100	PC 350
	6	PVC	--	--	RPO	100	AWWA C900/PC 235
	10	PVC	--	--	RPO	100	ASTM D2241/SDR 21
HDD Installation	6	RJPVC	--	--	RJ, RJC	100	AWWA C900/PC 235
	10	RJPVC	--	--	RJ, RJC	100	ASTM D2241/SDR 21

(1) Reference Section 02516.
(2) Refer to Pipe Tables on Contract Drawings.
(3) Ductile Iron pipe to be used in wet well where shown and in force main from Station 0+00 through the meter vaults as shown on the Contract Drawings.

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 02505

BURIED DUCTILE-IRON PIPE AND FITTINGS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Requirements for providing buried ductile-iron pipe, fittings and appurtenances.

1. Provide ductile-iron pipe and fittings complete with all necessary jointing facilities and materials, specials, adapters and other appurtenances required for installation in and completion of the pipelines to be constructed.

2. Provide plain end or rubber gaskets (push-on joint) of the types, sizes and classes shown or specified.

B. Related Work Specified In Other Sections Includes, But is Not Limited to, the Following:

1. Section 02500 - Laying and Jointing Buried Pipelines
2. Section 02516 - Leakage Test

1.2 REFERENCES

A. Codes and standards referred to in this Section are:

1. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings

2. AWWA C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast, for Water and Other Liquids

3. AWWA C153/A21.53 - Ductile-Iron Compact Fittings, 3 In. Through 12 In., for Water and Other Liquids

1.3 SYSTEM DESCRIPTION

A. Design Standards: Provide ductile-iron pipe meeting the requirements of AWWA C151/A21.51.

1. Provide pipe of the various sizes and classes as specified in the schedule or shown. Provide restrained joints a minimum of 20 feet upstream and downstream of a fitting unless noted otherwise.

2. Construct concrete encasements where shown.

1.4 SUBMITTALS

A. General: Provide all submittals, including the following, as specified in Division 1.

B. Submit the following shop drawings:

1. Pipe joints, fittings, sleeves and cleanouts. Where special designs or fittings are required, show the Work in large detail and completely describe and dimension all items.

2. Fully dimensioned drawings of piping layouts, including fittings, couplings, sleeves, cleanouts, valves, supports and anchors. Label pipe size, materials, type, and class on drawings and include the limits of each reach of restrained joints. Provide cross sections showing elevations of cleanouts, pipes, fittings, sleeves, and valves.

3. Alignment survey and laying schedule as specified in Division 1. Cross reference the laying schedule to identification marks on pipeline pieces.

4. Catalog data for pipe, joints, fittings, sleeves, harnessing and cleanouts.

C. Quality Control: Submit certificate of compliance for pipe, fittings, gaskets, lining, polyethylene encasement, coatings, specials, sleeves and cleanouts in accordance with this Section.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver, store and handle all pipe, fittings and appurtenances as specified in Division 1 and Section 02500.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable manufacturers are listed below. Manufacturers of equivalent products may be submitted.

1. Ductile-iron pipe and fittings.

    a. American Cast Iron Pipe Company
    b. McWane Incorporated
    c. Griffon Pipe Products, Incorporated
    d. United States Pipe and Foundry

2. Ductile-iron retainer glands.

    a. 3-inch through 24-inch diameter
        (1) Nappco, Inc. Series 1246
        (2) Ebba Iron, Inc. Series 100

3. Restrained push-on joints.

    a. U.S. Pipe and Foundry TR Flex
    b. McWane Inc. Super-Lock
    c. American Cast Iron Pipe Company Lok-Ring or Flex-Ring

4. Gaskets.

    a. John Crane, Inc.
    b. Garlock Packing Company
    c. U.S. Rubber Company
    d. American Cast Iron Pipe Company
    e. United States Pipe and Foundry
    f. McWane Inc.

5. Approved Pipe Lining Applicators.

    a. Baumann Coatings, Inc., Bessemer, AL
    b. Vulcan Materials, Birmingham, AL
    c. Bredero Shaw Company, Houston, TX

2.2 MATERIALS

A. Fittings: Provide all compact rubber gasket joint fittings meeting the requirements of AWWA C153/A21.53, unless shown or specified otherwise.

B. Rubber Gasket Joints: Provide push-on type joints meeting the requirements of AWWA C111/A21.11.

C. Harnessing: For ductile iron pipe and fittings with push-on joints that require harnessing, provide ductile iron restrained push-on joints.

D. Sleeves: Provide mechanical joint solid sleeves meeting the requirements of AWWA C110/A21.10 where shown, specified or required for connection to existing facilities.

E. Cleanouts

1. Provide cleanouts where shown or specified.

2. Size: Provide not less than 6 inch diameter cleanout openings for pipe 8 inches in diameter or larger. Provide cleanout openings for pipe 6 inches in diameter or smaller of the same diameter as the pipe.

3. Cleanout Covers: Provide cleanout covers which are blind flanges meeting the requirements of AWWA C110/A21.10, except where conformation is required with the inside curvature of the pipeline, in which case the covers are flanged plugs of proper shape with American Standard flange drilling.

a. Fasten covers by means of steel studs and bronze nuts. Drill and tapcovers for a 1-1/2-inch diameter pipe connection.

4. Plugs: Equip the flange of conformed plugs with a dowel or other suitable means for proper setting.

F. Wall Castings, Connecting Pieces, and Special Fittings

1. General: Provide wall castings and connecting pieces, such as bell and bell, bell and spigot, bell and flange, flange and flange, flange and spigot, and flange and flare, meeting the requirements of AWWA C110/A21.10.

2. Design: Provide special fittings, where required, of an approved design that have the same diameters and thicknesses as standard fittings, unless otherwise required, but their laying lengths and other functional dimensions are determined by their positions in the pipeline and by the particular piping materials to which they connect.

3. Intermediate Collar: Where watertightness is essential and at other locations where indicated, provide wall castings with an integrally cast intermediate collar located at the center of the wall.

G. Temporary Bulkheads: Provide temporary bulkheads at the ends of sections where adjoining pipelines have not been completed and are not ready to connect.

1. Remove all temporary bulkheads when they are no longer needed.

H. Linings and Coatings

1. Ceramic Epoxy Interior Lining: Line all sanitary force main pipe with a ceramic epoxy not less than 40 mils nominal dry film thickness. Line exterior of spigot ends and interior of socket with ceramic epoxy 8 to 10 mils nominal dry film thickness. Pipe lining material shall be applied in accordance with the lining manufacturer recommendations.

2. Asphaltic Coating: Shop coat pipe which is to be buried with the standard asphaltic outside coating specified in AWWA C151/A21.51.

3. Encased Pipe: Do not coat or paint the outside of fittings and pipe which are to be encased in concrete.

4. Labels: Paint the size, class designation, manufacture date, and control number cross referenced to the laying schedule conspicuously in white on the outside of each pipe, fitting, and special casting after the shop coat has hardened.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install all buried ductile iron pipe and fittings in accordance with the manufacturer's recommendations and approved shop drawings and as specified in Division 1 and Section 02500.

3.2 LEAKAGE TESTING

A. Cleaning: Flush clean and test all pipes after installation.

B. Testing: Test pipes for leaks and repair or tighten as required.

C. Procedures: Conduct tests in accordance with Section 02516.

3.3 SCHEDULES

A. Refer to the Schedules contained in Section 02500 Laying and Jointing Buried Pipelines for information on the piping that is to be constructed using the pipe materials and methods specified herein.

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 02507

BURIED POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Requirements for providing buried PVC pipe, fittings and appurtenances.

1. For gravity sewer applications, provide PVC pipe and fittings complete with all necessary jointing facilities and materials, specials, adapters and other appurtenances required for installation in and completion of the pipelines to be constructed.

2. For pressure pipe applications, provide PVC pressure pipe and lined ductile iron fittings complete with all necessary jointing facilities and materials, specials, adapters and other appurtenances required for installation in and completion of the pipelines to be constructed.

B. Related Work Specified In Other Sections Includes:

1. Section 02500 - Laying and Jointing Buried Pipelines
2. Section 02516 - Leakage Test

1.2 REFERENCES

A. Codes and standards referred to in this Section are:

1.	ASTM D 3034	-	Type PSM PVC Sewer Pipe and Fittings
2.	ASTM D 2241	-	PVC Pressure-Rated Pipe (SDR Series)
3.	ASTM D 2321	-	Underground Installation of Flexible Thermoplastic Sewer Pipe
4.	ASTM D 2774	-	Underground Installation of Flexible Thermoplastic Pressure Pipe
5.	ASTM F 477	-	Elastomeric Seals (Gaskets) for Joining Plastic Pipe

6. ASTM D 3139 - Joints for Plastic Pressure Pipe Using Flexible Elastomeric Seals

7. AWWA C110/A21.10 - Ductile-Iron and Gray-Iron Fittings 3 inches thru 48 inches, for Water and Other Liquids

8. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron and Gray Iron Pressure Pipe and Fittings

9. AWWA C900 - PVC Pressure Pipe and Fabricated Fittings, 4 inches thru 12 inches.

1.3 SYSTEM DESCRIPTION

A. Design Standards: Provide 4-inch through 15-inch PVC gravity sewer pipe and fittings meeting the requirements of ASTM D 3034. Provide 4-inch through 12-inch PVC pressure pipe meeting the requirements of ASTM D 2241 or AWWA C900 as specified. Provide restrained mechanical joint ductile-iron pipe fittings for PVC pressure pipe meeting the requirements of AWWA C110/A21.10.

1. Provide pipe of the various sizes and classes as specified in Section 02500. Restrain pressure pipe joints where shown, but at a minimum 20 feet upstream and downstream of each fitting.

2. Construct concrete encasements where shown.

1.4 SUBMITTALS

A. General: Provide all submittals, including the following, as specified in Division 1.

B. Submit the following shop drawings:

1. Catalog data for sewer pipe, joints, fittings, sleeves, harnessing, and all appurtenances.

2. Manufacturer's installation instructions.

C. Quality Control: Submit certificate of compliance for pipe, fittings, gaskets, coatings, specials, sleeves and cleanouts in accordance with this Section.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver, store and handle all pipe, fittings and appurtenances as specified in Division 1 and Section 02500.

B. When PVC pipe is delivered to the jobsite it shall not be exposed to sunlight for more than three (3) weeks. PVC pipe exposed to sunlight for more than three (3) weeks shall be covered with an opaque protective covering. The pipe shall be left stacked and no more pipe than can be installed in one day shall be strung along the jobsite.

PART 2 PRODUCTS

2.1 OPEN-CUT INSTALLATION

A. MANUFACTURERS

Acceptable manufacturers are listed below. Manufacturers of equivalent products may be submitted.

1. Diamond Plastics Corporation, Grand Island, Nebraska
2. North American Pipe, Houston, Texas
3. J-M Manufacturing Company, Inc., Livingston, New Jersey

B. MATERIALS

1. Pressure Pipe and Joints: Provide pressure pipe with bell ends in accordance with ASTM D 2241 or AWWA C900. Provide elastomeric gasket joints in accordance with ASTM D 3139 and ASTM F 477.

2. Fittings for Pressure Pipe: Provide restrained mechanical joint ductile-iron fittings for 350 pound working pressures meeting the requirements of AWWA C110/A21.10. Provide fittings with a ceramic epoxy lining and a bituminous coating and polyethylene encasement.

3. Gravity Sewer Pipe and Joints: Provide gravity sewer pipe with joints that are a molded integral part of the pipe section. Provide joints with elastomeric gasket joints in accordance with ASTM F 477. Provide fittings matching the pipe type for all depths of bury. Do not use joints or couplings furnished loose or solvent cement joints.

4. Rubber Gasket Joints: Provide mechanical joints meeting the requirements of AWWA C111/A21.11.

5. Harnessing: Provide restrained fittings as manufactured by Uni-flange, Corp., EBAA Iron Sales, Inc., or equal.

6. Color: Provide pipe made of 100% of the color specified. Provide green sewer pipe and white pressure pipe.

7. Pressure Pipe Outside Diameter: Provide pressure pipe of the outside diameter consistent with iron pipe size (IPS).

8. Pipe Marking: Provide mark on each pipe segment to designate compliance with applicable ASTM specification.

9. Temporary Bulkheads: Provide temporary bulkheads at the ends of sections where adjoining pipelines have not been completed and are not ready to connect. Remove all temporary bulkheads when they are no longer needed.

10. Date of Manufacturer: Provide pipe and fittings manufactured no earlier than 12 month period preceding the date of the Agreement.

2.3 HORIZONTAL DIRECTIONAL DRILLING INSTALLATION

A. MANUFACTURERS

Acceptable manufacturers are listed below. Manufacturers of equivalent products may be submitted.

1. North American Specialty Products, Wayne, Pennsylvania
2. J-M Manufacturing Company, Inc., Livingston, New Jersey

B. MATERIALS

1. Pressure Pipe and Joints: Provide restrained joint PVC pressure pipe for use with the horizontal directional drilling installation method manufactured in accordance with ASTM D 2241 or AWWA C900 as specified. Provide pressure pipe that uses a coupling with a spline and groove assembly that when aligned, a nylon spline is inserted resulting in a fully circumferential restrained joint that locks the pipe and coupling together or internal grip ring, casing and gasket retraint. Provide coupling joints that meet the leakage test requirements of ASTM D 3139. Provide elastomeric gaskets in the couplings that meet ASTM F 477.

2. Fittings for Pressure Pipe: Provide restrained mechanical joint ductile-iron fittings for 350 pound working pressures meeting the requirements of AWWA C110/A21.10. Provide mechanical joints meeting the requirements of AWWA

C111/A21.11. Provide fittings with a ceramic epoxy lining and a bituminous coating and polyethylene encasement. Provide restraining fittings as manufactured by Uni-flange, Corp., EBAA Iron Sales, Inc., or equal.

3. Pressure Pipe Outside Diameter: Provide pressure pipe of the outside diameter consistent with iron pipe size (IPS).

4. Provide pipe and fittings manufactured no earlier than 12 month period preceding the date of the Agreement.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install all buried PVC pipe in accordance with the manufacturer's recommendations and approved shop drawings and as specified in Division 1 and Section 02500.

3.2 LEAKAGE TESTING

A. Cleaning: Flush clean and test all pipes after installation.

B. Testing: Test pipes for leaks and repair or tighten as required.

C. Procedures: Conduct tests in accordance with Section 02516.

3.3 SCHEDULES

A. Refer to the Schedules contained in Section 02500 Laying and Jointing Buried Pipelines for information on the piping that is to be constructed using the pipe materials and methods specified herein.

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 02509

PRECAST MANHOLES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Requirements for providing precast manhole sections including bases, risers, cones and all other appurtenances for a complete installation. Provide manhole sections built with steps and in accordance with the details shown. Construct manhole sections of precast reinforced concrete conforming to ASTM C 478.

1.2 REFERENCE

A. Codes and standards referred to in this Section are:

1. ASTM A 48 - Specification for Gray Cast Iron Castings

2. ASTM C 478 - Specification for Precast Reinforced Concrete Manhole Sections

3. ASTM C 443 - Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets

4. ASTM C 923 - Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures and Pipes

5. ASTM D 4101 - Specification for Propylene Plastic Injection and Extrusion Materials

6. ASTM A 615 - Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement

7. ASTM C 877 - Specification for External Sealing Bands for Concrete Pipe, Manholes, and Precast Box Sections

1.3 SUBMITTALS

A. General: Provide all submittals, including the following, as specified in Division 1.

B. Shop Drawings:

1. Submit shop drawings of precast manholes and structures including evidence of compliance with ASTM standards, and a table or chart showing the specific sections and the orientation of manhole penetrations for each manhole supplied.

2. Submit shop drawings of the preformed joint sealant, resilient connector, manhole sealant, chimney seal, manhole frame and cover, and manhole step.

C. Quality Control: Submit shop and field test reports of concrete samples tested in an approved laboratory.

1.4 DELIVERY, STORAGE AND HANDLING

A. General: Take every precaution to prevent damage to the manhole sections during transportation and unloading. Unload manhole sections using skids, pipe hooks, rope slings, or suitable power equipment, if necessary, and keep the sections under control at all times. Do not allow the manhole sections to be dropped, dumped or dragged under any conditions. Follow applicable requirements specified in Division 1.

B. Damaged Section: If any manhole section is damaged in the process of transportation or handling, reject and immediately remove such sections from the site, and replace the damaged manhole sections at no increase in Contract Amount.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable manufacturers are listed below. Other manufacturers of equivalent products may be submitted.

1. Preformed Joint Sealing Compound:

a. Ram-Nek, as manufactured by K.T. Snyder Company, Inc., Houston, TX

b. Kent-Seal, as manufactured by Hamilton-Kent, Kent, OH

2. Manhole Sealant

a. IPANEX, as manufactured by IPA Systems, Inc., Philadelphia, PA

b. Force 10,000 D, as manufactured by W.R. Grace, Cambridge, MA

3. Resilient Connectors:

   a. KOR-N-SEAL, as manufactured by NPC Systems, Inc., Milford, NH

   b. PSX: Positive Seal, as manufactured by Press-Seal Gasket, Corp., Fort Wayne, IN

4. Butyl Rubber Backplaster (Sanitary Sewer Manholes Only):

   a. TROWELABLE EZ-STIK #3, as manufactured by Press-Seal Gasket, Corp., Fort Wayne, IN

   b. KENT SEAL #3, as manufactured by Hamilton-Kent, Kent OH

5. External Chimney Seal (Sanitary Sewer Manholes Only):

   a. Cretex Specialty Products

   b. Adaptor, Inc.

6. Manhole Frames and Covers:

   a. Frame number 1022 and cover (with City of West Lafayette Logo) to be Type "B" with concealed pickhole, as manufactured by East Jordan Iron Works, East Jordan, MI

   b. Frame number R-1772 and cover (with City of West Lafayette Logo) to be Type "B" with concealed pickhole, as manufactured by Neenah Foundry, Neenah, WI

7. External Concrete Joint Collar:

   a. MacWrap, as manufactured by Mar Mac Construction Products, McBee, SC

2.2 MATERIALS

A. Concrete, Steel Reinforcement and Aggregates: Provide reinforced concrete, cementitious materials, aggregates and steel reinforcement conforming to the requirements of ASTM C 478 for constructing sewer manholes.

B. Manhole Sealant: Provide sanitary manholes with waterproofing admixtures to assure water-tight manhole construction. Use minimum dosage requirement for IPANEX waterproofing admixture of 14 oz per 100 lb of cement. Use minimum dosage requirement for Force 10,000 D microsilica of 10% by weight of cement. Stencil manhole certifying that waterproofing admixture was used.

C. Preformed Joint Sealing Compound: Provide preformed joint sealing compound for joining manhole sections.

D. Butyl Rubber Backplaster: Provide trowelable grade butyl rubber base backplaster material to seal exterior sanitary manhole joints and adjusting rings.

E. O-ring Joints: Provide O-ring rubber gasket conforming to ASTM C 433 for joining manhole sections.

F. Resilient Connectors: Provide resilient connectors conforming to ASTM C 923 for joining sewers to manhole riser sections.

G. Adjusting Rings: Provide precast concrete adjusting rings conforming to ASTM C 478 for adjusting frame and cover elevation.

H. Manhole Frames and Covers: Provide manhole frames and covers conforming to ASTM A 48, Class 35B.

I. Manhole Steps: Provide manhole steps conforming to ASTM D 4101 and A 615.

J. External Concrete Joint Collar: Provide external joint collar that has a high-strength, internal polypropylene mesh and an impervious polyethylene exterior. Compression bands conforming to ASTM C 877 provide positive seal on each side of the joint.

2.3 CONSTRUCTION

A. Manhole Base Section: Provide manholes of 4500 psi reinforced concrete, designed to meet ASTM C478. Provide manhole base and first riser section as one complete precast unit, unless otherwise shown. When benches are made at the manufacturing site, provide concrete used for benched inverts conforming to the requirements for concrete used for precast sections. When benches are made in the field, use Class D concrete and including waterproofing admixture as specified in paragraph 2.2B.

B. Manhole Joints: Join riser, cone and flat slab top sections with O-ring rubber gasket joints plus preformed joint sealing compound in accordance with the sealing compound manufacturer's recommendations, except that install sufficient sealing compound so as to show a "squeeze-out" on the outside of the joint.

Apply trowelable grade butyl rubber backplaster material one-quarter (1/4) inch minimum thickness, when dry, on the outside of the sanitary manhole at each joint, extending six (6) inches above and below the joint. Apply butyl rubber backplaster on the outside of the chimney from three (3) inches below the bottom adjustment ring on the cone section to, and covering, the adjustment rings just

below the casting. Next, apply shrink wrap or visquine to the outside of each joint to further seal sanitary manhole.

C. Manhole Sealant: Provide manhole manufacturer's written confirmation that all reinforced pre-cast concrete sanitary manhole sections contain the inorganic copolymer waterproofing admixture IPANEX or microsilica Force 10,000 D, in compliance with manufacturer's application instructions.

D. Resilient Connectors: Provide stainless steel elements of the connector that are totally non-magnetic Series 305 stainless steel. Use a stainless steel clamp that is capable of sustaining applied torque in excess of eighty (80) inch-pounds.

E. Manhole Tops: Use eccentric cone tops for manholes six feet or more in depth. Use flattops if indicated on the drawings or when manhole is less than six feet deep.

F. Adjusting Rings: Provide adjusting rings of a minimum nominal thickness of not less than two (2) inches.

G. Manhole Frames and Covers: Provide gasket seal cover, heavy duty type, with the City of West Lafayette Logo and the words "Wastewater Utility" cast in each manhole cover.

H. Manhole Steps: Provide polypropylene step with a reinforced 3/8 of an inch minimum diameter reinforcing steel, grade 60. Do not use cast iron steps.

2.4 SOURCE QUALITY CONTROL

A. Accept that the quality of all materials, the process of manufacture, and the finished precast manhole or structure is subject to inspection and approval by the ENGINEER. The OWNER or ENGINEER may make such inspection at the place of manufacture, on the work after delivery or at both places. The OWNER or ENGINEER may reject any precast manhole or structure at any time on account of failure to meet any of the specifications' requirements even though sample manhole sections may have been accepted as satisfactory at the place of manufacture.

1. The OWNER reserves the right to core manholes either at the job site or point of delivery to validate strength of concrete and placement of steel. If cores fail to demonstrate the required strength or indicate incorrect placement of reinforcing steel, reject all sections not previously tested until sufficient additional cores are tested, at no increase in Contract Amount, to substantiate conformance to these requirements.

B. Prior to being installed, each precast manhole or structure shall be carefully inspected. Reject those not meeting the specifications and replace at the Contractor's expense.

C. Acceptance: Base acceptance of precast manhole or structure on passing a proof-of-design test in accordance with ASTM C 478.

PART 3 EXECUTION

3.1 INSTALLATION

A. Lift Holes: Provide lift holes that are formed, tapered, or drilled. Repair lift holes using a conical shaped pre-cast plug, properly sealed in place using non-shrink cement grout or an expanding Portland Cement mixture such as Octocrete.

B. Manhole Base Section: Provide smooth trough with semicircular bottom that extends upward to the height of the pipe crown. Provide manhole bench that is smooth and slopes toward the trough at one inch per foot.

C. Connections to Riser Section: Manufacture riser sections with openings properly located for making connections to sewers. Provide 6 inches minimum distance between a joint in a manhole section and the nearest edge of an opening for a connecting sewer. Make the diameter of such openings to be not more than 4 inches larger than the outside diameter of the pipe to be connected.

D. Resilient Connectors: To connect a sanitary sewer to a new manhole, core drill and provide a flexible boot. After assembly, grout all pipe connections inside manhole in accordance with manufacturer's recommendations.

E. Manhole Tops: Set cones or flattops so that no more than 12 inches of reinforced concrete rings are required to adjust the top of the manhole casting to grade.

F. Adjusting Rings and External Chimney Seal: Provide a soil tight seal between the precast sanitary manhole and adjusting ring, and each adjoining adjusting ring, and between the adjusting ring and casting by the use of two (2) rows of 1/2 inch extrudable preformed gasket material or trowelable grade butyl rubber or an approved equal. After butyl rubber is applied to exterior of adjustment rings, install an exterior chimney seal as specified in Section 02509, Paragraph 2.1 A.5.

G. Manhole Frames: Set manhole frame on 1/2 inch extrudable preformed gasket material or trowelable grade butyl rubber or an approved equal. In paved areas, match top of casting with finished grade; in unpaved/grassy areas, install casting so that the top extends at least three inches above finished grade, and grade surface to provide positive surface drainage away from manhole.

H. Manhole Steps: Locate steps to one side of the manhole granting access to the bench. Install steps with non-shrink mortar or epoxy grout.

I. External Concrete Joint Collar: Install external joint collar at every manhole joint where 25 feet below the ground surface.

3.2 TESTING

A. Conduct manhole tests in accordance with Section 02516.

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 02516

LEAKAGE TESTS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Testing for any signs of leakage in all pipelines and structures required to be watertight.

1. Test gravity sewers by the Low-Pressure Air Test Method, as specified.

2. Test gravity sewers by the Mandrel Deflection Test (all flexible sewer pipe materials), as specified.

3. Closed Circuit Television Inspections of New Sanitary Sewers, as specified.

4. Test sanitary sewer manholes by Vacuum Test, as specified.

5. Test chimney seals, as specified.

6. Test wet well structure for leakage, as specified.

7. Test sanitary force mains and wet well piping by Hydrostatic Pressure, as specified.

B. Operation of Existing Facilities: Conduct all tests in a manner to minimize as much as possible any interference with the day-to-day operations of existing facilities or other contractors working on the site.

C. Pressure/Leakage Test Water: Provide and dispose of pressure/leakage test water to a sanitary sewer only after receiving the approval of the local sewer authority or to another location in accordance with state and federal laws and regulations.

1.2 PERFORMANCE REQUIREMENTS

A. Written Notification of Testing: Provide written notice when the work is ready for testing, and make the tests as soon thereafter as possible. The CONTRACTOR must receive approval of the ENGINEER on which test will be conducted on the new sewer system or any portion thereof.

1. Provide personnel for reading meters, gauges, or other measuring devices.

2. Furnish all other labor and required testing equipment.

1.3 REFERENCES

A. Codes and standards referred to in this Section are:

1. ASTM C 1244 - Standard Test Method for Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) Test
2. ASTM F 1417 - Standard Test Method for Installation Acceptance of Gravity Sewer Lines Using Low-Pressure Air
3. AWWA C 600 - Installation of Ductile-Iron Water Mains and Their Appurtenances (Hydrostatic Pressure Test)

1.4 SUBMITTALS

A. General: Provide all submittals, including the following, as specified in Division 1.

B. Testing Report: Prior to placing the sewer system in service submit for review and approval a detailed bound report summarizing the leakage test data, describing the test procedure and showing the calculations on which the leakage test data is based.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.1 LOW-PRESSURE AIR TEST – GRAVITY SEWERS

A. Testing Procedure: Test gravity sewers using low-pressure air in accordance with ASTM F 1417.

1. Isolate the section of sewer under test using pneumatic plugs that have a sealing length greater than the diameter of the pipe and are capable of resisting test pressure without external bracing or blocking. It is advisable to plug the upstream end of the line first to prevent any upstream water from collecting in the test line.

2. Introduce low pressure air slowly into the sealed line until the internal air pressure reaches the "starting air pressure" of 4.0 psig greater than the average back pressure of any groundwater above the pipe, but not greater than 6.0 psig.

3. After the starting air pressure is reached, throttle the air supply to maintain that internal pressure for at least 2 minutes. This time permits the temperature of the entering air to equalize with the temperature of the pipe wall.

4. When temperatures have been equalized and the starting pressure stabilized, disconnect the air supply and allow pressure to drop. Observe the continuous monitoring pressure gauge while the pressure is decreased to no more than 0.5 psig from the starting air pressure. The time in minutes required for the pressure to drop 0.5 psig shall not be less than as calculated using the following formula:

$$T = \frac{0.085 \times (D) \times (K)}{60 \times Q \times 2}$$

Where:

T = Shortest time, in minutes, allowed for the air pressure to drop 0.5 psig
K = 0.000419 x (D) x (L), but NOT less than 1.0
Q = Leak rate, 0.0015 cubic feet per minute per square feet of internal surface
D = Inside pipe diameter, in inches
L = Length of pipe being tested, in feet

3.2 MANDREL DEFLECTION TEST

A. Testing: A five percent (5%) Mandrel Deflection Test shall be performed on all flexible gravity sewer pipe (PVC, HDPE, etc.). These pipes shall be mandrel tested with a rigid device sized to pass five percent (5%) or less deflection (or deformation) of the base inside diameter of the pipe. The mandrel test shall be conducted no earlier than forty-five (45) days after reaching final trench backfill.

1. Test methods and equipment shall be subject to the ENGINEER'S approval. Each pipe material/type required to be Mandrel tested shall be tested with a mandrel approved by the pipe manufacturer.

2. Conduct test in presence of the ENGINEER or his representative, and the test results must be reviewed and certified by the ENGINEER or his representative prior to final acceptance of the sewer.

3. Any pipe section found to have failed by deflection within the warranty period will be replaced by the CONTRACTOR, all at no addition to the Contract price.

3.3 HYDROSTATIC PRESSURE TESTS – FORCE MAINS

A. Testing: The hydrostatic pressure test shall proceed as follows:

1. The force main shall be completely backfilled prior to testing.

2. The upstream and downstream plugs/bulkheads will be equipped with a minimum of two (2) openings for filling/draining the pipeline and for bleeding air from the line. Provide suitable bracing/restraining system in accordance with the plug/bulkhead manufacturer's requirements that are to remain in place during the testing.

3. The test line shall be filled with water at a slow rate to prevent air entrapment. Trapped air shall be expelled through high point bleed off valves as the line is being filled.

4. Pressure test buried force main pipe for leakage by maintaining the fluid in the pipe at the specified pressure for a minimum period of 1 hour. The ENGINEER or his representative must be present for the entire period.

5. Pressure test the piping for leakage as a whole or in sections, valved or bulkheaded at the ends. Apply the specified pressure to the piping through a tap in the pipe by means of a hand pump or other approved method. Do not use air for testing.

B. Test Pressures: The force main shall be tested at 1.5 times the pump shut-off head as determined from the pump manufacturer's performance curve, or to 100 psi, whichever is greater.

C. Allowable Leakage: Stop all visible leakage. Do not allow leakage for any piping, as determined by the above test, to exceed the allowable leakage determined by the following formula listed in AWWA C600:

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

in which L is the allowable leakage in gallons per hour, S is the length of water main tested in feet, D is the nominal diameter of the pipe in inches and P is the average test pressure in psi gauge.

D. Repair: Compliance with the allowable leakage criteria will not preclude the ENGINEER from requiring repair of any and all visible leakage identified during the test period.

1. When leakage occurs in excess of the specified amount, locate and repair defective pipe, joints, valves or cleanouts.

2. If the excess leakage is determined to be caused by defective materials furnished, improper workmanship, or damage to the materials, make the necessary repairs or replacements at no addition to the Contract Price.

3. If defective portions cannot be located, remove and reconstruct as much of the original work as necessary to obtaining piping that meets the leakage requirements specified herein and retest, all at no addition to the Contract Price.

3.4 TELEVISION INSPECTION – GRAVITY SEWERS

A. Internal Pipe Inspection: Before final acceptance, inspect all new gravity sewers by closed-circuit television inspection. Conduct CCTV operations in accordance with Section 02651.

3.5 LEAKAGE TESTS FOR WATERHOLDING CONCRETE STRUCTURES

A. Perform leakage tests on precast concrete wet wells at both lift stations, before backfilling, by completely filling the structure with water (maximum water level). Test shall conform to the requirements of ACI 350.1R-93/AWWA 400-93. Testing shall not be performed before after all portions of structure elements have been completed. The CONTRACTOR shall be responsible for proper disposal of all water used for leakage testing. The method of disposal shall be subject to approval by the OWNER.

1. Plug all pipe openings, taking care to securely brace the plugs.

2. Fill the structure to be tested with water to the maximum level. Optional: Allow a 3-day interval between the time the structure is filled with water and the start of the leakage testing to minimize the effect of the concrete absorption on the test results.

3. Inspect the walls and all joints for leakage. If structural distress is observed, report immediately to the OWNER. Visible flowing leaks or damp spots that show on the exterior surface of the structure shall not be permitted.

4. Begin the test and observe the water level in the structure for a 48 hour period.

   a. Make an inspection for locations of leakage through the exterior surface of the structure, especially in areas around fittings; and construction, expansion and other joints. Monitor underdrains for any increase in flow.

   b. Leakage will be considered acceptable if:

      (1) There are no visible leakages or visible damp areas and

      (2) The amount of water loss in each 24 hour period is not more than 0.1 percent of the volume to which the structure was filled, after correcting for the evaporation loss or precipitation gain in accordance with ACI 350.1R-93, Chapter 3.

   c. If visible leaks appear, submit, for approval, the repair procedure and materials for all elements of structure. Make the repairs at no additional cost to the OWNER. Leakage test the structure again after repairs. Continue repair and re-test cycle until the structure passes the leakage test.

   d. Damp areas are not permitted at any location on the tank wall. Damp areas are defined as spots where moisture can be picked up on a dry hand. All such areas shall be repaired as necessary at no additional cost to the OWNER.

3.6 MANHOLE TESTING

A. Testing: Demonstrate the integrity of installed materials and construction procedures by conducting a Vacuum Test in accordance with ASTM C 1244. Testing prior to backfilling is highly recommended to facilitate corrective measures in case of test failure. Proceed with the manhole test as follows:

   1. Plug all pipe openings, taking care to securely brace the plugs.

   2. With the vacuum tester set in place:

      a. Inflate the compression band to 40 psi to affect a seal between the vacuum tester base and the manhole frame.

      b. Connect vacuum pump to the outlet port with the valve open.

c. Draw a vacuum to ten inches of mercury (10” Hg) and close the valve.

3. The test shall pass if the vacuum remains at 10” Hg or drops to 9” Hg in a time greater than one minute.

B. Repair: If the manhole shows leakage or signs thereof, repair the manhole to the satisfaction of the ENGINEER and retest.

3.7 CHIMNEY SEAL TESTING

A. Testing Procedure: Test all chimney seals as follows:

1. Conduct leakage test after the manhole has passed the vacuum test.

2. Install the chimney seal and only the bottom band per manufacturer’s recommendation. Fully tighten the bottom band. Do not install the top band.

3. Pull the top of the chimney seal away from the manhole frame. Pour one (1) gallon of water between the chimney seal and the manhole.

4. Observe the bottom seal for a minimum of one (1) minute for leakage. Drain the water by folding the top of the chimney seal down.

5. If there is no leakage, install the top band per manufacturer’s recommendation.

B. Chimney Seal Failure:

1. If the bottom band or the chimney seal has any leakage, then remove, replace or reposition the bottom band or chimney seal and retest.

3.8 REPAIR OF LEAKING PIPES

A. Procedures: Repair leaks as follows:

1. Replace broken pipe or joint assemblies found to leak.

2. When leakage occurs in excess of the specified amount, locate and repair defective valves, pipe, cleanouts or joints.

3. If the excess leakage is determined to be caused by defective materials furnished, improper workmanship, or damage to the materials, make the necessary repairs or replacements at no addition to the Contract Price.

4. If defective portions cannot be located, remove and reconstruct as much of the original work as necessary to obtain piping that meets the leakage requirements specified herein and retest, all at no addition to the Contract Price.

END OF SECTION

SECTION 02651

SEWER TELEVISING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Closed-circuit television (CCTV) inspection of new underground sewer pipelines.

B. Related Work Specified in Other Sections Include:

1. Section 02760 - Sewer Cleaning

1.2 SYSTEM DESCRIPTION

A. Testing: CCTV inspection of new sanitary sewers shall be conducted no earlier than forty-five (45) days after reaching final trench backfill or not before passing a mandrel test (for flexible pipes).

B. Provide all necessary CCTV equipment:

1. Provide television inspection equipment with working pan and tilt capabilities, and an accurate footage counter manufactured specifically for for sewer inspections.

2. Provide camera able to transmit a continuous image to the television monitor as it is being pulled through the sewer segment.

3. Supply camera with a minimum of 1,000 feet of coaxial cable.

4. Equip camera with an articulating lens to provide clear views of laterals and other items of importance.

5. The camera shall be equipped with remote control devices to adjust the light intensity. The lighting system shall be adequate for quality pictures. A reflection in front of the camera may be required to enhance lighting.

1.3 SUBMITTALS

A. Submit sewer televising DVD-ROMs including inspection reports to the ENGINEER for review and approval.

1. Provide DVD-ROMs of a quality sufficient to evaluate the condition of the sewer, locate the service connections, and verify cleaning. If quality is not sufficient, re-inspect the pipeline segment and provide inspection reports and DVD-ROMs at no addition to the Contract Price. Camera distortions, inadequate lighting, dirty lens, or blurred/hazy picture will be cause for rejection of DVD-ROMs and rejection of the associated line segment.

2. Maintain a master copy of all inspection reports and DVD-ROMs submitted until final acceptance of contract.

3. DVD-ROM Label: One label shall be placed on the non-recordable side of the DVD-ROM. Permanently label each DVD-ROM with the following:

   a. OWNER's Name
   b. Project Name
   c. Contractor's Name
   d. Inspection Type: Pre-Installation, Post-Installation
   e. Date Televised
   f. Date Submitted

4. DVD-ROM Case Label: Two labels are required. One label shall be placed on the spine of the case and the other on the face of the case. Permanently label each DVD-ROM case with the following information:

   a. Spine of DVD-ROM case:

      (1) Project Name

   b. Face of DVD-ROM case:

      (1) OWNER's Name
      (2) Project Name
      (3) Contractor's Name
      (4) Date Televised
      (5) Date Submitted

1.4 QUALITY ASSURANCE

A. Experience Requirements:

1. Provide personnel operating camera equipment with a minimum of three (3) years experience in sewer televising and certified by the National Association of Sewer Service Companies (NASSCO) Pipeline Assessment Certification Program (PACP).

2. Conduct all television inspections in compliance with NASSCO's PACP condition assessment defect coding guidelines. Prepare inspection reports on an individual sewer segment basis that identify all service laterals and pipeline defects.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

3.1 PREPARATION

A. Cleaning: Clean pipelines prior to CCTV inspections. Provide cleaning in accordance with Section 02760 - Sewer Cleaning.

3.2 CCTV PIPELINE INSPECTION

A. Be aware that this Contract requires work in active sewers. Follow all federal, state, and local requirements for safety in confined spaces.

B. Select the appropriate equipment, tools, and methods for securing safe passage of the camera.

C. Inspection: After cleaning the sewer segments, internally inspect sewer segments to verify it was constructed in accordance with Contract Documents.

1. Record these inspections on DVD and include a verbal narrative or text display noting:

a. Date and location (street address)

b. Sewer segment number: "from" manhole number and "to" manhole number.

c. Locations of observations, structural defects, joint deterioration, leakage or evidence thereof, material transitions, and other abnormalities with respect to the sewer condition. Indicate the distance from the centerline of the upstream manhole for each item noted.

d. A written inspection log listing recorded observations for each sewer main.

2. Carefully inspect the interior of the sewer main to determine the location and extent of any installation defects. Stop the camera at all defects and service connections and use the pan and tilt features to obtain a clear picture.

3. Maximum acceptable speed of camera through sewer is thirty feet per minute (30 fpm).

4. Do not split a sewer segment between two DVDs.

5. If any obstruction in the sewer segment, such as a protruding building lateral, prohibits the passage of the television camera, attempt to inspect the remainder of the sewer segment by making a reverse setup at the next downstream manhole. Reverse set-ups are at no addition to the Contract Price.

6. Should the CONTRACTOR's televising equipment become lodged in any sewer line, remove the equipment, at no additional cost to the Contract Price. This includes, if necessary, excavation and repair of the sewer, underground utility repairs, backfilling and surface restoration. Re-televise any line segment in which his equipment became lodged after said equipment has been removed to demonstrate to the OWNER that no damage exists as a result of the televising operations.

7. Correct all defects discovered during the television inspection before the Work will be considered for substantial completion and at no addition to the Contract Price.

8. Allow sufficient time for the ENGINEER to review the videos prior to the substantial completion milestone.

3.3 ACCEPTANCE

A. Present on DVD a continuous image of not less than ninety-five percent (95%) of the internal pipe surface at all times. The DVD to be accompanied by a complete written inspection report.

3.4 DELIVERABLE

A. Submit two (2) DVDs and two (2) printed copies of the final inspection reports.

END OF SECTION

SECTION 02760

SEWER CLEANING

PART 1 GENERAL

1.1 DESCRIPTION

A. Scope:

1. Furnish all material, labor and equipment required to clean new sanitary sewer pipelines as specified herein complete with all appurtenances and accessories, as required. Clean pipes to allow for a closed-circuit television (CCTV) camera to discern 95% of the internal pipe surface, to discern all pipeline defects and to facilitate sewer rehabilitation.

2. The cleaning work required may include, but is not limited to, the following:

a. Field locate all manholes along the sewer reaches to be cleaned.

b. Maintain and protect vehicular and pedestrian traffic, and meet all requirements of the OWNER and all other governmental agencies having jurisdiction.

c. Clean existing sanitary sewers, as specified, to permit proper closed-circuit television (CCTV) inspection.

d. Dispose of waste and sediment as specified herein.

e. Remove roots as specified herein.

f. Clean-up as the work progresses and after the completion of all work activities.

g. All other work required for the complete and satisfactory cleaning of the pipeline.

h. Remove protruding service connections.

i. Control flow in sewers as needed to permit the work to be accomplished, by use of plugs, flow restrictors, pumped bypasses or other reviewed means.

B. Related Work Specified in Other Sections Includes:

1. Section 02651 - Sewer Televising

1.2 REQUIREMENTS

A. Be aware that this Contract requires work in active sewer manholes and shall follow all Federal, State and local requirements for safety when in confined spaces.

B. Provide experienced personnel in the cleaning of sanitary sewers. Furnish documentation of experience to the OWNER upon request.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

3.1 CLEANING

A. Take sole responsibility for safety during the performance of all Work.

B. Clean the sewer with hydraulically propelled, high velocity jet or mechanically powered equipment. Select equipment based on the conditions of the sewer line at the time work commences. The equipment and methods selected shall be satisfactory to OWNER and shall be capable of removing dirt, grease, rocks, sand, roots, and other material and obstructions from the sewer line.

C. Determine the extent of the cleaning during the pre-bid jobsite examination.

D. During sewer cleaning operations, take precaution in the use of cleaning equipment to prevent damage to the existing pipe. There may be some conditions such as broken pipe that prevent cleaning from being accomplished or where damage would result if cleaning were attempted or continued. Should such conditions be encountered, immediately notify ENGINEER. If, in the course of cleaning operations, damage does result from preexisting and unforeseen conditions such as broken pipe, CONTRACTOR shall not be held responsible. Notify ENGINEER of any conditions that warrant termination of cleaning activities.

E. When using hydraulically propelled devices, take precautions to ensure that the water pressure created does not cause damage or flooding to public or private property.

F. Take precautions during sewer cleaning operations to prevent damage to homes with laterals on the sewer main being cleaned. Immediately notify OWNER of any damage to homes or other private property due to sewer cleaning operations. Be responsible for repair of any damage due to sewer cleaning operations at no addition to the Contract Price.

G. Debris disposal is the responsibility of the CONTRACTOR. Remove all material resulting from the cleaning operations from the site at least once each working day.

H. Ensure no solids are passed downstream to the next pipe section during the cleaning operation. Construct a suitable sand trap, weir, dam, or other approved method in the downstream manhole in such a manner that all solids and debris are trapped and removed.

I. Obtain permission for access where access to manholes in easements and rights-of-way is required.

J. Provide and maintain traffic control devices throughout prosecution of the Work as shown and specified.

K. Clean upstream sewer reaches before the downstream reaches are cleaned.

3.2 ACCEPTANCE

A. Acceptance of sewer line cleaning will be based on inspection at manholes and viewing of video tape completed following cleaning. A line will be considered clean if the depth of debris remaining after cleaning is less than or equal to the following:

Pipe Size	Maximum Debris Remaining
12 inches and smaller	Negligible

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 02764

SEWER MANHOLE LINING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Work necessary for lining sewer manholes, including manhole walls, bench surfaces, and lift station wet wells to protect against corrosion and to withstand hydrostatic forces from groundwater as shown.

1.2 REFERENCES

A. Codes and Standards referred to in this section:

1. ASTM D638 – Tensile Properties of Plastics

2. ASTM D790 – Flexural Properties of Unreinforced and Reinforced Plastics

3. ASTM D695 – Compressive Properties of Rigid Plastics

4. ASTM D4541 – Pull-Off Strength of Coatings Using a Portable Adhesion Tester.

5. ASTM D4060 – Test Methods for Abrasion

6. ASTM D2240 – Durometer Hardness

7. ASTM F1216 – Standard Practice for Rehabilitation of Existing Pipelines and Conduits by Inversion and Curing of a Resin-Impregnated Tube

1.3 SUBMITTALS

A. Product Data and Information:

1. Manufacturer's standard catalog data for the product to be used together with information on toxicity and hazardous nature of chemicals.

2. Manufacturer's recommended installation instructions.

3. Manufacturer certification that Applicator has been trained and approved in the handling, mixing, and application of the products to be used.

4. Certification that the equipment to be used for applying the products have been manufactured or approved by the protective coating manufacturer and applicator personnel have been trained and certified for proper use of the equipment.

5. Liner thickness calculations certified by Professional Engineer in the State of Indiana.

B. Quality Control:

1. Qualifications of applicator(s) proposed for this project including certification by the product manufacturer that applicator is trained in the handling, mixing and application of the product.

2. Manufacturer's five (5) year labor and material warranty.

3. Final installation documentation (including digital photos) on completed structures.

1.4 QUALITY ASSURANCE

A. Experience Requirements:

1. CONTRACTOR applying concrete protective linings shall have a minimum three (3) years active experience in the installation of the product bid.

2. CONTRACTOR must have successfully installed the product bid in at least 250 sewer manholes or other wastewater structures. Acceptable documentation of these minimum installation requirements must be submitted to the OWNER.

3. The manufacturer shall provide written certification that the Applicator has been trained and certified by the manufacturer to handle and apply their products, as well as appropriate re-certification documentation, as necessary, by the manufacturer.

B. Quality Control:

1. Sewer products are intended to have a 50-year design life, so to assure quality during construction, only proven products and experienced installers shall be approved.

2. For concrete protective lining products to be proven, CONTRACTOR must provide documentation that the specified material to be used has been

successfully installed in a minimum 3,000 sewer manholes or other wastewater structures.

1.5 DELIVERY, STORAGE AND HANDLING

A. Keep materials dry, protected from weather and properly store until used for application.

B. Materials are to be stored in accordance with manufacturer requirements and handled according to their material safety data sheets.

1.6 WARRANTY

A. Concrete protective lining shall be warranted from defects and failure for a period of ten (10) years after OWNER acceptance. If the materials and installation furnished by the CONTRACTOR fail during this period, repair the structure at no addition to the Contract Price.

PART 2 PRODUCT

2.1 MANUFACTURERS

A. Acceptable manufacturers for concrete protective linings are shown below. Other manufacturers of equivalent products may be submitted prior to bid.

1. SprayWall as manufactured by SprayRoq, Inc.

2.2 MATERIALS – SPRAYWALL

A. Protective linings shall be of a type which has a documented record of successful performance in sewer system applications.

B. Protective linings shall consist of two-component polyurethane which is 100% VOC-free and self-priming.

C. Protective lining materials shall be designed and manufactured to withstand hydrogen sulfide corrosion in a wastewater environment.

D. Protective lining shall be flexible to resist failures due to freeze and thaw cycles and ground movement.

E. Design lining to withstand hydrostatic groundwater forces with water table 4 feet below the ground surface.

F. Physical Properties:

1. Concrete protective lining shall have a minimum of 1/4" total thickness for all structure depths. Protective lining shall conform these minimum physical properties:

Description	Test Method	Value
Flexural Modulus	ASTM D790	735,000 psi
Flexural Strength	ASTM D790	14,000 psi
Tensile Strength	ASTM D638	7,450 psi
Elongation	ASTM D638	4% at break
Compressive Strength	ASTM D695	19,000 psi
Abraision	ASTM D4060	17.7mg loss
Hardness, Shore D	ASTM D2240	85
Adhesion to Concrete	ASTM D4541	Substrate Failure

2.3 STRUCTURAL REQUIREMENTS

1. Provide protective linings that are designed for a minimum 50-year design life under continuous loading and hydrostatic conditions.

2. Design the liner based on the condition of the existing manhole that shall be classified as partially deteriorated as described in ASTM F1216.07b, Appendix X1. Design the liner to withstand all imposed loads.

3. The liner shall be designed by a registered professional engineer. Design the liner to have sufficient wall thickness to withstand the anticipated external pressures and loads that will be imposed after installation.

4. Along with the above minimum structural standards, use the following values in calculating the design liner thickness:

Parameter	Value
Modulus of Elasticity of adjacent soils	1,000 psi
Soil Density	120 pcf
Poisson's Ratio	0.3
Water Table Elevation	4 feet below surface level
Live Load (traffic areas)	AASHTO H20 highway load
Factor of Safety	2

5. In wall thickness design, use equations, as detailed in ASTM F1216.07b, Appendix X1.

6. The initial flexural modulus of elasticity (short-term) of the submitted material will be utilized with the long term deformation percentage as determined by ASTM D2990 in the design equation outlined in ASTM 1216-07b, Appendix X1. The definition of long term value will be identified as initial flexural modulus of elasticity less the reduction in value used by creep over a fifty (50) year minimum period and verified by third party DMA testing.

PART 3 EXECUTION

3.1 PREPARATION

A. Surface Preparation:

1. Thoroughly clean all structure walls and other surfaces that are to receive protective linings using high pressure water spray in accordance manufacturer's recommendations.

3.2 INSTALLATION

A. Schedule:

1. Concrete protective lining installation shall commence prior to introduction of wastewater to structure.

B. After surface preparation, (including surface cleaning and preparing a dry surface for lining), the protective lining shall be applied in strict accordance with manufacturer's recommendations.

C. A permanent identification number and date of work performed shall be affixed to the structure in a readily visible location.

3.3 TESTING AND ACCEPTANCE

A. Testing:

1. The ENGINEER shall be notified a minimum of 48 hours prior to conducting of all tests.

2. CONTRACTOR shall measure applied thickness of protective lining materials either during or immediately following the application process

(prior to reinstating service through the structure) utilizing either wet or dry film thickness gage or holiday test. CONTRACTOR shall provide records to the OWNER and ENGINEER of test results for each structure that include Project Name, Location, Application Date and Completed By, Test Date and Completed By, Test Method, and Test Results.

3. Upon completion and curing of the protective linings, OWNER's REPRESENTATIVE shall make visual inspection of the completed work and may make additional gage measurements or request holiday test. Any defects discovered during gage measurement or visual inspection shall be repaired by CONTRACTOR to satisfaction of OWNER at no additional cost to OWNER.

B. Acceptance:

1. After all work is completed, provide OWNER with color photographs showing post-installation conditions.

END OF SECTION

SECTION 02900

LANDSCAPING WORK

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Soil, soil preparation, excavation, planting, seeding, sodding, fertilizing and maintenance.

B. Related Work Specified in Other Sections Includes:

1. Section 02316 - Earth Excavation
2. Section 02317 - Backfilling

1.2 SUBMITTALS

A. General: Provide all submittals as specified in Division 1.

1.3 DELIVERY, STORAGE AND HANDLING

A. General: Deliver, store and handle all products and materials as specified in Division 1 and as follows.

B. Top Soil: Deliver top soil in a dry state without enough moisture to allow it to be packed or squeezed into a ball.

C. Balled and Bare Root Plants: Immediately after delivery, set all balled plants on the ground with the balls well protected with soil. Water and properly maintain all plants until planting. Plant or heel in bare rooted plants which cannot be planted immediately upon delivery. No materials heeled in for more than a week may be used. Before the roots are covered, open bundler and separate the plants.

D. Grass Seed: Deliver grass seed in standard size bags of the vendor, showing weight, analysis and name of vendor. Store the seed so as not to impair its effectiveness.

E. Sod: Deliver sod to the site in fresh condition and within two days of the time it has been dug.

F. Fertilizer: Deliver fertilizer mixed as specified, in standard size bags, showing weight, analysis and the name of the manufacturer. Store the fertilizer in a weatherproof storage place in a manner that will keep it dry without impairing its effectiveness.

1.4 ENVIRONMENTAL REQUIREMENTS

A. Seeding: Sow grass seed between August 15th and October 15th unless sowing between March 15th and June 1st is permitted. Sow seed when the wind velocity is below 5 mph. Do not seed earlier or later than these times without written approval.

B. Sodding: Place sod between August 15th and October 15th or between March 15th and June 1st, or as otherwise approved.

B. Planting: Unless otherwise directed, plant deciduous material from March 1st to June 1st and from September 15th to November 15th. Plant evergreen material from April 1st to June 1st and from September 15th to November 1st.

1.5 WARRANTY

A. General: Apply the one-year warranty to all seeded and planted areas. Have the warranty period commence after the final acceptance of all landscaping work exclusive of all replacement plant materials.

B. Plant Material: Warranty plant materials for a period of one year.

C. Seeded Areas: Warranty seeded areas to the time of establishment of an acceptable uniform stand of grass. Acceptable stand is defined as 95% coverage of the disturbed area with weed-free grass.

D. Sod: Warranty sod to 30 days following the first cutting.

1.6 MAINTENANCE

A. General: Maintain all seeded and planted areas during the warranty period.

B. Grass Areas: Maintain all seeded and sodded areas by watering, weeding and fertilizing as required to establish a uniform stand of weed-free grass. Reseed or resod areas failing to develop a uniform stand. Apply a minimum of 2 applications of fertilizer for the grass as necessary to achieve weed-free turf. Bear the cost of the water.

C. Trees, Shrubs and Ground Covers: Cultivate trees, shrubs and ground covers and weed and water when necessary, but not less than twice a month, to prevent plant material from dying. Spray as required to keep trees and shrubs free of insects and

disease. Restore or replace damaged stakes and guy supports and tree wrappings. Replace any plant material which is found to be dead or dying during the warranty period to original specifications upon request. Include the full cost of replacing dead or dying plant material in the Contract Amount. No separate payment will be made for replacements. Maintain plant material to be alive, in good growing condition and free of weeds.

D. Replacement: Replace plant material and resod or reseed grass areas only during the specified planting seasons and warranty the replacement material for the same period of time as the original material.

PART 2 PRODUCTS

2.1 SOIL

A. Existing Topsoil: Use existing site stripped topsoil to backfill final 6 inches below finished grade. If additional topsoil from off-site is required, provide a natural friable top soil of the region, rich in organic matter, without any material toxic to plant growth and of uniform quality, free of large roots, sticks, hard clay, weeds, brush, stones over 1-inch in maximum dimension or other litter or waste products. Provide topsoil containing no decomposed stone, salts or alkali, and not less than 15 parts per million of available nitrates, 3 parts per million of available phosphorus, 15 parts per million of potash, and having a pH of not less than 6.0 nor more than 7.2 at a depth of 8 inches below the surface of the field from which it is removed. Provide topsoil with a mechanical analysis as follows:

Sieve	Percentage Passing
1 inch	100
1/4 inch	97-100
No. 100	40-60

B. Off-Site Topsoil: If insufficent amount of existing topsoil exists, provide off-site topsoil meeting the above requirements to backfill to finished grade.

C. Planting Soil: Prepare planting soil by mixing 10 parts of topsoil with fertilizer and 1 part of peat moss.

2.2 GRASS SEED AND SOD

A. Grass Seed: Provide a fresh, clean, new crop of grass seed composed of 20 percent Creeping Red Fescue, 30 percent Nightsky Perennial Rye Grass, 30 percent CaddieShack II Perennial Rye Grass, and 20 percent Common Kentucky Blue Grass. Provide seed components free of noxious weed seeds and having not less than the following purity and germination:

Component	Percent Purity	Percent Germination
Creeping Red Fescue	95	85
CaddieShack II Perennial Rye Grass	95	90
Nightsky Perennial Rye Grass	95	90
Common Kentucky Blue Grass	95	85

Tag each sack in accordance with the agricultural seed laws of the United States and the State of Indiana. Show on each tag the producer's guarantee as to the year grown, the percentage of purity, the percentage of germination and the tests by which the percentages were determined. Provide seed for this project having a test date within 6 months of the date of sowing.

B. Sod: Provide nursery-grown Improved Kentucky Blue Grass sod, free of weeds, a minimum of 1-inch thick of dense growth and cut with sharp edges in 18-inch widths and not less than 3 feet long. Sod which has been grown on peat or which has been dug more than two days previous to delivery or which has been allowed to have the roots dry out on which the grass has turned brown will not be accepted.

2.4 PLANT MATERIALS

A. General: Provide plant materials that are true to species or variety, sound, healthy, vigorous acclimated plants free from defects, disfiguring knots, sun-scaled injuries, abrasions of the bark, plant diseases and insect eggs, borers and all other forms of infestations. Provide material that has normal, well-developed branch systems and vigorous root systems and that is freshly dug, nursery-grown stock grown under the same climatic conditions as the Project location. Provide material grown under climatic conditions similar to those in the locality of the project for at least two (2) years and transplanted or root pruned at least in the last three (3) years.

B. Plant Size: Dimension a plant as it stands in its natural position. Measure trees under 4 inches in caliper at a point 6 inches above the ground and trees more than 4 inches in caliper at a point 12 inches above ground. Provide the stock of a fair average of the minimum and maximum sizes specified. Do not cut back large shrubs to sizes specified.

C. Balled, Burlapped and Platformed Plants: Dig balled and burlapped, as well as balled and platformed, plants with sufficient roots and a solid ball of earth securely held in place by burlap and stout natural fiber rope. Manufactured balls are not acceptable. Provide balled and platformed plants with sturdy platforms of a size equal to the diameter of the horizontal midsection of the ball of earth.

D. Trees: Replacement trees can be selected from the following list of acceptable species: Autumn Blaze Maple, Cumulus Allegheny Serviceberry, October Glory Red Maple, Thornless Cockspur Hawthorn, Winter King Hawthorn, Skyline Honeylocust, Cherokee Sweetgum, Red Oak, Pin Oak, Chinkapin Oak, Shagbark Hickory, Tulip Poplar, or Black Gum. The trees are to be single stem, 1.5 inch or greater in caliper.

2.5 COMMERCIAL FERTILIZER

A. Provide all commercial mixture fertilizer uniform in composition, free flowing, conforming to state and federal laws and suitable for application with equipment designed for that purpose. Provide fertilizer with organic, inorganic or combined elements with the minimum following composition by weight:

1.	Nitrogen	12 percent
2.	Phosphorus	12 percent
3.	Potassium	12 percent

B. Application: Apply fertilizer at a rate of 6 pounds per 1,000 square feet at planting.

2.6 ACCESSORIES

A. Provide Tree Wrap: Provide new, clean, plain, 8-ounce weight burlap material 6 inches wide for wrapping tree trunks.

B. Mulch: Provide organic mulch, Type Grade ‘A’, Shredded hardwood or bark mulch suitable as a top dressing for trees and shrubs.

PART 3 EXECUTION

3.1 GRADES

A. Grass Areas: Grade lawns to meet walks, curbs and adjoining surfaces after uniform settlement of surfaces. Correct water pockets or ridges which appear after surface settlement takes place on or before the end of the guarantee period.

3.2 EXCAVATION FOR PLANTING

A. General: Obtain approval for all plant locations before excavation. Remove from the site all material that is surplus and unsuitable for backfill.

B. Installation: Have trees and shrubs planted by a qualified landscape installer whose work has resulted in successful establishment of exterior plants.

C. Grass Areas: Excavate for ground cover and grass areas to the required depths for grass to receive 2 inches of off-site topsoil.

D. Plant Pits: Excavate plant pits with vertical sides and a circular outline.

1. Dig tree and evergreen pits about twice the diameter of the ball, and deep enough to permit an 8-inch layer of compacted planting soil beneath the ball.

2. Dig shrub pits a minimum of twice the diameter of the ball and deep enough to allow 6 inches of compacted planting soil beneath the ball.

E. Drain: Install french drains for all trees, ornamental trees, and evergreens planted on berms and other locations where the grade permits, from bottom of planting pit to the finished grade with a trench 9 inches wide, filled with a 6-inch thick layer of 3/4-inch washed gravel. Cover the gravel layer with a filter mat before backfilling the trench with soil.

3.3 SOIL CONDITIONING

A. Disking: Before the application of seeding, disk the area to be planted with grass to a depth of 8 inches. Continue the disking until the subsoil surface is sufficiently broken to provide a good bond between subsoil and topsoil. Spread the required depth of off-site topsoil over the disked area to a uniform depth and density.

3.4 SEEDING AND SODDING

A. Seeding: Sow seed at the rate recommended by the seed producer, but not less than 10 pounds per 1,000 square feet. Evenly rake the surface after seeding with a fine-tooth rake. Mulch all newly seeded areas and cover with a minimum of 1/4-inch of straw or hay, approximately at the rate of 1.5 bales per 1,000 square feet, then thoroughly wet.

B. Sodding: Lay sod in such a manner that the surface is smooth and even all edges abut one another tightly. Water and roll sod so that a bond is produced between the prepared topsoil and the sod. On slopes greater than 3 to 1, stake installed sod with approved wooden sod stakes at a minimum rate of three stakes per square yard of sod.

3.5 PLANTING

A. Layout: Outline locations for trees, shrubs, evergreens and bed and stake for approval. Obtain location approval prior to commencing planting operations.

B. Setting Plants: Remove all soil from top of root ball to root flare. Remove burlap and wire baskets from tops of root balls and partially from sides, but do not remove from under root balls. Set plants plumb and straight with the crown at finished grade. Compact planting soil around the base of the ball, and fill the void 3/4 of the way up from the bottom. Water each plant immediately. After the water has completely drained, backfill the plant pits to finished grade. Properly spread out roots of bare root plants and carefully work topsoil among them. Cut off any broken or frayed roots with a clean cut. Form a shallow basin, the size of the ball with a ridge of soil to facilitate watering. After that operation is completed, apply a second watering immediately. Finish all planting pits and beds within a period of three (3) days following installation. Construct tree saucers, cultivate and outline planting pits with a neat edge, when necessary.

C. Mulching: Immediately after planting operations are completed, cover all tree and shrub pits with mulch to a minimum depth of 3 inches extending 6 feet in diameter around the tree. Create 4 inch high earth saucer beyond edge of root ball, per City Standard Detail. Limit mulch for trees to saucer diameter. Do not place mulch within 3 inches of trunks.

D. Pruning: Prune each tree and evergreen with clean, sharp tools in accordance with standard horticultural practice to preserve the natural character of the plant. Remove suckers and all dead, broken or badly bruised branches.

E. Wrapping: Wrap the tree trunks of all trees with trunk-wrap tape. Start at base of trunk and spiral cover trunk to height of first branches. Overlap wrap, exposing half the width, and securely attach without causing girdling. Inspect tree trunks for injury, improper pruning, and insect infestation; take corrective measures before wrapping.

F. Staking: Stake trees as necessary to be plumb and straight and to prevent wind tip-out (see City Standards). Remove stakes and/or guy wires after a period of one year after time of planting.

G. Watering: During planting, thoroughly saturate the soil around each plant with water and as many times later as seasonal conditions require until the end of the guarantee period. Bear the cost of the water.

END OF SECTION

SECTION 03100

CONCRETE FORMWORK

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Provide concrete formwork for structural concrete as specified to form concrete to profiles shown. Provide concrete with broom finish.

B. Related Work Specified in Other Sections Includes:

1. Section 03200 - Concrete Reinforcement
2. Section 03250 - Concrete Accessories
3. Section 03310 - Cast-In-Place Concrete

1.2 REFERENCES

A. Codes and standards referred to in this Section are:

1. ACI 318 - Building Code Requirements for Reinforced Concrete

2. ACI SP-4 - Formwork for Concrete

1.3 SUBMITTALS

A. Do not provide submittals for concrete formwork

1.4 QUALITY ASSURANCE

A. Formwork Compliance: Use formwork complying with ACI SP-4.

B. Coordinate the inspection of forms with the Owner's Project Representative. Coordinate the inspection of all formwork and reinforcing in advance of scheduling delivery of concrete to the Project Site. Provide a minimum of 24 hours advance notice to the Owner's Project Representative in advance of concrete placement.

PART 2 PRODUCTS

2.1 MANUFACTURER

A. Acceptable manufacturers are listed below. Other manufacturers of equivalent products may be submitted.

1. Release Agent
Magic Kote by Symons Corporation

2. Rustications
Symons Corporation, Des Plaines, IL

2.2 MATERIALS

A. Structural Concrete: Provide structural concrete form materials as follows:

1. Obtain approval for form material before construction of the forms.

2. Use a nonreactive type form release agent.

3. Use form ties, hangers, and clamps of such type that, after removal of the forms, no metal will be closer than one inch from concrete surface. Wire ties will not be permitted.

4. Provide ties with swaged washers or other suitable devices to prevent seepage of moisture along the ties. Leave the ties in place.

5. Use lugs, cones, washers, or other devices which do not leave holes or depressions greater than 7/8-inch in diameter.

PART 3 EXECUTION

3.1 DESIGN

A. Design Responsibility: Be responsible for the design, engineering and construction of the architectural concrete formwork and the structural concrete formwork. Conform the work to the recommendations of ACI SP-4.

B. Setting Time and Slag Use: The presence of fly ash or ground granulated blast furnace slag in the concrete mix for architectural concrete and structural concrete will delay the setting time. Take this into consideration in the design and removal of the forms.

C. Responsibility During Placement: Assume and take sole responsibility for adequate design of all form elements for support of the wet concrete mixtures specified and delivered.

D. Consistency: Design forms to produce concrete members identical in shape, lines and dimensions to members shown.

3.2 CONSTRUCTION DETAILS FOR FORMWORK

A. Structural Concrete Details: Follow the following details for all structural concrete:

1. Provide forms which are substantial, properly braced, and tied together to maintain position and shape and to resist all pressures to which they may be subjected. Make forms sufficiently tight to prevent leakage of concrete.

2. Determine the size and spacing of studs and wales by the nature of the work and the height to which concrete is placed. Make forms adequate to produce true, smooth surfaces with not more than 1/8-inch variation in either direction from a geometrical plane. Provide horizontal joints which are level, and vertical joints which are plumb.

3. Supply forms for repeated use in sufficient number to ensure the required rate of progress.

4. Thoroughly clean all forms before reuse and inspect forms immediately before concrete is placed. Remove deformed, broken, or defective forms from the work.

5. Provide temporary openings in forms at convenient locations to facilitate cleaning and inspection.

6. Coat the entire inside surfaces of forms with a suitable form release agent just prior to placing concrete. Form release agent is not permitted on the reinforcing steel.

7. Assume and take responsibility for the adequacy of all forms and remedying any defects resulting from their use.

3.3 FORM REMOVAL

A. General: Do not remove forms, form ties and bracing for structural and architectural concrete without specific permission of the CONTRACTOR's Registered Professional Engineer.

B. Structural Concrete Form Removal: Do not remove forms for structural concrete until the concrete has hardened sufficiently to support its own load safely, plus any superimposed load that might be placed thereon. Leave the forms in place for the minimum length of time indicated below or until the concrete has reached the minimum strength indicated as determined by testing, whichever time is reached first.

1. The times indicated represent cumulative days or hours, not necessarily consecutive, during which the air surrounding the concrete is above 50 degrees F. These times may be decreased if reshores are installed.

	Minimum Time	Minimum Strength (psi)
a. Columns	12 hrs.	1300
b. Columns	12 hrs.	1300
c. Side forms for girders and beams	12 hrs.	1300
d. Walls	12 hrs.	1300
e. Bottom forms of slabs		
Under 10 feet clear span	4 days	2300
10 to 20 feet clear span	7 days	2700
Over 20 feet clear span	10 days	2900
f. Bottom forms of beams and girders		
Under 10 feet clear span	7 days	2700
10 to 20 feet clear span	14 days	3000
Over 20 feet clear span	21 days	3500

2. Increase form removal times as required if concrete temperature following placement is permitted to drop below 50 degrees F or if fly ash or ground granulated blast furnace slag is used in the concrete mix.

3. Withdraw the removable portion of form ties from the concrete immediately after the forms are removed. Clean and fill holes left by such ties with grout as specified in Cast-In-Place Concrete, Subsection Structural Concrete Surfaces.

4. Plug tie holes flush with the surface using portland cement mortar. Prewet tie holes with clean water and apply a neat cement slurry bond coat. Densely tamp mortar of a dry-tamp consistency into the tie holes exercising care so as not to smear mortar onto the finished concrete surface. Include sufficient white cement in the mortar mix to cause the plugged holes to blend in with the adjacent surfaces. Make sample patches with different mixes to assure that this requirement is met.

3.4 RESHORING

A. Reshoring Method: Develop a system for reshoring and early removal of forms, in the event early stripping of forms becomes necessary. Include details and schedules in this system for each element which is to be reshored.

B. Construction Load Support: Do not support construction loads upon any unshored portion of the structure exceeding the structural design loads.

3.5 TOLERANCES

A. Tolerance Limits: Design, construct and maintain concrete form and place the concrete to provide completed concrete work within the tolerance limits set forth in ACI SP-4.

3.6 SURVEY OF FORMWORK

A. Field Survey: Employ an engineer or surveyor to check by instrument survey the lines and levels of the completed formwork before concrete is placed and make whatever corrections or adjustment to the formwork are necessary to correct deviations from the specified tolerances.

B. Placement Surveying Requirements: Check formwork during the placement of the concrete to verify that the forms, braces, tie rods, clamps anchor bolts, conduits, piping, and the like, have not been knocked out of the established line, level or cross section by concrete placement or equipment.

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 03200

CONCRETE REINFORCEMENT

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Requirements for providing concrete reinforcement as shown and specified herein. Reinforcement includes all steel bars, wire and welded wire fabric as shown and specified.

B. Related Work Specified in Other Sections Includes:

1. Section 03100 - Concrete Formwork
2. Section 03310 - Cast-In-Place Concrete

1.2 REFERENCES

A. Codes and standards referred to in this Section are:

1.	ACI SP66	- ACI Detailing Manual
2.	ACI 318	- Latest edition "Building Code Requirements for Reinforced Concrete"
3.	ASTM A 185	- Steel Welded Wire Fabric, Plain, for Concrete Reinforcement
4.	ASTM A 615/A615M	- Deformed and Plains Billet-Steel Bars for Concrete
5.	ASTM A 706/A706M	- Low Alloy Steel Deformed Bars for Concrete Reinforcement
6.	AWS D1.4	- Structural Welding Code - Reinforcing Steel

1.3 SUBMITTALS

A. Provide all submittals, including the following, as specified in Division 1.

1. CONTRACTORS' Shop Drawings: Submit checked Working Drawings, including bar lists, schedules, bending details, placing details and placing plans and elevations for fabrication and placing reinforcing steel conforming to "ACI Detailing Manual - 88".

a. Do not bill wall and slab reinforcing in sections. Show complete elevations of all walls and complete plans of all slabs, except that, when more than one wall or slab are identical, only one such elevation or plan is required. These plans and elevations need not be true views of the walls or slabs shown. Bill every reinforcing bar in a slab on a plan. Bill every reinforcing bar in a wall on an elevation. Take sections to clarify the arrangement of the steel reinforcement. Identify all bars, but do not bill on such sections.

b. For all reinforcing bars, unless the location of a bar is clear, give the location of such bar or bars by a dimension to some structural feature which will be readily distinguishable at the time bars are placed.

c. Make the reinforcing steel placing drawings complete for placing reinforcement including the location of support bars and chairs, without reference to the design drawings.

d. Submit Detailer certification that every reinforcing steel placing drawing and bar list is completely checked and corrected before submittal for approval.

e. If, after reinforcing steel placing drawings and bar lists have been submitted for approval, a review reveals that the drawings and lists obviously have not been checked and corrected they will be returned for checking and correcting by the Detailer.

1.4 DELIVERY, STORAGE AND HANDLING

A. Deliver, store and handle all products and materials as specified in Division 1and as follows:

1. Delivery Requirements: Have reinforcing steel delivered to the work in strongly tied bundles. Identify each group of both bent and straight bars with a metal tag giving the identifying number corresponding to the reinforcing steel placing drawings and bar lists.

2. Storage: Properly store all bars in an orderly manner, with all bars completely off the ground. Keep bars clean after delivery to the site of the work.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable manufacturers are listed below. Other manufacturers of equivalent products may be submitted.

1. Mechanical connections

a. Dowel Bar Splicer/Dowel-In System and Coupler Splice System of the Richmond Screw Anchor System

b. Cadweld Rebar Splice by Erico Products Inc.

c. Bar Grip Splice by Barsplice Products Inc.

2.2 MATERIALS

A. Steel Bars: Use new billet steel bars, deformed bars, meeting the requirements of ASTM A 615 Grade 60 for reinforcing steel bars.

1. Roll all reinforcing steel bars with special deformations or identifying marks indicating the ASTM Specification and Grade.

2. Use bars free from defects, kinks and from bends that cannot be readily and fully straightened in the field.

3. Supply reinforcing bars in lengths which will allow convenient placement in the work and provide the required lap of joints as shown. Provide dowels of proper length, size and shape for tying walls, beams, floors, and the like together.

B. Welded Wire Fabric: Use welded wire fabric of the electrically welded type, with wires arranged in rectangular patterns, of the sizes shown or specified and meeting the requirements of ASTM A 185.

C. Supports and Accessories: Provide bar supports and other accessories and, if necessary, additional supports to hold bars in proper position while concrete is being placed.

1. Use side form spacers against vertical or sloping forms to maintain prescribed side cover and cross position of bars.

2. Use individual hi-chairs with welded cross ties or circular hoops to support top bars in slabs thicker than 8 inches.

3. Bolsters, chairs and other accessories:

a. Use hot-dipped galvanized or provide plastic coated legs when in contact with forms for surfaces of concrete other than architectural surfaces.

b. Use stainless steel when in contact with forms for architecturally exposed surfaces.

c. Use chairs of an approved type and space them properly to support and hold reinforcing bars in position in all beams and slabs including slabs placed

directly on the subgrade or work mat. Do not use continuous hi-chairs for supporting of top bars in slabs over 8 inches in thickness.

D. Mechanical Connections: Provide mechanical connections that develop at least 125 percent of the specified yield strength of the bar in tension.

2.3 FABRICATION

A. Drawing Review Prior to Fabrication: Do not fabricate any material before final review and approval of shop drawings.

B. Bending and Cutting: Cut bars to required length and bend accurately before placing. Bend bars in the shop unless written approval for field bending is obtained. If field bending is permitted, do it only when the air temperature, where the bending operation is performed, is above 30 degrees F. Do not field bend bars which have been partially embedded in concrete.

C. Splices: Use lapped splices for tension and compression splices unless otherwise noted.

D. Cleaning: Clean and bend reinforcement in accordance with ACI 315 and ACI 318.

PART 3 EXECUTION

3.1 INSTALLATION

A. Placement: Place all bars in accordance with CRSI "Recommended Practice for Placing Reinforcing Bars".

B. Tolerances: Place bars used for top reinforcement in slabs to a vertical tolerance of plus or minus 1/4-inch. Place all other reinforcement to the tolerances given to ACI 318.

C. Cleaning: Have reinforcing steel delivered without rust other than that accumulated during transportation to the work. At all times, fully protect reinforcing steel from moisture, grease, dirt, mortar and concrete. Before being placed in position, thoroughly clean reinforcing steel of all loose mill scale and rust and of any dirt, oil, grease coatings, or other material that might reduce the bond. If there is a delay in depositing concrete, inspect and satisfactorily clean the steel immediately before the concrete is placed.

D. Bar Positioning: Place bars in the exact positions shown with the required spacing and cross wire bars securely in position at intersections to prevent displacement during the placing of the concrete. Fasten the bars with annealed wire of not less than 17 gauge or other approved devices.

E. Bar Extension Beyond Formwork: On any section of the work where horizontal bars extend beyond the length of the forms, perforate the form or head against which the work

ends or at the proper places to allow the bars to project through a distance at least equal to the lap specified.

F. Unacceptable Materials: Do not place reinforcing steel with damaged, unsuitably bonded epoxy-coating or rusting. If approved, mars, exposed threads of mechanical connections and cut ends may be field coated with approved epoxy coating material.

G. Review of Placement: Have reinforcing placement reviewed by the ENGINEER before concrete is placed.

H. Welding - Not Approved: Do not use reinforcing bar assemblies made by welding of any kind, or accessories of any kind which require field welding to reinforcing bars.

I. Welding - Approved: Where welding of reinforcing steel is shown, AWS D1.4 "Structural Welding Code - Reinforcing Steel" applies.

J. Tension and Compression Lap Splices: Conform tension and compression lap splices to ACI 318 with all supplements. Avoid splices at points of maximum tensile stress wherever possible. Provide temperature bars with the clear spacing shown. Stagger all bar splices in hoop tension bars in circular tanks with not more than 50 percent of the bars spliced in any one direction. Have welded splices made by certified welders in accordance with AWS D1.4.

K. Welded Wire Fabric: Place welded wire fabric in the positions shown, specified or required to fit the work. Furnish and place suitable spacing chairs or supports, as specified for bars, to maintain the fabric in the correct location. Where a flat surface of fabric is required, provide flat sheets, when available. Otherwise reverse roll the fabric or otherwise straighten to make a perfectly flat surface before placing. Obtain approval for the length of laps not indicated.

L. Concrete Cover: Place reinforcing steel and welded wire fabric and hold in position so that the concrete cover, as measured from the surface of the bar or wire to the surface of the concrete, is as shown or specified.

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 03250

CONCRETE ACCESSORIES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Requirements for providing concrete accessories shown and specified herein such as waterstops, dovetail anchor slots, cast-in-place reglets, inserts, joint filler, preformed joint seal, joint sealant and neoprene pads.

B. Products Installed: Waterstops, dovetail anchor slots, cast-in-place reglets, inserts, joint filler, preformed joint seal, joint sealant and neoprene pads.

C. Related Work Specified in Other Sections Includes:

1. Section 03100 - Concrete Formwork
2. Section 03200 - Concrete Reinforcement
3. Section 03310 - Cast-in-Place Concrete

1.2 REFERENCES

A. Codes and standards referred to in this Section are:

1. AASHTO - Standard Specifications for Highway Bridges

2. ASTM A 536 - Standard Specifications for Ductile-Iron Castings

3. ASTM D 412 - Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers - Tension

4. ASTM D 3545 - Test Methods for Alcohol Content and Purity of Acetate esters by Gas Chromatography

5. ASTM D 3575 - Test Methods for Flexible Cellular Materials Made From Olefin Polymers

6. CRD-C513 - Specifications for Rubber Waterstops

7. CRD-C572 - Specifications for Polyvinyl Chloride Waterstop

8. Fed. Spec.
TT-S-00227 - Sealing Compound, Elastomeric Type, Multicomponent (for Calking, Sealing, and Glazing in Buildings and Other Structures)

9. Fed. Spec.
TT-S-00230 - Sealing Compound, Elastomeric Type, Single Component (for Calking, Sealing, and Glazing in Buildings and Other Structures)

1.3 SUBMITTALS

A. Provide all submittals, including the following, as specified in Division 1.

1. Product Data and Information: Submit printed manufacturers data and specifications for each item used on this project.

2. Samples: Provide one sample of each item used.

3. Joint Sealant and Preformed Joint Seal: Indicate special procedures, surface preparation and perimeter conditions requiring special attention. All products in contact with potable water shall be "NSF Standard 61" certified. Submit certified material records indicating approval for use with potable water.

1.4 DELIVERY, STORAGE AND HANDLING

A. Deliver, store and handle all products and materials as specified in Division 1.

PART 2 PRODUCTS

2.1 MANUFACTURER

A. Acceptable manufacturers are listed below. Other manufacturers of equivalent products may be submitted.

1. Joint Filler

a. Sonoflex F Foam by Sonneborn Building Products
b. PVC Joint Filler No. 327 by A.C. Horn

2. Sealant Backup Material

a. Sealtight Backer Rod

b. Sonofoam Backer Rod

3. Preformed Joint Seal

a. Evazote 380, ESF by Epoxy Industries

4. Wedge Inserts

a. Type F-7 by Dayton Superior, Miamisburg, OH

5. Dovetail Anchor

a. A.A. Wire Products Co.
b. Dur-O-Wal Inc.

6. Flashing Reglets

a. Standard reglets by Beehive Anchoring System

7. Bentonite Clay Waterstop

a. Hydrotite Leak Master LV-1 Waterstop by Greenstreak
b. Waterstop RX-101 by American Colloid Company

2.2 MATERIALS

A. Extruded Waterstops: Provide waterstops made of extruded polyvinyl chloride unless otherwise shown or specified.

1. Do not use any reclaimed plastic material in their manufacture.

2. Provide plastic waterstops meeting the requirements of CRD-C572, except as modified herein. Provide a Shore A/10 durometer hardness between 73 and 79, the tensile strength not less than 1850 psi, and specific gravity not more than 1.38.

3. Unless otherwise shown, use waterstops for construction joints which are flat, at least 6 inches wide, and not less than 3/8-inch thick at the thinnest section. Provide these waterstops with ribbed longitudinal strips.

4. Unless otherwise shown, provide waterstops for expansion joints at least 9 inches wide and not less than 1/4-inch thick at the narrowest point and not less than 3/8-inch thick immediately adjacent to the center of the waterstop. Provide the waterstop with ribbed longitudinal strips with a 3/4-inch inside diameter hollow bulb center. Limit joint movement to 1/4-inch under a tensile force of not more than 500 pounds per lineal inch.

B. Rubber Waterstops: Provide rubber water stops where shown or specified.

1. Provide rubber water stops of either the molded or extruded type, fabricated from a high grade tread type compound, either SBR or natural rubber, conforming to CRD-C513.
2. Provide water stops for construction joints at least 6 inches wide and 3/8-inch thick and with solid end bulbs 3/4-inch in diameter.

3. Provide water stops for expansion joints 9 inches wide and 3/8-inch thick and with solid end bulbs 1-inch in diameter and a hollow center bulb 1-1/2 inches in diameter with a 3/4-inch diameter center cavity.

C. Expansion Joint Filler: Use joint filler for all expansion joints.

1. Provide a closed cell polyethylene or PVC joint filler of the thickness shown.

D. Joint Sealant Requirements: Finish expansion joints with a joint sealant where shown or specified.

1. Joint sealant materials may be either a single component urethane compound meeting the requirements of Fed. Spec. TT-S-00230C, or a 2-component urethane compound meeting the requirements of Fed. Spec. TT-S-00227E, except as modified in this specification.

2. Provide the urethane sealant of 100 percent polymer, non-extended, containing no solvent, lime, or coal tar. Color as selected by the ENGINEER, but not black. Conform sealant properties to the following:

Property	Value	Test Method
b. Maximum final cure	3 days	--
c. Minimum tensile strength	140 to 200 psi	ASTM D 412
d. Minimum elongation	400%	ASTM D 412
e. Modulus at 100% elongation	40-60 psi	ASTM D 412
f. Shore A hardness	25-40	ASTM D 2240
g. Solid content	98-100%	--
h. Peel strength	20-40 lb/in.	Fed. Spec. TT-S-00230C Fed. Spec. TT-S-00227E
i. Minimum recovery	80-90%	Fed. Spec. TT-S-00230C

Property	Value	Test Method
		Fed. Spec. TT-S-00227E
j. Initial tack-free cure	24-48 hrs.	Fed. Spec. TT-S-00230C Fed. Spec. TT-S-00227E

3. Provide primer as recommended by the manufacturer of the sealant, subject to approval.
4. Provide fillers and backup materials in contact with sealant which are nonimpregnated and free from asphalt, creosote, oil or extractable plasticizers. Use a backup material of a closed cell polyethylene foam rod with a diameter 1/4-inch larger than the joint width.

E. Preformed Joint Seal: Provide a preformed joint seal where shown or specified.

1. Provide joint material which is resilient, non-extrudable, impermeable, closed-cell, cross-linked, ethylene vinyl acetate, low density, polyethylene copolymer, nitrogen blown material which is ultraviolet light, weather and wear resistant, and which is concrete beige in color.

2. Conform material properties with the following:

Property	Value	Test Method
a. Density, pcf	2.8 to 3.4	ASTM D 3575 Suffix: W, Method A
b. Water Absorption total immersion 3 months	0.02% by volume	ASTM D 3575 Suffix: L
c. Tensile Strength	125 psi	ASTM D 3575 Suffix: T
d. Elongation before breaking	255%	ASTM D 3575 Suffix: T
e. Working Temperature	-94° to 160°F	--

F. Neoprene Pads: Use neoprene pads as shown or required where slabs or beams must be prevented from bonding to footings, walls, columns or other rigid parts of the structure.

1. Use neoprene pads of a structural grade meeting the requirements of Section 25, Division 2 of the AASHTO Standard Specifications for Highway Bridges.

2. Do not use neoprene pads thinner than 1/4-inch.

G. Wedge Inserts: Make wedge inserts for 5/8-inch and 3/4-inch bolts of ductile iron conforming to ASTM A 536.

H. Dovetail Anchors: Provide dovetail anchors of one of the following types:

1. Dovetail anchors having a 3/16-inch by 1-inch by 1/2-inch stainless steel dovetail section with 3/16-inch diameter stainless steel wire.

2. Dovetail anchor slots of 24 gauge galvanized steel 1-inch by 1-inch by 5/8-inch throat. Fill anchor slots.

I. Flashing Reglets: Provide flashing reglets of 24 gauge galvanized steel foam filled reglets.

PART 3 EXECUTION

3.1 INSTALLING OF WATERSTOPS

A. Assembly of Extruded Waterstops: Prefabricate corners and intersections for all waterstops. Make only butt joints in the field. Miter and assemble corners and intersections with approved equipment, as described for field joints.

1. Make field joints by cutting the ends of the sections to be spliced so they will form a smooth even butt joint. Heat the cut ends with the splicing tool until the plastic melts. Press the two ends together until the plastic cools. Do splicing in a way that limits damage to the continuity of the ribbed strips.

2. Carry waterstops in the walls into lower slabs and join them to the waterstops in the slabs. Make all waterstops continuous. Set waterstops accurately to the position and line shown. Hold edges securely fixed in position at intervals of not more than 24 inches so that they will not move during the placing of the concrete. Do not drive nails through the waterstops.

B. Bentonite Waterstops

1. Keep product dry at all times.

2. Follow manufacturer’s instructions.

C. Splices: Use splices made in the manufacturer's plant where possible for rubber waterstops.

1. Use a preformed rubber union or fitting and splicing cement as recommended by the manufacturer when splices are made.

2. Carry waterstops in the walls into lower slabs and join them to the waterstops in the slabs. Make all waterstops continuous. Set waterstops accurately to the position and line shown. Hold edges securely fixed in position at intervals of not more than 24 inches so that they will not move during the placing of the concrete. Do not drive nails through the waterstops.

D. Joint Filler Placement: Place joint filler for expansion joints against the completed portion of the work before the concrete for the next section is placed.

1. Fasten the filler to the hardened concrete with a compatible adhesive in accordance with manufacturer's instructions. Extend the filler through the thickness of the wall or slab and make it flush with the finished surface, except where a preformed joint seal or joint sealant is shown.

2. In joints having a waterstop, fit the filler accurately on each side of the waterstop to prevent the intrusion of concrete.

E. Preparation of 2-Component Sealants: Mix 2-component joint sealant using a slotted paddle and slow speed mixer for 5 to 8 minutes, continually working paddle from top to bottom until the sealant color is uniform. Scrape down the side of the container and paddle blade several times during the mixing operation to ensure uniform mixing.

1. Properly prepare joint surfaces by removing all foreign matter and concrete laitance so that concrete surfaces are structurally sound, clean, dry, and free of all oil, grease, wax, waterproofing compounds or form release materials prior to the application of primer and sealant.

2. Prime all concrete joint surfaces and all surfaces exposed to water prior to sealing, with no exceptions. Prime all other surfaces as recommended by the manufacturer of the sealant. Provide the prime as recommended by the manufacturer of the sealant, subject to approval. Apply the primer by either brushing or spraying on the joint surfaces. Apply and install the sealant within 2 to 24 hours after the application of primer.

3. For horizontal joints, install the sealant by pouring directly from a suitable shaped can or by flowing from a bulk-loading gun.

4. Fill vertical joints from a gun, starting from the bottom, to avoid bridging and the formation of air voids.

5. Fill overhead joints from a gun, by laying a bead along each side of the joint and then filling the middle. Immediately after installation, tool in the sealant in order to establish firm contact with joint surfaces and to provide a smooth sealant surface. Tool in accordance with the manufacturer's instructions.

6. Control joint depth with the use of joint fillers and backup materials. Make joint widths and sealant depths as shown. Do not exceed 1/2-inch for sealant depth.

F. Preformed Joint Seal Surface Preparation: Properly prepare joint surfaces by removing all foreign matter and concrete laitance so that concrete surfaces are structurally sound, clean, dry, and free of all oil, grease, wax, water-proofing compounds or form release materials.

1. Blast clean or saw cut all existing concrete surfaces to expose a clean bare concrete surface. Allow new concrete to be well cured, and attain a minimum of 80 percent of the specified strength before installing sealant.

2. Apply bonding adhesive, as recommended by the manufacturer to the concrete surfaces in strict compliance with the manufacturer's recommendations. Install the joint material under a compression of 25 percent and in one continuous operation, in accordance with manufacturer's recommendations. Do all splices and directional changes using heat welding method as recommended by the manufacturer.

G. Unbonded Joints: Use unbonded horizontal joints as shown or required where slabs of beams must be prevented from bonding to footings, walls, columns or other rigid parts of the structure.

1. Prevent bonding by use of structural grade neoprene pads placed over the bearing surface of the footing, wall or other supporting part of the structure so as to isolate it from the new concrete being placed.

H. Encasing Inserts: Encase wedge inserts, flashing reglets and dovetail anchor slots in the concrete as shown. Take special care to place and maintain them to the proper lines and grades and to compact concrete thoroughly around them to prevent the passage of water. Set these items before placing concrete and thoroughly brace them to prevent movement during the progress of the work. Provide dovetail anchor slots spaced not more than 16 inches apart for all concrete walls faced with masonry.

END OF SECTION

SECTION 03310

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Providing cast-in-place concrete as specified herein to form concrete to profiles as shown on the plans including the following work:

1. Setting of anchor bolts, base plates, floor grating and plate, frames, and other steel and aluminum members embedded in concrete as indicated.

2. Furnishing and setting of sleeves, inserts and other embedded accessories for mechanical and electrical equipment.

3. Grouting of base plates

4. Equipment pads

B. Related Work Specified in Other Sections Includes:

1. Section 03100 - Concrete Formwork
2. Section 03200 - Concrete Reinforcement
3. Section 03250 - Concrete Accessories

1.2 REFERENCES

A. Codes and standards referred to in this Section are:

1. ACI 304R - Guide for Measuring, Mixing, Transporting and Placing Concrete
2. ACI 305R - Hot Weather Concreting
3. ACI 306R - Cold Weather Concreting
4. ACI 308 - Practice for Curing Concrete
5. ACI 503R - Use of Epoxy Compounds with Concrete
6. ASTM C 171 - Specification for Sheet Materials for Curing Concrete
7. ASTM C 596 - Test Method for Drying Shrinkage of Mortar Containing Portland Cement
8. ASTM C 827 - Test Method for Early Volume Change of Cementitious Mixtures
9. ASTM C 881 - Specification for Epoxy-Resin-Base Bonding Systems for Concrete

10. ASTM C 1107 - Hydraulic Cement Grout (Non-shrink) Dry Package

1.3 SUBMITTALS

A. Provide all submittals, including the following, as specified in Division 1.

1. Notorized certificates of manufacture as evidence that the cement, fly ash and ground granulated blast furnace slag conform to the specified requirements. Include in these certificates the mill-test reports on the cement.

2. Samples of aggregates, sieve analyses and manufacturers data showing conformance to the specified requirements.

3. Concrete mix designs for each type of concrete.

4. Independent laboratory tests showing that grout is nonshrink at various ages in accordance with ASTM C 1107, showing no expansion after set (ASTM C 287), developing 3,000 psi with a trowelable mix within 24 hours (ASTM C 109) and having a placement time based on initial set of not less than 60 minutes (ASTM C 191). Include test results showing that, in projects of similar scope and size, the effective bearing area (EBA) is between 95 and 100 percent. Provide grout exposed to the weather free of discoloration without the necessity of special surface treatments.

5. Air content tests in accordance with ASTM C 138 or C 173 with mix design data.

6. Detailed field report records of ready-mixed-concrete.

7. Manufacturers' Literature: Material description and application or installation instructions for curing compound, vapor barrier, floor hardener, floor sealer, epoxy adhesives, synthetic fibers, admixtures, polymer modified nonsag mortar, and corrosion-resistant coatings.

8. Test reports of floor flatness (F_F) and floor levelness (F_L) conforming to ASTM E 1155.

1.4 QUALITY ASSURANCE

A. Codes: The following specific codes and standards apply:

1. ACI 318 - Latest Edition, "Building Code Requirements for Reinforced Concrete".

2. ASTM C 1107 relating to nonshrink grout.

3. ASTM - as referred to in the various subsections herein.

B. Testing Requirements: Testing laboratory provided by OWNER is responsible for conducting tests as required in Division 1.

C. Testing Assistance: Cooperate with the laboratory personnel, provide access to Work, and manufacturer's operations. Provide and deliver to the laboratory adequate quantities of representational samples of materials proposed to be used which require testing.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver, store and handle all products and materials as specified in Division 1 (and as follows:)

1. Cement: Store cement delivered in bulk to the batching plant in weathertight bins and batch using an appropriate weighing device, in accordance with ASTM C 94.

a. Store cement in weathertight buildings, bins or silos which will exclude moisture and contaminants. Do not use cement that has deteriorated from storage. Retest, before use, cement stored for a period longer than 6 months after the previous testing and reject it if it fails to meet all of the specified requirements. Do not use accepted cement that has been in storage for more than one year from the time of original acceptance.

b. Store cement delivered to the job site in strong, well-made bags plainly marked with the brand, name of manufacturer and net weight. Reject packages received in a damaged condition.

2. Aggregates: Keep aggregates clean and free from all other materials during transportation and handling. Keep them separated from each other until measured in batches and placed in the mixer.

a. Stockpile aggregates in a manner to prevent segregation unless finish screening is provided at the batch plant.

PART 2 PRODUCTS

2.1 MATERIALS

A. Cement Requirements: Provide a cement which is a domestic product from an approved source. Use standard Portland cement meeting the requirements of ASTM C 150 Type I or Type II.

1. Provide Portland cement used in the manufacture of concrete pressure pipe which does not have an air-entraining agent. Also, use a nonplastic (O slump) mix if portland cement without air-entraining agent is used in the manufacture of concrete sewer pipe.

B. Cementitious Material Requirements:

1. Fly Ash Requirements: Provide fly ash with a uniform light color from a source approved by the ENGINEER and with cementitious properties conforming to the requirements of ASTM C 618 Class C or F, with the following exceptions:

Loss on ignition - 5 percent maximum
Sulfur trioxide - 4 percent maximum

Store fly ash at the concrete mixing plant separate from the cement and do not intermix cement and fly ash prior to being added to the concrete mix.

2. Slag Requirements: Provide ground granulated blast furnace slag with cementitious properties conforming to the requirements of ASTM C 989, Grade 120, from an approved local product for normal weight concrete. Provide material having a uniform light color. Do not intermix cement and ground granulated blast furnace slag prior to being added to the concrete mix.

C. Fine Aggregate Requirements: Provide fine aggregate of natural sharp sand meeting the requirements of ASTM C 33 for normal weight concrete, except as modified herein. Provide fine aggregate subjected to the test for organic impurities that will not produce a color darker than standard.

1. Provide fine aggregate meeting the requirements of the soundness test set forth in Paragraph 7.1 of ASTM C 33. The exceptions stated in Paragraphs 7.2 and 7.3 do not apply.

D. Coarse Aggregate Requirements: Provide coarse aggregate consisting of crushed stone meeting the requirements of ASTM C 33 for normal weight concrete.

1. The limits for deleterious substances and physical property requirements given in Table 3 of ASTM C 33 apply for each concrete class designation without exception.

2. Grade coarse aggregate according to Size No. 467 or No. 57 in Table 2 of ASTM C 33 for Class C concrete and Size No. 57 for Class B concrete.

E. Lightweight Aggregate Requirements: Provide lightweight aggregate meeting the requirements of ASTM C 330 for Class E Concrete as defined in Section 2. Design Mix.

F. Admixture Use: Limit the use of admixtures to the following:

1. Air-entraining admixture conforming to ASTM C 260

2. Water-reducing admixture conforming to ASTM C 494 Type A

3. Water reducing set retarders conforming to ASTM C 494 Type D

4. Use water-reducing and set-retarding admixtures only after obtaining written permission. Provide test data indicating that the concrete containing the admixtures has improved workability and does not show any abnormal behavior such as premature stiffening or slump loss for at least 30 minutes after mixing has been completed, or any other abnormal differences when compared with concrete made without the admixture. Base such test data on fresh concrete from the proposed supplier, using batching equipment proposed for use on the project.

5. Do not use admixtures containing calcium chloride, thiocyanates or more than 0.05 percent chloride ion. Obtain written conformance to the above requirements and the chloride ion content of each admixture from the admixture manufacturer prior to mix design review.

6. When more than one admixture is used, dispense each admixture separately into the mix, and at different times during mixing, in accordance with the recommendation of ACI Committee 212. After system approval, make no changes in batching equipment or concrete constituents without approval.

G. Water: Use clean water in mixing concrete which does not contain deleterious amounts of acids, alkalis or organic materials, furnished only from water from approved sources.

H. Curing Covers: Provide water curing quilted covers consisting of an outer covering of burlap or cotton or other approved material, and needled, punched or sandwiched inner layer of cotton batting or other approved material, in all weighing not less than 20 ounces per square yard.

I. Waterproof Paper and Film: Provide waterproof paper or polyethylene film both meeting the requirements of ASTM C 171 for use as sheet material curing covers and vapor barriers.

1. For curing provide waterproof paper consisting of one ply of an approved type of fiber, reinforced waterproof building paper, consisting of cross fibers embedded in asphalt, between two layers of waterproof building paper, the whole being combined under heat and pressure to form a monolithic sheet.

2. For curing and vapor barriers provide polyethylene film consisting of white opaque sheeting manufactured from virgin resin and containing no scrap or additives. Do not use a film of less than 4 mils in thickness.

J. Clear Curing Compounds: Provide "Super Rez Seal" or "Super Pliocure" clear curing and sealing compounds by the Euclid Chemical Co., "Masterkure" by Master Builders, or Cure and Seal E-31 by Symons. Provide a compound of a clear styrene acrylate type, 30 percent solids content minimum, and have test data from an independent testing laboratory indicating a maximum moisture loss of 0.030 grams per sq. cm. when applied at a coverage rate of 300 square feet per gallon.

K. Resin Compounds: For concrete floor surfaces exposed to sunlight provide a resin type curing compound of a dissipating resin type, conforming to ASTM C 309 Type 1D, "Kurez DR" with The Euclid Chemical Co., Resi-Chem Clear Cure by Symons or equal. Use film having a chemical break down of a four-to-six-week period.

L. Chemical Floor Hardener: Provide chemical floor hardener consisting of magnesium and zinc fluosilicate such as "Lapidolith as manufactured by L. Sonneborn Sons, Inc., "Saniseal" as manufactured by Master Builders Co., or Fluosilicate by Symons or equal.

1. Alternatively, where chemical hardening is required, substitute a natural, nonmetallic aggregate surface hardener at the time the floor is placed, in which case omit the latter application of chemical floor hardener. Obtain the hardening by incorporating into the surface of the freshly floated concrete a dry shake of Master Builders Mastercron Pre-Mixed, Procron as made by Protex Industries, Inc. or equal, at the rate of 1/2 pound per square foot of floor surface. Perform all preparation, application procedures, curing and precautions in strict compliance with the manufacturer's recommendations and instructions submitted for approval prior to use.

M. Nonslip Aggregate Finish: Provide fused aluminum oxide grits, or crushed emery, as abrasive aggregate for nonslip finish with emery aggregate containing not less than 40 percent aluminum oxide and not less than 25 percent ferric oxide. Use material that is factory-graded, packaged, rust-proof, and nonglazing, and is unaffected by freezing, moisture, and cleaning materials.

N. Nonshrink Grout: Provide a flowable, prepackaged, nonshrink grout without dependence on gas expansion forces or enlargement of metal particles for its nonshrinking characteristics, Symons Multipurpose grout or equal. Allow no shrinkage below placement volume under ASTM C 827 and no drying shrinkage under ASTM C 1107.

1. In the event that grout contains water reducers, accelerators or fluidizers, provide a grout having shrinkage no greater than the equivalent sand cement and water mix, as tested under ASTM C 596.

O. Epoxy Adhesives: Provide epoxy adhesives as follows:

1. Sikadur 32 Hi-Mod by Sika Corporation, Richmond, VA or Euco 452 MV by Euclid Chemical Co., Cleveland, OH, Rescon 649 by Rescon Technology Corporation or equal. Use a two component, solvent-free, moisture insensitive,

structural epoxy adhesive, conforming to ASTM C 881, Type I and II, Grade 2, Class B and C, epoxy resin adhesive.

2. Sikadur 31, Hi-Mod Gel by Sika Corporation, Richmond, VA or Euco No. 452 Gel by Euclid Chemical Co., Cleveland, OH, Rescon R306 by Rescon Tehcnology Corporation or equal. Use a 2-component solvent-free, moisture insensitive, high modulus, high strength, structural epoxy paste adhesive, conforming to ASTM C 881, Type I and II, Grade 3, Class B and C, epoxy resin adhesive.

P. Nonsag Mortar: Provide Polymer Modified Nonsag Mortar as follows:

1. Sikatop 123 by Sika Corporation, Richmond, VA, Rescon R626 by Rescon Technology Corporation or equal. Use a 2-component, fast setting, nonsag, patching mortar, specifically formulated for application by trowel on vertical and overhead surfaces.

Q. Corrosion-Resistant Coating: Use Sika Armatec 110 by Sika Corporation, Richmond, VA, Rescon R-504 by Rescon Technology Corporation or equal as a corrosion-resistant coating.

2.2 DESIGN MIX

A. Concrete Mix Classifications: Furnish and place concrete of the type divided into various classes according to use and compressive strength.

1. Use Class A concrete for all precast concrete units.

2. Use Class B concrete for all architectural and structural reinforced concrete structures designed for high strength and watertightness; and for columns, walls, beams, slabs, stairs, and, in general, wherever formwork other than simple forms are required.

3. Use Class C concrete for all reinforced concrete structures designed for high strength and watertightness; and for bottoms of structures, electrical duct encasement, and, in general, where concrete is deposited directly on the bottoms of slopes of excavations and where only simple forms are requires.

4. Use Class D concrete for low-strength concrete, plain or reinforced, used for work mats beneath structures, soil stabilization, pipe cradles and encasement, filling, and other similar purposes. Clean boulders or fragments of rock excavated during construction may be embedded in large volumes of Class D concrete to provide added bulk. Use care in placing the boulders or rock fragments so that there will be no voids in the concrete.

5. Use Class E concrete for sand/lightweight concrete slabs placed over metal decks.

B. Compressive Strength: Provide, as a minimum, the specified compressive strength of concrete in pounds per square inch for the classes previously described as follows. Designate the 28-day strength as f'_c.

Class	7-Day Test	28-Day Test
A	3,400	5,000
B	2,700	4,000
C	2,700	4,000
D	1,300	2,000
E	2,700	4,000

1. Proportion and produce concrete to provide an average 28-day compressive strength in excess of the specified compressive strength, f'_c. Base the required proportions on tests of cylinders made, cured and tested as specified.

2. Prepare mix designs for each type of concrete required and submit for approval. Concrete which will be placed by pumping methods will require a separate mix design and mix design approval, as described herein, in addition to the mix design approval required for other placement methods.

C. Concrete Proportions: Select concrete proportions to provide the required strength and durability and to provide workability and consistency so that the concrete can be worked into forms and around reinforcement without segregation or excessive bleeding.

1. Provide concrete for all structures which is watertight. Do not allow the maximum water-cementitious material ratio to exceed 0.45 by weight of the total cementitious constituent. Measure the quantity of water to be the total quantity, including free surface moisture contained in the aggregates.

2. Do not allow the amount of fly ash to be less than 100 or to exceed 150 pounds per cubic yard while maintaining a minimum cement content of 350 pounds per cubic yard. Do not allow the amount of fly ash to be more than 15% of the amount of Portland cement in the design mix.

3. Do not allow the amount of ground granulated blast furnace slag contained in Class B and C concrete to be less than 150 or to exceed 190 pounds per cubic yard, while maintaining a minimum cement content of 445 pounds per cubic yard.

4. Provide Class B and C concrete that also contains a minimum of 1-pound of synthetic fibers per cubic yard. Conform fiber reinforced concrete to the requirements of ASTM C 1116 unless otherwise specified.

5. Establish concrete proportions including the water-cementitious material ratio on the bases of field experience or trial mixtures with the materials to be used in accordance with Section 5.3 of ACI 318.
6. Provide sand/lightweight concrete with a dry weight not more than 115 pounds per cubic foot. Limit shrinkage to .03 percent at 28 days.

D. Air Entrainment:

1. Provide air entrained Class B and C concrete with an average total air content of 5 percent. Allow a tolerance of plus or minus 1.5 percent on air content as delivered.

E. Slumps: When tested in accordance with ASTM C 143, provide a concrete mix design with slumps within the following limits:

Concrete Placement	Minimum and Maximum Slump in Inches	
	Class B and C	Class D
Normal	3 to 4	3 to 5
Pumped	4 to 6	4 to 6

1. Base the mix design slump on the concrete mix with water reducing admixture. For production concrete, allow no more than 1-inch increase in slump by use of specified water reducing admixtures. Measure slump at the end of the hose for pumped concrete.

2. Grade the combined aggregates for the design mix such that when a sample of the mix is separated on No. 4 standard sieve, the weight passing the sieve is not less than 30 percent nor greater than 40 percent of the total, unless otherwise specified.

F. Measurement and Mixing: Measure and mix concrete in accordance with the recommendations of ACI 304R, as modified.

1. Measure cement, and fine and coarse aggregates separately by weight by equipment providing an accuracy within one percent of the net load weighed. Measure cement and water within 1 percent accuracy by weight. Measure aggregates within 2 percent accuracy. Measure admixtures within 3 percent accuracy by weight.
2. Use weighing equipment meeting the requirements of the United States Bureau of Standards. Make available standard testing weights and other necessary equipment at all times for testing the equipment.
3. Mix concrete in a rotary, batch-type mixer of adequate design to produce a thorough mix, homogeneous in composition and uniform in color. Mix each batch of one cubic yard or less not less than 1-1/2 minutes after the last of the ingredients have been added to the mixer. Increase the mixing time 15 seconds for each cubic yard or fraction thereof.

2.3 READY MIX CONCRETE

A. Ready Mix Requirements: For ready-mixed concrete meet the requirements of ASTM C 94, except as modified in the following paragraphs, and subject the mix to all provisions herein relative to materials, strength, proportioning, consistency, and testing. Article 18 of ASTM C 94, however, does not apply. In the event of low strengths, procedures outlined in Section 3.01 "Low Concrete Strength Test Results" apply.

B. Delivery: Provide the rate of delivery of the mixed concrete such that the interval between placing of fresh concrete in contact with concrete already placed from previous batches does not exceed 45 minutes. Do not allow the elapsed time between the introduction of mixing water to the cement and aggregates and depositing concrete in the work to exceed 60 minutes, including mixing and agitating time.

C. Agitation: Do not deliver concrete in nonagitating equipment.

D. Field Records: Prepare a detailed concrete field record in which the following information is identified:

1. Number of concrete batches produced.

2. Proportions of materials used.

3. Approximate location of final deposit of each batch in the structure.

4. Time and date of mixing and placing.

PART 3 EXECUTION

3.1 PLACING CONCRETE

A. General: Place concrete only in the presence of the ENGINEER. Where the procedure is not specified, place concrete in accordance with the recommendations of ACI 304R.

B. Continuous Operation: Place no concrete after its initial set has occurred, and do not use retempered concrete under any conditions. Make concreting operations continuous until the section, panel, or scheduled placement is completed. Should the concreting operations be unavoidably interrupted, provide construction joints formed at proper locations as specified.

C. Minimum Handling: Convey and place concrete with minimum handling and deposit the concrete in the forms as close as possible to its final position and in no case more than 5 feet in a horizontal direction therefrom. Do not rehandle concrete.

D. Horizontal Layers: Place concrete in horizontal layers shallow enough so that the previous layer is still soft when the next layer is added and the two layers can be vibrated together. Do not exceed 18 inches in depth for each layer.

E. Use of Chutes: Deposit wall and column concrete through heavy duck canvas or galvanized steel chutes equipped with suitable hopper heads. Provide chutes of variable lengths so that the free fall of concrete does not exceed 3 feet. Provide illumination where required, inside the forms so that the concrete is visible from the deck and runways at the point of deposit.

F. Protection Against Elements: Protect freshly placed exposed concrete against damage from the elements or other sources.

G. Hot Weather Placement: For placement of concrete during hot weather, follow the recommendations of ACI 305R.

1. Place no concrete if the temperature of the concrete at the time of placement exceeds 90 degrees F.

2. When the temperature of the concrete at the time of placement is consistently above 75 degrees F and a noticeable decrease in slump or an increase in mixing water demand occurs, use a retarding admixture, after obtaining written permission to do so.

3. Protect unformed surfaces of concrete placed during hot weather from drying by continuous moist curing for at least 24 hours. Start curing as soon as the concrete has hardened sufficiently to withstand surface damage. If moist curing is not carried beyond 24 hours, cover the surface while damp with a suitable heat-reflecting plastic membrane or spray exterior surfaces with a white pigmented dissapting curing compound in accordance with Section 3.5 Curing.

4. Protect formed surfaces of concrete placed during hot weather from drying as recommended in ACI 305 R.

H. Cold Weather Placement: For placement of concrete during cold weather, follow the recommendations of ACI 306R, except that set-accelerators will not be permitted.

1. Before placement of concrete, completely remove all ice, snow and frost from all surfaces to be in contact with the concrete. Do not place concrete on a frozen subgrade. Heat surfaces to be in contact with the concrete to a temperature as near as practical to that of the concrete being placed.

2. When mean daily temperatures at the site are below 40 degrees F provide concrete at a temperature, as placed, of not less than 50 degrees F, except for mass concrete provide a temperature of the concrete as placed of not less than 45 degrees F. Heat aggregates or mixing water or both to obtain these placement temperatures. Do not

permit the concrete temperatures as mixed to exceed the placement temperature by more than 10 degrees F for air temperatures of 0 degrees to 30 degrees F, nor by more than 15 degrees F for air temperatures below 0 degrees F.

3. Maintain concrete in place at a temperature of 50 degrees F by keeping forms in place, covering with insulated blankets, heated enclosures or combinations of these for the following minimum time intervals, except that forms shall not be removed in less than the time specified in Section 03100.

a.	Footings and walls below grade and slabs on grade	2 days
b.	Exposed walls and columns carrying no load	3 days
c.	Exposed floor slab, beams and girders above grade and partially loaded	6 days

4. Protect exposed surfaces of new concrete from drying out. When dry heating is used for protection against low temperatures, cover exposed concrete surfaces with an approved sheet material or membrane as specified in Section 03100 subsection "Curing". Use water curing only if icing problems can be avoided. During periods of very cold weather, continue the protection against low temperature for an extended curing period as required to prevent freezing of the concrete.

5. Permit concrete that is to be exposed to freezing temperatures to undergo some drying just prior to and during the period of adjustment to ambient cold-weather conditions. When protection against low temperatures is removed, do not allow the resulting temperature drop in any part of the concrete to exceed 5 degrees per hour nor 40 degrees F for the first 24-hour period.

I. Concrete Embedments:

1. Encase pipes, anchor bolts, sleeves, steps, castings, floor drains, manhole frames, cast-in reglets, dovetail anchor slots, and other inserts in concrete as shown. Take special care to place and maintain them to the proper lines and grades and to compact concrete thoroughly around them to prevent the passage of water. Insofar as possible, set them before placing concrete and thoroughly brace to prevent movement during the progress of the work.

2. Space dovetail anchor slots vertically not more than 16 inches apart on all concrete walls faced with masonry.

3.2 VIBRATING CONCRETE

A. Use of Vibrators: Consolidate all concrete by means of mechanical internal vibrators applied directly into the concrete in a vertical position in accordance with the recommendations of ACI 309.

B. Vibrator Size: Provide a sufficient intensity and duration of vibration to cause concrete to combine with previously placed concrete, to fill corners, to compact thoroughly and to embed reinforcement, pipes, conduits, and similar work completely. Insert vibrators into and withdraw from the concrete vertically at close intervals. Do not use vibrators to move concrete laterally.

C. Spare Units: Have on hand a sufficient number of vibrators to assure that the incoming concrete can be properly compacted within 15 minutes after placing. Provide reserve vibrators for use when others are being serviced. Do not start the placement of any concrete unless more than one vibrator is available.

3.3 CONCRETE TESTS

A. Compression Testing: Test concrete test cylinders in compression at the laboratory designated.

B. Samples: Take samples for strength tests of laboratory cured cylinders for tests of each class of concrete placed each day consisting of four cylinders from the same batch of concrete. Test two cylinders at 7 days and two at 28 days. Determine concrete strength by the average of the two cylinder strengths determined at either age. Take samples not less than once a day nor less than once for each 150 cubic yards of concrete, or 5,000 square feet of area.

C. Field Curing: Take samples for field cured cylinders to determine concrete compressive strength for form removal time as required.

D. Laboratory Curing: Sample fresh concrete in accordance with ASTM C 172. Mold and laboratory cure cylinders for strength tests in accordance with ASTM C 31.

E. Slump Tests: Perform slump tests in accordance with ASTM C 143, at the same time cylinders are made. Make tests to determine air content of fresh concrete twice daily, at least 4 hours apart, in accordance with either ASTM 173 or with an approved testing device. Concrete with excessive slump or improper air content will be rejected. Deliver no additional concrete until the cause of the deficiency is determined and corrected.

F. Test Requirements: Test cylinders in accordance with ASTM C 39 for both the 7-day and the 28-day compressive strength.

G. Successful Testing Requirements: Consider the strength level of the concrete mix for each individual class of concrete satisfactory when:

1. The average of all sets of three consecutive 28-day strength tests (average of two cylinders) equal or exceed the specified compressive strength (f'_c).

2. No individual 28-day strength test (average of two cylinders) falls below f'_c by more than 500 psi.

3. If either of these requirements are not met, make changes in the mix proportions immediately to achieve the required strength.

3.4 LOW CONCRETE STRENGTH TEST RESULTS

A. Test Cores: If it is determined that the serviceability of the concrete is significantly reduced by low concrete strength test results, take test cores from the area in question. Drill and test cores in accordance with ASTM C 42 except as noted. Take three cores for each strength test more than 500 psi below the specified f'_c.

B. Acceptable Levels of Strength: Concrete in the area represented by core tests will be accepted if the average of three cores is equal to or greater than 0.85 f'_c and no single core is less than 0.75 f'_c.

C. Unacceptable Concrete: Remove and replace concrete that does not meet the core test requirements or strengthen the concrete to the satisfaction of the ENGINEER.

3.5 CURING

A. General: Generally follow the recommendations of ACI 308 for curing concrete.

B. Protection: Protect concrete surfaces normally exposed to the atmosphere against too rapid drying by curing for a minimum period of 7 days. For hot weather concreting and cold weather concreting follow the recommendations of ACI 305R and ACI 306R for curing concrete. Commence the curing period immediately following the placing of the concrete. Accomplish curing by one of the following methods. Should there be any delay in the application of the method of curing used, cover the concrete with moistened burlap held in complete contact with the surface or kept wet by continuous sprinkling.

1. Accomplish water curing by the use of quilted covers wetted and applied to the concrete surface as soon as the forms have been removed, or in the case of slabs, as soon as the concrete has set up sufficiently to prevent marring of the surface. Maintain the covering material in a thoroughly saturated condition and maintain the presence of free water between the mat and the surface of the concrete at all times throughout the curing period.
2. Accomplish sheet material curing by use of waterproof paper or polyethylene film applied to the concrete surface as soon as it has set sufficiently hard to prevent marring. First, thoroughly wet the concrete surface, and then place the sheet materials in direct contact and anchor thereto in a manner to assure continuous contact throughout the curing period. Lap the sheet materials a minimum of 3 inches with the seams taped, cemented, or glued. Discoloration is objectionable on floors which have been steel troweled to a hard finish. Do not use polyethelene film on these floors.

3. Use clear curing compound membranes on floor surfaces without overlays of concrete, tile or paint. Accomplish membrane curing immediately after removal of forms or in the case of unformed surfaces, immediately after final finishing. Coat the entire exposed surface with a clear curing compound meeting the requirements of ASTM C 309 Type I applied uniformly by means of an approved pressure spray distributor at the rate of 200 square feet per gallon of material. Apply the material so that the concrete surface is completely coated and sealed with one application. Do not apply the membrane to faces of construction joints or other surfaces against which additional concrete will be placed. Keep such surfaces continuously wet by other means.

4. Use dissipating resin type curing compounds on exterior surfaces exposed to sunlight.

   a. Provide maximum coverage of 400 square feet per gallon on floated or broomed surfaces for the curing/sealing compound. Provide maximum coverage for the dissipating resin compound of 300 sq. ft./gal. on steel-troweled surfaces and 200 sq. ft./gal. on floated or broomed surfaces.

3.6 JOINTS AND BONDING

A. Joints: Make construction joints where shown or permitted. Locate such joints to ensure stability, strength, and watertightness, and provide a waterstop where shown. Build all corners monolithically, and continuously concrete on either side to points shown.

B. Timing Between Placement: Provide at least 2 hours of elapsed time after placing concrete in the columns or walls before depositing concrete in beams, girders, or slabs supported thereon. Consider beams, girders, brackets, column capitals, and haunches as part of the floor system and place them integrally with the floor.

C. Horizontal Keyways: Build horizontal keyways to permit flushing water to escape from the keyways.

D. Keyway Description: Provide continuous, straight, and regular keys or grooves in joints. Bring exposed concrete surfaces to a true level line at the top of every horizontal construction joint. Provide the exposed construction joints with a row of form ties located in the concrete at from 4 to 6 inches from the joint to tighten the forms for subsequent sections. Set reinforcement to extend into subsequent sections of construction, as shown. If required, provide water stops having watertight splices and corner intersections and meet the requirements as specified. Remove all bulkheads or other joint forming material before placing adjacent concrete.

E. Continuous Placement Procedure: Carry on continuous placing of concrete between the construction joints shown. If for any reason it becomes necessary to stop the placing of

concrete at locations other than those indicated, such locations and the manner of making the joint are subject to approval.

F. Grout Use Between Surfaces: Thoroughly clean and wet concrete surfaces against which the new concrete is to be placed. Just prior to placing new concrete, slush horizontal surfaces and joints with at least 2 inches of cement grout of the same mixture as the concrete but with coarse aggregate omitted. Use special care in placing and puddling concrete at vertical joints to ensure a bond with existing concrete. Do not make vertical construction joints in watertight construction, unless shown or approved in writing.

G. Contraction (Control) Joints in Slabs-on-Ground: Construct contraction joints in slabs-on-ground to form panels of patterns as shown. Use saw cuts 1/8" x 1/4 slab depth or inserts 1/4" wide x 1/4 of slab depth, unless otherwise indicated.

1. Form contraction joints by inserting premolded plastic, hardboard or fiberboard strip into fresh concrete until top surface of strip is flush with slab surface. Tool slab edges round on each side of insert. After concrete has cured, remove inserts and clean groove of loose debris.

a. Contraction joints in unexposed floor slabs may be formed by saw cuts as soon as possible after slab finishing as may be safely done without dislodging aggregate.

2. If no joint pattern is shown, provide joints not exceeding 15 feet in either direction and located to conform to bay spacing wherever possible (at column centerlines, half bays, third-bays).

3.7 CONCRETE FLOOR SURFACES

A. Floor Surfaces: Construct the concrete floor surfaces monolithicly with the structural slab which consists of the structural concrete, being finished as indicated in the following schedule, unless otherwise shown or as specified:

1. Tank bottoms and other surfaces not to be used as walkway areas - screeded, wood floated, steel troweled.

2. Tank bottoms to receive concrete topping swept in by mechanisms - screeded, wood floated.

3. Exterior walkways and platforms over tanks to be used as walking areas - screeded, wood floated, steel troweled, broomed.

4. Exterior sidewalks - screeded, wood floated, divided into panels, steel troweled, broomed.

5. Interior working spaces such as screen rooms, motor rooms and pump rooms - screeded, wood floated, steel troweled, chemically hardened.

6. Interior surface in areas to receive tile or carpeting such as offices, control rooms, toilet rooms and the like - screeded, wood floated, steel troweled, broomed.

B. Panel Construction: Construct panels, where required, approximately 10 feet square using an edger to form dummy joints 1/4-inch deep.

C. Float Finish: Apply float finish to monolithic slab surfaces to receive trowel finish and other finishes as specified, and slab surfaces which are to be covered with membrane or elastic waterproofing, membrane or elastic roofing, as otherwise indicated.

1. After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating when surface water has disappeared or when concrete has stiffened sufficiently to permit operation of power-driven floats, or both. Consolidate surface with power-driven floats, or by hand-floating if the area is small or inaccessible to power units. For nonsloping level surfaces check and level the surface plane to tolerances of F_F 18 and as determined by ASTM E 1155. For sloping surfaces check the surface planes to a tolerance of F_F 18 as determined by ASTM D 1155. Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to a uniform, smooth, granular texture. Check the floors flatness (F_F) and levelness (F_L) on an area of 400 square feet for level floors and 400 square feet of sloping floors or tanks to be selected by the ENGINEER.

D. Trowel Finish: Apply trowel finish to monolithic slab surfaces to be exposed-to-view, and slab surfaces to be covered with resilient flooring, carpet, ceramic or quarry tile, paint, or other thin film finish coating system.

1. After floating, begin first trowel finish operation using a power-driven trowel. For nonsloping level surfaces check and level the surface plane to tolerances as determined by ASTM E 1155. Cut down high spots and fill low spots. For sloping surfaces check the surface planes to a tolerance of $F_F = 20$ as determined by ASTM E 1155. Check the floor flatness (F_F) and levelness (F_L) on an area of 400 square feet for level floors 400 square feet for sloping floor or tanks to be selected by the ENGINEER. Begin final troweling when surface produces a ringing sound as trowel is moved over surface. Consolidate concrete surface by final hand-troweling operation, free of trowel marks, uniform in texture and appearance, and with surface leveled to tolerances specified. Grind smooth surface defects which would telegraph through applied floor covering system.

E. Trowel and Fine Broom Finish: Where ceramic or quarry tile is to be installed with thin-set mortar, apply trowel finish as specified, then immediately follow with slightly scarifying surface by fine brooming.

F. Nonslip Broom Finish: Apply nonslip broom finish to exterior concrete platforms, steps, and ramps, and elsewhere, where indicated.

1. Immediately after float finishing, slightly roughen concrete surface by brooming with fiber bristle broom perpendicular to main traffic route. Coordinate required final finish with the ENGINEER before application.

G. Chemical-Hardener Finish: Apply chemical-hardener finish to interior concrete floor slabs that do not receive a floor covering. Apply liquid chemical-hardener after complete curing and drying of the concrete surface. Dilute liquid hardener with water (parts of hardener/water as follows), and apply in 3 coats; first coat, 1/3-strength; second coat, 1/2-strength; third coat, 2/3-strength. Evenly apply each coat, and allow 24 hours for drying between coats.

1. Apply proprietary chemical hardeners, in accordance with the manufacturer's printed instructions.

2. After the final coat of chemical-hardener solution is applied and dried, remove surplus hardener by scrubbing and mopping with water.

H. Nonslip Aggregate Finish: Apply the nonslip aggregate finish to concrete stair treads, platforms, ramps, sloped walks, and elsewhere where indicated.

1. After completion of float finishing, and before starting trowel finish, uniformly spread 25 pounds of dampened nonslip aggregate per 100 square feet of surface. Tamp aggregate flush with surface using a steel trowel, but do not force it below the surface. After broadcasting and tamping, apply trowel finishing as specified.

2. After curing, lightly work the surface with a steel wire brush, or an abrasive stone and water to expose nonslip aggregate.

I. Protection: Cover all finished floors, walkways, and slabs with boards, canvas, heavy paper or similar covering to protect them from damage.

3.8 STRUCTURAL CONCRETE SURFACES

A. Beveling Edges: Finish top edges of walls and equipment pads with a 1/2-inch beveled edge, unless other details are shown, and rub off any burrs remaining upon removal of the forms.

B. Form Removal Inspection: Immediately after stripping the forms, inspect all concrete surfaces. Remove all fins, offsets, burrs, ridges, or other unsightly marks from the exposed concrete.

C. Patching: Patch tie holes, placement joints, voids, stone pockets, or other defective areas before the concrete is thoroughly dry. Chip away defective areas to a depth of not less than 1 inch with all edges perpendicular to the surface. Wet the area to be patched, including at

least 5 inches of the adjoining surface, prior to placing the patching mortar. Then scrub onto the surface a grout of equal parts of cement and sand mixed to a brushing consistency followed immediately by the patching mortar. Make the patch of the same material and of approximately the same proportions as used for the concrete, except omit the coarse aggregate. For exposed concrete, substitute white cement for part of the gray cement so that the patch will match the color of the surrounding concrete. Determine the proportion of white and gray cement by making a trial patch. Use as little water as consistent with requirements of handling and placing.

D. Mortar: Do not retemper mortar. Thoroughly compact and screed off the mortar so as to leave the patch slightly higher than the surrounding surface. Then leave it undisturbed for a period of 1 to 2 hours to permit initial shrinkage before being finally finished. Finish the patch to match the adjoining surface and cure as specified for the original concrete.

3.9 GROUTING

A. Grout Placement: Place grout under column setting plates, under equipment bases, in conjunction with the setting of anchors or dowels in holes drilled in concrete, and elsewhere as required. Grout base plates and foundations using specified nonshrink grout. Use nonmetallic grout for exposed conditions, unless otherwise indicated.

B. Discoloration Requirements: Where grout will be exposed to the weather, make it free of discoloration without the necessity of special surface treatments.

C. Manufacturers Instructions: Mix and place all grout in accordance with manufacturer's instructions.

3.10 CONCRETE FILLETS AND TOPPING FOR TANK BOTTOMS

A. Fillets and Toppings: Provide concrete for fillets and toppings for tank bottoms conforming to the requirements of Class C concrete except for the following items:

1. Coarse aggregate conforming to ASTM C 33 Size 7

2. Minimum and maximum slumps:

a. Concrete fillets 2 inches - 4 inches

b. Concrete topping 3 inches - 5 inches

3.11 EPOXY ADHESIVE

A. Epoxy Adhesives for Bonding: Use epoxy adhesive for bonding fresh concrete to existing concrete where shown and grouting dowels into vertical holes.

B. Recommendations: Mix and apply epoxy adhesive in accordance with the manufacturer's recommendations and in accordance with the requirements of the "Standard Specification

for Bonding Plastic Concrete to Hardened Concrete with a Multi-Component Epoxy Adhesive - ACI 503R.

C. Surface Preparation: Roughen existing concrete, by sandblasting. Provide all surfaces free of standing water and clean as required.

3.12 EPOXY GEL

A. Epoxy Gels for Dowels: Use epoxy gel for grouting dowels into horizontal holes.

B. Application: Apply epoxy gels in accordance with the manufacturer's recommendations.

3.13 POLYMER MODIFIED NONSAG MORTAR

A. General: Mix and apply material in accordance with the manufacturer's recommendations.

B. Surface Preparation: Clean existing concrete that is to receive the material of all loose concrete, dirt, oil, grease and bond-inhibiting materials and mechanically roughen to obtain an aggregate-fractured surface with a minimum profile of $\pm$ 1/16-inch.

C. Mortar Placement: At the time of application, saturate existing concrete such that it is surface dry with no standing water. Scrub mortar into the substrate filling all pores and voids. Force the material against the edges of repairs, working it toward the center. After applying material, consolidate and then screed. Do not place the material in lifts greater than 1-inch. Where multiple lifts are required to achieve the required thickness, score the top surface of each lift to produce a roughened surface for the next lift. Allow the preceding lift to reach final set, 30 minutes minimum before applying fresh material. Scrub fresh mortar into the preceding lift. Allow mortar to set to desired stiffness and then finish with wood or sponge float for a smooth surface.

D. Curing Requirements: Moist cure with a fine mist spray of water, wet burlap, or nonsolvent-based curing compound. If necessary, protect newly applied material from rain. To prevent freezing, cover with insulating material.

3.14 CORROSION-RESISTANT COATING

A. Blast Cleaning: Blast clean existing exposed reinforcing steel to white metal color and immediately coat reinforcement with two 10 mil thick coats of corrosion-resistant coating applied in accordance with the manufacturer's recommendations.

3.15 MISCELLANEOUS CONCRETE ITEMS

A. Filling-In: Fill-in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after the work of other trades is in place. Mix, place, and cure concrete as specified, to blend with in-place construction. Provide other miscellaneous concrete filling shown or required to complete work.

B. Curbs: Provide a monolithic finish to interior curbs by stripping forms while concrete is still green and steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations. Set anchor bolts for machines and equipment to template at correct elevations, complying with certified diagrams or templates of the manufacturer furnishing machines and equipment.

D. Vapor Barrier Installation: Following leveling and tamping of gravel base for slabs on grade, place vapor barrier sheeting with longest dimension parallel with direction of concrete placement. Lap joints six inches and seal vapor barrier joints with manufacturer's recommended mastic and pressure-sensitive tape.

3.16 Manufacturer's Field Services: Furnish the services of a qualified representative of the grout manufacturer to provide instruction on proper grout preparation and grouting procedures.

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 03600

GROUT

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Furnishing fillet grout and non-shrink grout in conjunction with the setting of anchors or dowels in holes drilled in concrete, and elsewhere as required.

B. Related Work Specified in Other Sections Include:

1. Section 03100 - Concrete Formwork
2. Section 03310 - Cast-In-Place Concrete

1.2 REFERENCES

A. Codes and Standards Referred to in this Section:

1. ASTM C 33 - Specifications for Concrete Aggregates

2. ASTM C 109 - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2 in. [or 50 mm] Cube Specimens).

1.3 SUBMITTALS

A. Provide all submittals, including the following, as specified in Division 1:

1. Submit the following test reports:

a. Compression tests on cylinders for grout topping and fillet grout, as specified in Section 03310.3.3 “Concrete Tests”.

b. Compression tests, on mortar cubes for non-shrink grout as specified in Section 03310.3.3 “Concrete Tests”.

c. Air content tests, for grout topping and fillet grout, as specified in Section 03310 “Cast-In-Place Concrete”.

d. Slump tests, for grout topping and fillet grout as specified in Section 03310.3.3 “Concrete Tests”.

2. Test results showing that in projects of similar scope and size, the effective bearing area (EBA) under column bearings, beam bearings and equipment bases is between 95 and 100 percent.

3. Detailed field records for ready-mixed grout as specified in Section 03310.

1.4 QUALITY ASSURANCE

A. Testing Requirements: Testing laboratory provided by OWNER is responsible for conducting tests required in Division 1.

B. Testing Assistance: Cooperate with the laboratory personnel, provide access to Work, and manufacturer’s operations. Provide and deliver to the laboratory adequate quantities of representative samples of materials proposed to be used which require testing.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver, store and handle all products and materials as specified in Division 1, and as follows:

1. Portland Cement, Aggregates:

Deliver, store and handle as specified in Section 03310.

PART 2 PRODUCTS

2.1 MATERIALS

A. Acceptable Manufacturers:

1. Masterflow 928, as manufactured by MasterBuilders, Incorporated.
2. Multipurpose, as manufactured by Symons Corporation.
3. Sika grout 212, as manufactured by Sika Corporation.

2.2 GROUT MIXES

A. Non-Shrink Grout:

1. Add water to pre-packaged grout material and mix, as recommended by the manufacturer, to produce a flowable, non-shrink grout having a minimum compressive strength of 3000 psi in 24 hours.

2. Provide grout which when exposed to weather will be free of discoloration, without the necessity of special surface treatments.

B. Fillet Grout:

1. Grout to be proportioned from cement, fly ash, fine aggregate and ASTM C33, size no. 7 coarse aggregate with a water-reducing admixture.

2. Proportion to provide a grout having the following properties:

a. A minimum compressive strength of 4000 psi in 28 days.

b. An average air content of 5 percent ∀ 1.5 percent.

c. Minimum and maximum slumps:

(1) Fillet grout: 2-4 inches.
(2) Grout topping: 3-5 inches.

d. A maximum water-cementitious material ratio of 0.45 by weight of the total cementitious material.

3. Prepare design mixes, for each class of grout, as specified in Section 03310 “Cast-In-Place Concrete”.

C. Measurement and Mixing

Measure and mix material as specified in Section 03310.

PART 3 EXECUTION

3.1 INSPECTION

A. Substrate Condition:

Examine the substrate and conditions under which grout is to be placed and notify the ENGINEER, in writing, of unsatisfactory conditions. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to the OWNER.

3.2 INSTALLATION

A. General:

1. Mix and place all grout in accordance with the manufacturer's instructions. Notify the OWNER if manufacturer's instructions conflict with the Specifications. Do not proceed with installation until directed by the OWNER.

2. Drypacking will not be permitted.

3. Have manufacturers of proprietary products make available upon 72 hours notification the services of a qualified, full time employee to aid in assuring proper use of the product under job conditions. The cost of this service, if any, shall be borne by the Contractor.

4. Conform grout placement to temperature and weather limitations in Section 03310 "Cast-In-Place Concrete".

B. Grout Placement:

1. Prior to placement of grout, remove all laitance, debris and loose and foreign material from the base slab. Use waterblasting, sandblasting or other methods acceptable to the City.

2. Cure and protect the grout as specified in Section 03310 "Cast-In-Place Concrete".

3.3 TESTS

A. Sample and test grout for compressive strength, air content and slump as specified in Section 03310 "Cast-In-Place Concrete", except as follows:

1. Non-shrink grout: Prepare and test standard 2-inch mortar cubes in accordance with the requirements of ASTM C109. Make a minimum of one set of 6 cubes for each day of work or each 150 cubic yards of grout for each type of grout. Test two cubes for compressive strength at 7 days, one at 14 days and two at 28 days.

END OF SECTION

SECTION 11210

PACKAGE LIFT STATION

PART I GENERAL

1.1 SUMMARY

A. Scope: Requirements for furnishing all labor, materials, equipment and supervision to construct two prefabricated, skid mounted, weatherproof, pumping systems. All provisions in this specification apply to both prefabricated pumping systems unless specifically noted otherwise. A single manufacturer-supplier regularly engaged in the production of package-type sewage pumping stations of the type specified shall be responsible for furnishing and supervising the installation of a complete pumping system including prefabricated structure, vacuum prime pumps (Fairway Knolls LS), submersible pumps (Sheraton LS), adjustable frequency drives, station piping and valves, flow meter, access hatches, base elbows, guide rail systems, liquid level controls, back-up mercury float switches, pump and generator control panels, fiber optic cable communication system, interconnecting electrical conduit and wiring, standby engine generator set and all other equipment specified or required to provide a complete, automatic, smooth operating, and reliable pumping system.

The pumping system shall automatically operate two submersible sewage pumps based upon wet well level. The pumping system shall monitor incoming electrical power and shall provide its own standby power in the event of power failure. Provide equipment and wiring to be installed in the wet well or exposed to the wet well environment meeting the requirements for NEC Class 1, Group D, Division 1 hazardous areas.

1.2 SUBMITTALS

A. Shop Drawings: Submit working drawings, including arrangement and erection drawings of the equipment and equipment operating characteristics. Include the following:

1. Manufacturer's installation instructions for all equipment.

2. Pump performance curves. Draw the curves for the specified conditions. Plot total head, input kilowatts, and overall efficiency, as a function of capacity from zero to maximum capacity.

3. General arrangement drawing of pumping unit, base elbow and guide rail

system.

4. General arrangement drawing of generator set with sufficient data to verify system components and compliance with specification requirements.

5. Shop drawings showing plan and elevation views with certified overall dimensions, as well as wiring interconnection details.

6. Interconnection wiring diagrams showing all external connections required; with field wiring terminals marked in a consistent point-to-point manner.

7. Cross section drawing of pumping unit.

8. Parts list with materials of construction identified.

9. Furnish manufacturer's catalog data for each motor.

10. Motor performance characteristics.

11. Spare parts list.

B. Certificate of Compatibility: For each motor controlled by an adjustable frequency drive, furnish a certificate that the motors are compatible with the adjustable frequency drives and the equipment loads to be driven.

C. Quality Control Submittals: Submit 6 certified standard commercial test reports for motors larger than 5 HP. Perform the following tests in accordance with NEMA standards:

1. No load running current and speed

2. Lock rotor current

3. Dielectric routine tests

4. Motor efficiency tests

5. Motor power factor tests

D. Warranties: Submit 3 copies of all equipment warranty documents as listed in the specification.

E. Operation and Maintenance: Submit Operation and Maintenance manuals for all equipment in accordance with Section 01783.

1.3 QUALITY ASSURANCE

A. Qualifications: Provide submersible pump station equipment produced by a manufacturer-supplier who regularly engages in the design, manufacture, assembly and production of package-type lift stations of the size and type as specified for not less than ten years.

1.4 DELIVERY, STORAGE AND HANDLING

A. Deliver, store and handle all products and materials as specified in Division 1.

1.5 PARTS

A. General: Provide the following spare parts for each pump:

1. Vacuum Prime Pumps:
   a. One complete replacement pump shaft seal assembly
   b. One complete pump seal gasket
   c. One volute gasket

2. Submersible Pumps:
   a. One set of cable entry grommets
   b. One set of “O”-rings
   c. One set of Wear Rings
   d. One set of Gaskets

B. Special Tools: Furnish a complete set of special wrenches, spanners, eyebolts and other special tools sufficient to completely dismantle and reassemble each pumping unit. Provide tools of forged steel, case hardened, and full finished.

PART 2 PRODUCTS

2.1 MANUFACTURED EQUIPMENT

A. These specifications are based on certain products deemed most suitable for the application involved. Acceptable manufacturers are listed below and should be the basis of the Contractor’s bid.

1.	Package Lift Station:	Precision Systems, Calumet City, IL
2.	Vacuum Primed Pumps:	Smith & Loveless
3.	Submersible Pumps:	Flygt
4.	Control Panels:	Toric Engineering
5.	Generator Set:	Cummins Power Generation

B. All equipment specified above to be supplied by the package lift station manufacturer to provide a single source service and warranty facility.

2.2 GENERAL CONSTRUCTION

A. Materials: Provide Type 316 stainless steel fasteners, bolts, nuts and washers for all equipment and system components that will be installed outdoors or exposed to the pumped liquid.

B. Component Joints: Provide machined metal-to-metal joints on component parts that are assembled together. Fit with an "O"-ring seal where watertight joints are required. Arrange the "O"-ring seal for automatic compression and sealing without adjustment or bolt torquing procedures. Do not use flat gaskets or sealing compounds to obtain watertight joints. Furnish machined rabbet fits on component joints as required to provide automatic alignment of rotating parts.

2.3 OPERATING CONDITIONS

A. The following conditions indicate the minimum requirements for the pumping and standby power equipment:

1. Pumping Equipment

FAIRWAY KNOLLS LIFT STATION

a.	Pump Type	Vacuum Primed
b.	Design Capacity, gpm	350
c.	Design Head, feet	77
d.	Shutoff Head, feet	91
e.	Horsepower	15
f.	Max Speed, rpm	1760
g.	Efficiency at design condition, %	69
h.	Power Requirement	3/60/460
i.	Discharge Size, inches	4
j.	Min Solids Capacity, inches	3
k.	Manufacturer	Smith & Loveless
l.	Model	4B2D
m.	Number of Pumps	2

SHERATON LIFT STATION

a.	Pump Type	Submersible
b.	Capacity at rating point, gpm	980
c.	Total head at rating point, feet	75
d.	Overall efficiency at rating point, minimum, %	68
e.	Shutoff Head, feet	117

f.	Capacity at reduced speed rating point, gpm	740
g.	Total head at reduced speed rating point, feet	56
h.	Efficiency at reduced speed rating point, minimum, %	72
i.	Motor Horsepower, hp, maximum	30
j.	Max Speed, rpm	1760
k.	Power Requirement	3/60/460
l.	Discharge Size, inches	6
m.	Min Solids Capacity, inches	3
n.	Manufacturer	Flygt
o.	Model	NP 3171 MT 434
p.	Number of Pumps	2

2. Standby Power Equipment

FAIRWAY KNOLLS LIFT STATION

a.	KW	60
b.	KVA	75
c.	Cylinders	10
d.	Displacement (cubic in.)	412.5
e.	Horsepower Output	97.5
f.	Speed, rpm	1800
g.	Fuel Type	Natural Gas
h.	Generator Set Manufacturer	Cummins Power Generation
i.	Generator Model	60GGHE
j.	Automatic Transfer Switch, amps	225
k.	ATS Model	OTPC400

SHERATON LIFT STATON

a.	KW	85
b.	KVA	106
c.	Cylinders	10
d.	Displacement (cubic in.)	412.5
e.	Horsepower Output	176
f.	Speed, rpm	1800
g.	Fuel Type	Natural Gas
h.	Generator Set Manufacturer	Cummins Power Generation
i.	Generator Model	85GGHG
j.	Automatic Transfer Switch, amps	225
k.	ATS Model	OTPC400

2.4 VACUUM PRIMED PUMPS – FAIRWAY KNOLLS LIFT STATION

A. General: Provide pumps of the vertical, centrifugal, heavy duty, non-clog, vacuum prime type, each driven by an electric motor mounted as an integral part of the

pump. Design the raw sewage pumps to pump raw sewage and operate with adjustable frequency drives. Design the pump units for continuous and intermittent duty.

B. Pump Curve: Design each pump to have a continuously rising characteristic curve from the specified rating points to shutoff which passes through the rating points, and which meets or exceeds the specified heads and capacities all within the Hydraulic Institute tolerances.

FAIRWAY KNOLLS LIFT STATION

1.	Shutoff Head	0 gpm	@ 91 TDH
2.	Primary Rating Point # 1	350 gpm	@ 77 TDH
3.	Secondary Rating Point #2	670 gpm	@ 61 TDH

C. Pump Construction:

1. The pumps shall be vertical, non-clog type of heavy cast iron construction, especially designed for the use with mechanical seals and vacuum priming. In order to minimize seal wear caused by lineal movement of the shaft, the shaft bearing nearest the pump impeller shall be locked in place so that end play is limited to the clearance within the bearing. The shaft from the top of the impeller to the lower bearing supporting the impeller shall be sized to minimize seal wear resulting from shaft deflection caused by the radial thrust of the pump. Shaft overhang, defined as the distance from the centerline of the lower bearing to the top of the impeller, shall not exceed 6 in.

2. The bearing nearest the impeller shall be designed for the combined thrust and radial load. The upper bearing shall be free to move linearly with the thermal expansion of the shaft and carry only radial loads.

3. The shaft shall be solid stainless steel through the mechanical seal to eliminate corrosion and abrasive rust particles. Removable shaft sleeves will not be acceptable if the shaft under the sleeve does not meet the specified minimum diameter.

4. The pump impeller shall be of the enclosed type made of close-grained cast iron and shall be statically and dynamically balanced. The impeller shall be keyed with a stainless steel key and secured to the motor shaft by a stainless steel cap screw equipped with a Nylock or other suitable self-locking device. The impeller shall not be screwed or pinned to the motor pump shaft and shall be readily removable without the use of special tools. To prevent the buildup of stringy materials, grit and other foreign particles around the pump

shaft, all impellers less than full diameter shall be trimmed inside the impeller shroud. The shroud shall remain full diameter so that close minimum clearance from shroud to the volute is maintained. Both the end of the shaft and the bore of the impeller shall be tapered to permit easy removal of the impeller from the shaft.

5. The pump shall have an adaptor providing a large water reservoir above the impeller to provide for positive exclusion of air from the impeller. The seal shall be inside this area to assure lubrication. Pumps which do not use hollow priming adapters for positive lubrication of the seal will not be acceptable.

6. The pump shall be so constructed so as to permit priming from the low pressure area behind the impeller. Priming from the high pressure connections will not be acceptable. The priming bowl shall be transparent to enable the operator to monitor the priming level.

7. The pump shall be arranged so that the rotating element can easily be removed from the volute without disconnecting the electrical wiring or disassembling the motor, impeller, backhead or seal, so that any foreign object may be removed from the pump or suction line.

8. The pump shaft shall be sealed against leakage by a single mechanical seal constructed so as to be automatically drained and primed each time the pump is drained and primed. Water which lubricates the mechanical seal shall be automatically drained from around the seal if the pump loses prime, in order to allow both the pump and the seal to be drained.

9. The seal shall be of carbon and ceramic materials with the mating surfaces lapped to a flatness tolerance of one light band. The rotating ceramic shall be held in mating position with the stationary carbon by a stainless steel spring.

10. The pump volute shall be furnished with mounting lugs and be bolted to the station floor plate, forming a gas-tight seal.

D. Motor:

1. General. Pump motors shall be vertical, solid shaft, NEMA P-base, squirrel cage induction type. Motor will be inverter duty rated with a service factor of 1.00 for 460-volt, 3-phase, 60-hertz electrical service.

2. Ratings. Design the motor to have suitable output torque and speed characteristic to start and operate the pump over the range of specified conditions. Do not exceed the nameplate horsepower rating, at the design

condition, nor at any head across the pump curve for the selected impeller. Motor will be NEMA Design B and designed for continuous load operation and continuous on-off cycling of ten starts per hour minimum without exceeding the 80 degrees C temperature rise.

3. Insulation. Provide the motor with a minimum of NEMA Class F (155 degrees C) moisture resistant insulation. Provide insulation to protect against adverse affects of a nonsinusoidal waveform from variable speed operation.

4. Motor Frame. Provide open drip-proof design with forced air circulation by integral fan. Openings for ventilation shall be uniformly spaced around the motor frame. Leads shall be terminated in a cast connection box and shall be clearly identified

5. Bearings. Provide regreasable bearings with support side thrust loadings, with an AFBMA B-10 bearing life rated at least 100,000 hours, based on a reliability of 90 percent. A bearing cap shall be provided to hold the bottom motor bearing in a fixed position. Bearing housings shall be provided with fittings for lubrication as well as purging old lubricant.

6. Cables. Provide the motor and sensor cable(s) entry with a mechanical locking ring or compression type cord grip to protect the cable jacket from being pulled out of the motor. Provide sufficient cable lengths to prevent splices or junction boxes between the pump motor and the control panel. Provide cables conforming to NEC specifications for cable sizing.

7. Lifting Eyes. The motor shall be fitted with heavy lifting eyes, each capable of supporting the entire weight of the pump and motor

E. Shaft:

1. Design. Provide a one piece, fully machined pump and motor shaft. The motor-pump shaft shall be centered, in relation to the motor base, within 0.005". The shaft runout shall not exceed 0.003".

2. Material. Provide shafts of either carbon steel or stainless steel. Protect carbon steel shafts from exposure to the pumped liquid by employing a stainless steel sleeve or chrome plating.

F. Vacuum Priming System:

1. A separate and independent priming system shall be provided for each wastewater pump, providing complete standby operation. Each priming system shall include a separate vacuum pump. Vacuum pumps shall have

corrosion resistant internal components. They shall each be capable of priming the wastewater pump and suction piping in less than 60 seconds, under rated suction lift conditions of 20' at mean sea level.

2. Each priming system shall be complete with vacuum pump, vacuum control solenoid valve, prime level sensing system, and a float operated check valve installed in the system ahead of the vacuum pump to prevent liquid from entering the vacuum pump. The float operated check valve shall have a transparent body for visual inspection of the liquid level and shall be automatically drained when the vacuum pump shuts off.

3. The priming system shall automatically provide positive lubrication of the mechanical seal each time the wastewater pump is primed. To prevent excessive stoppage due to grease accumulation, no passageway in the priming system through which wastewater must pass shall be smaller than the equivalent of a 2 ½" opening.

4. The prime sensing system shall be of the ultrasonic type. The sensor shall monitor water level in the pump/motor adaptor without the use of electrodes or float switches. The ultrasonic sensing system used shall have a minimum field experience of one year before acceptance for this project.

5. The priming system shall be supplied with vacuum line filters for each pump priming system. The filters shall be replaceable and shall be between the priming bowl and the solenoid valve for each pump.

2.5 SUBMERSIBLE SEWAGE PUMPS – SHERATON LIFT STATION

A. General: Provide pumps of the vertical, centrifugal, heavy duty, non-clog, submersible type, each driven by submersible electric motor mounted as an integral part of the pump. Design the raw sewage pumps to pump raw sewage and operate with adjustable frequency drives. Design the pump units for continuous and intermittent duty.

B. Pump Curve: Design each pump to have a continuously rising characteristic curve from the specified rating points to shutoff which passes through the rating points, and which meets or exceeds the specified heads and capacities all within the Hydraulic Institute tolerances.

SHERATON LIFT STATION

1.	Shutoff Head	0 gpm	@ 117 TDH
2.	Primary Rating Point # 1	980 gpm	@ 75 TDH
3.	Secondary Rating Point #2	1400 gpm	@ 63 TDH

4. Reduced Speed Primary Rating Point #3 740 gpm @ 56 TDH

C. Casing:

1. General. Provide pump casing of the centrifugal single volute, centerline discharge type. Do not use diffusion vanes.

2. Materials. Construct pump casing of gray cast iron, Class 35B in accordance with ASTM A 48.

3. Wear Rings. Construct renewable wear rings of AISI 329 stainless steel.

D. Impeller:

1. General. Design impeller of the enclosed non-clog type. Provide pump-out vanes or a back ring, arranged with minimum clearances so as to preclude solids and stringy material from damaging the mechanical seal, on the back of the impeller.

2. Materials. Construct the impeller of gray cast iron, Class 35B in accordance with ASTM A 48.

3. Wear Ring. Construct renewable impeller wear ring of AISI 329 stainless steel.

4. Assembly. Secure the impeller to the shaft with a stainless steel key and lock nut in such a way that it cannot unscrew or become loosened due to rotation in either direction.

E. Oil Chamber:

1. General. Provide an oil chamber constructed of ASTM A 48 cast iron to function as a buffer between the pumped liquid in the casing and the motor. Arrange the oil chamber to accommodate thermal expansion of the oil. Furnish an oil chamber drain plug that is accessible from outside the pump unit and permits changing oil without dismantling pump components.

F. Mechanical Seal:

1. Design. Provide each pump with a double or tandem mechanical seals. Design the upper seal unit, between the oil chamber and motor housing, with one stationary silicon-carbide ring and one positively driven rotating silicon-carbide ring. Design the lower seal unit, between the pump casing and oil chamber, with one stationary ring and one positively driven rotating ring. Furnish these rings made of silicon-carbide. Use stainless steel for metal

parts. Protect the spring element of the lower seal from solids contained in the pumped liquid. Do not rely upon the pumped liquid for lubrication. No seal damage is to result from operating the pumping unit out of its liquid environment.

G. Motor:

1. General. Provide a completely sealed submersible motor. Motor will be inverter duty with a service factor of 1.10 for 460-volt, 3-phase, 60-hertz electrical service.

2. Ratings. Design the motor to have suitable output torque and speed characteristic to start and operate the pump over the range of specified conditions. Do not exceed the nameplate horsepower rating, at the design condition, nor at any head across the pump curve for the selected impeller. Motor will be NEMA Design B and designed for continuous load operation and continuous on-off cycling of ten starts per hour minimum without exceeding the 80 degrees C temperature rise.

3. Insulation. Provide the motor with a minimum of NEMA Class F (155 degrees C) moisture resistant insulation. Provide insulation to protect against adverse affects of a nonsinusoidal waveform from variable speed operation.

4. Stator Housing. Provide the motor with an ASTM A 48 cast iron stator housing. For motors that employ cooling water jackets, design the water jacket passages to preclude clogging by solids contained in the pumped liquid.

5. Bearings. Provide regreasable bearings with support side thrust loadings, with an AFBMA B-10 bearing life rated at least 100,000 hours, based on a reliability of 90 percent.

6. Cables. Provide the motor and sensor cable(s) entry with a mechanical locking ring or compression type cord grip to protect the cable jacket from being pulled out of the motor. Arrange the cable entry so as to provide a watertight seal. Isolate the cable entry leads from the internal motor leads to prevent entry of water into the motor chamber by leakage or wicking. Provide sufficient cable lengths to prevent splices or junction boxes between the pump motor and the control panel. Provide cables suitable for submersible pump application and conforming to NEC specifications for cable sizing.

H. Shaft:

1. Design. Provide a one piece, fully machined pump and motor shaft. Design the shaft to limit shaft deflection under maximum pumping load to 0.002 inches at the lower mechanical seal face and to obtain a rotating assembly first critical speed of not less than 150 percent of the rated speed.

2. Material. Provide shafts of either carbon steel or stainless steel. Protect carbon steel shafts from exposure to the pumped liquid by employing a stainless steel sleeve or chrome plating.

I. Protective Monitoring System:

1. General. Provide each pumping unit with a monitoring system to protect critical machine functions during operation.

2. Motor Winding Temperature. Provide thermistors to monitor motor temperature to protect against overheating. Activate an alarm light and motor shutdown on high temperature.

3. Lower Seal Failure. Provide a moisture sensor in the oil chamber to protect against damage from water contamination. Activate an alarm and shutdown the pump upon sensing moisture.

4. Sensor Monitoring Device. Provide a monitoring device or devices designed to be compatible with the sensors and motor controls. Locate monitoring devices in the control panel.

J. Guide Rail System and Base Elbow:

1. Design. Provide each pump with a base elbow and guide rail system. Design the guide rail system to permit installation and removal of the pump from its base elbow discharge connection without requiring personnel to enter the wet well.

2. Guide Rail System. Provide a guide bracket that is an integral part of the pump casing and permits sliding the pumping unit, along two unthreaded stainless steel guide rails. Construct guide brackets of non-sparking bronze. Provide Type 316 guide rail connected to the base elbow at the bottom. Support the guide rails at intermediate locations (minimum of one support every 10 feet of guide rail) and at the top with stainless steel brackets bolted to the wall of the wet well or concrete slab. Fit each pump with a stainless steel lifting chain of adequate length and strength to permit the raising and lowering of the pump for inspection and removal.

3. Base Elbow. Provide a cast iron base elbow arranged for automatic pump connection. Provide the pump casing with a machined discharge flange which, when the pump is lowered into the pumping position, will automatically align and mate with the plain-end of the base elbow. Provide the flanges with a bronze liner designed to be non-sparking. Design the discharge connection such that no motion other than vertical is required to seat the mating flange of the casing to the base elbow. Accomplish sealing of the pump connection by metal-to-metal contact or by a positive resilient seal of Buna-N attached to the pump casing discharge flange. Design the base elbow to support the weight of the pumping unit and prevent it from bearing directly on the wet well floor.

4. Mounting Accessories. Provide anchor bolts, nuts, washers, and accessories and other adapter equipment necessary for mounting the pumping equipment and appurtenances. Construct mounting accessories of Type 316 stainless steel.

5. Guide System Warranty. The package lift station manufacturer shall guarantee the guide rail system, including base elbow and all its parts for a period of ten years.

2.6 LIFT STATION COMPONENTS

A. Pressure Gauges:

1. Provide each pump with a discharge pressure gauge of the dial-indicating bourdon tube type. Manufacture pressure gauges to the requirements of ASME B40.1. Provide Grade 2A pressure gauges with a range of 0 to 100 psi with an accuracy of 0.5 percent of maximum scale reading.

2. Construct gauges with a nominal size of 4 ½ inches. Construct the bourdon tube and fitting of bronze. Manufacture dials with white faces with black numerals and markings.

3. Furnish diaphragm seals of Type 316 stainless steel to isolate the process fluid from the pressure gauge. Equip the seal with a ¼ inch NPT pressure device connection and a ½ inch NPT process connection.

4. Connect each gauge with stainless steel pipe, fittings and isolating stopcocks. Equip each gauge with a snubber and threaded protective diaphragm seal made of stainless steel.

5. Supply pressure gauges manufactured by U.S. Gauge, Ashcroft, or equal.

B. Station Piping:

1. Provide ductile-iron pipe and fittings complete with all necessary jointing facilities and materials, specials, adapters, hangers and supports required for installation in and completion of the sewage pipelines to be constructed.

2. Provide ductile-iron pipe meeting the requirements of AWWA C151/A21.51. Provide ductile-iron fittings meeting the requirements of AWWA C110/A21.10. Provide flanged ductile iron pipe with a minimum 350 psi pressure class. Line ductile-iron pipe interior with a ceramic epoxy not less than 40 mills nominal dry thickness and applied in accordance with the lining manufacturer recommendations. Ceramic epoxy lining to be Protecto 401 Ceramic Epoxy or equivalent.

3. Provide steel pipe spools where protrusions through floor facilitate the requirement for a continuously welded seam. Piping shall be steel and conform to material specification ASTM A-53(CW) for nominal pipe size four (4) inch and smaller and ASTM A-53(ERW) Grade B for nominal pipe size five (5) inches and larger. Steel butt-welding fittings shall conform to material specification ASTM A-234 Grade WPB and to the dimensions and tolerances of ANSI Standards B16.9 and B16.28 respectively. Line steel pipe interior with a ceramic epoxy not less than 40 mills nominal dry thickness and applied in accordance with the lining manufacturer recommendations. Ceramic epoxy lining to be Tnemic Perma-Shield PL Series 431 or equivalent.

4. Forged steel flanges shall conform to material specification ASTM A-105 Class 60 and/or ASTM A-181 for carbon steel forgings and to the dimensions and tolerances of ANSI Standards B16.5 as amended in 1992 for Class 150 and Class 300 flanges.

5. The piping sizes shall be as shown on the drawing.

   a. Size 10 inch and below - Schedule 40
   b. Size 12 inch and above - Standard weight (.375" wall)

6. All transmission piping including valves shall be shot blasted to a commercial finish per SSPC-SP6. Finished pipe system shall receive a minimum 10 mils epoxy in two coats of Sherwin Williams Macropoxy 646 for a combined 8-10 mils minimum dry thickness.

C. Check Valves:

1. General: Provide single disc swing check valves designed to allow a full diameter passage and to operate with a minimum loss of pressure. Provide

check valves that meet the requirements of AWWA C508.

2. Design: Equip check valves with bronze renewable seat rings, bronze discs or disc rings and bronze disc hinge bushings and pins. Carefully mount discs and provide discs that swivel in disc hinges. Provide pins, discs and other parts that are non-corrosive, non-sticking and properly cured to operate satisfactorily within a temperature range of 34 to 100 degrees Fahrenheit and with the fluids or gases specified.

3. Levers and Weights: Equip 6 inch and larger check valves with outside levers and weights.

D. Plug Valves:

1. General: Provide quarter turn plug valves having an eccentric action that causes the plug to rise off the seat contact during the opening movement rather than sliding from its seat.

2. Plugs: Provide plug valves with Neoprene or Buna-N faced plugs.

3. Materials: Construct plug valves of cast iron or semi-steel at least equal to ASTM A 126, Class B. Provide uncoated or epoxy coated body seats. Make the overlay a minimum of 1/16-inch thick for valve sizes 20-inch and smaller. Provide zinc plated bonnet bolts, studs and nuts.

4. Seat Adjustment: Make the water-tightness or gas-tightness of the valve seating adjustable. Provide a seating adjustment device that is external to the valve and that can be used without the need to remove the valve from the piping and with the valve under pressure.

5. Lubrication: Furnish plug valves with oil impregnated, permanently lubricated, bronze or Type 316 stainless steel bearings in the upper and lower journals.

6. Stem Seal: Provide a stem seal consisting of multiple, self-adjusting and replaceable chevron type packing rings and a packing gland or provide two replaceable, self-adjusting, U-cup seals. Make the stem seal adjustable and replaceable without removing the valve from the piping and without the need to disassemble the valve and operator. For buried or submerged service, provide a sealed enclosure to keep the stem seal clean.

E. Air Valve

1. Provide sewage air valve to allow unrestricted venting of air through it, during filling of the force main and to allow air to discharge during pump operation. Provide valve that will also allow venting of the force main to

prevent vacuum if site conditions dictate the need for this function. Provide an isolation gate valve to service the air valve. Pipe air release valve such that all discharges are routed back into the wet wells.

2. Provide 500 psi rated valve with internals that are easily removed through the top cover without removing the main valve from the line. Supply inlet and blow off valves, quick disconnect couplings and minimum 5-foot hose for flushing valve. The valve inlet shall be 2" NPT and the outlet ½" NPT.

F. Wet Well Access Hatch:

1. Provide aluminum access doors of the size shown with clear opening sufficient for removal of the pumps. Fabricate access doors of 1/4-inch thick extruded aluminum. Door panels shall be 1/4-inch thick aluminum diamond plate reinforced to withstand a live load of 300 pounds per square foot. The doors shall open 90 degrees and automatically lock with stainless steel hold open arms with aluminum release handles. Doors shall close flush with the frame.

2. Install access doors over pumps located external to the fiberglass housing. Access hatch to be precast into the wet well top slab by installing Contractor.

3. A Type 316 stainless steel cable holder for power and control wires will be installed to the access door frame by the installing Contractor.

G. Wet Well Access Hatch Fall Protection Grating System

1. Grating: Provide fiberglass panels, molded in one piece, with load bearing bars in both directions to allow for use without continuous side support. Designed grating to support a 300 PSF live load.

2. Lift assistance: Provide type 316 stainless steel torsion rod incorporated into the grating panel design to provide lift assistance when opening the grating panel.

3. Hold open feature: Provide type 316 stainless steel hold open arm provided to lock the cover in the fully open 90 degree position. Provide a release handle to allow the grating panel to be closed.

4. Hardware: Type 316 stainless steel for all hardware, including mounting brackets, hinges, torsion rod, hold open arm, padlock loop, and fasteners.

5. Grating system panels shall meet the following performance characteristics:

a. High visibility safety yellow in color.

b. Lock in the fully open position.

c. Lift assistance for ease of operation.

d. UV and corrosion resistant construction with a twenty-five year manufacturer's warranty.

e. Locking to prevent unauthorized opening.

H. Lift Station Bypass System

1. Provide a pump bypass system to facilitate the connection of an emergency pump to a fixed suction and fixed bypass force main connection at the lift station.

2. Construct bypass of aluminum with non-corrosive hardware. Install suction and bypass connections with a male camlock fitting for quick connection of emergency pump. Protect camlock fittings at grade by an aluminum diamond plate lid with integral waterproof locking assembly. .

3. Install Schedule 80 PVC suction piping into the wet well from the suction bypass connections camlock. Suction pipe is to be the same diameter as camlock fitting and attached by threaded fitting on camlock. Extend suction pipe to within one foot of the bottom of the wet well and permanently support the suction pipe. Provide pipe supports and/or bracing as required.

4. Discharge camlock shall be piped to the discharge line of the station prior to shipment. Isolate camlock from force main by plug valve to prevent flow from passing through camlock when not in use. Connection to force main isolation plug valve are to be located within the packaged lift station structure.

2.7 ADJUSTABLE FREQUENCY DRIVES

A. This specification defines the minimum requirements for Variable Frequency Drives (VFD) and accessories for speed control of either constant or variable torque loads.

B. Technical Requirements:

a. Furnish complete VFD as specified herein of in the equipment schedule for loads designated to be variable speed. VFD's shall be both constant and variable torque rated.

b. The VFD shall convert incoming fixed frequency three-phase AC power into a variable frequency and voltage for controlling the speed input design, and the input voltage rectifier shall employ a full wave diode bridge; VFD's utilizing controlled SCR rectifiers shall not be acceptable. The output waveform shall closely approximate a sine wave. The VFD shall be of a PWM output design utilizing current IGBT inverter technology and voltage vector control of the output PWM waveform.

c. The VFD shall include a full-wave diode bridge rectifier and maintain a displacement power factor of near unity regardless of speed and load.

d. The manufacturer of the VFD shall demonstrate a continuous period of manufacturing and development of VFD's for a minimum of 10 years. VFD's that are brand-labeled are not acceptable.

e. The VFD shall produce an output waveform capable of handling maximum motor cable distances of up to 1,000 ft. (unshielded) without tripping.

f. The VFD shall utilize an output voltage-vector switching algorithm, or equivalent, in both variable and constant torque modes. Sine Coded PWM Drives are not allowed. The VFD will provide rated RMS fundamental voltage from the VFD. This allows the motor to operate at a lower temperature rise, extending its thermal life. VFD's that cannot produce rated RMS fundamental output voltage or require the input voltage to be increased above motor nameplate value to achieve rated RMS fundamental output voltage are not acceptable.

g. The VFD selected must be able to source the motor's full load nameplate amperage (fundamental RMS) on a continuous basis, and be capable of running the motor at it's nameplate RPM, voltage, current, and slip without having to utilize the service factor of the motor.

h. The VFD will be capable of running either variable or constant torque loads. In variable torque applications, the VFD shall provide a CT-start feature and be able to provide full torque at any speed up to the base speed of the motor. In either CT or VT mode, the VFD shall be able to provide it's full rated output current continuously and 100% of rated current for 60 seconds.

i. An Automatic Energy Optimization (AEO) selection feature shall be provided in the VFD to minimize energy consumption in variable torque applications. This feature shall dynamically adjust output voltage in response to load, independent of speed. This feature shall incorporate power factor compensation. Output voltage adjustment based upon frequency alone is not acceptable for single motor VT configurations.

j. An initial ramp function shall be available to provide a different beginning ramp time, up to 360 seconds, for application requiring a faster or slower ramp than normal operation.

k. An empty pipe fill mode shall be available to fill an empty pipe in a short period of time, then revert to the PID controller for stable operation. Pipe fill mode shall have a programmable time to reduce water hammer in the system.

l. Switching of the input power to the VFD shall be possible without interlocks of damage to the VFD at a minimum interval of 2 minutes.

m. Switching of power on the output side between the VFD and the motor shall be possible with no limitation or damage to the VFD and shall require no additional interlocks.

n. An Automatic Motor Adaptation function shall measure motor stator resistance and reactance to optimize performance and efficiency. It shall not be necessary to spin the motor shaft or decouple the motor from the load to accomplish this optimization. Additionally, the parameters for motor resistance and motor reactance shall be user-programmable.

o. The VFD shall have temperature controlled cooling fans for quiet operation, minimized internal losses, and greatly increased fan life.

p. VFD shall provide full torque to the motor given input voltage fluctuations of up to +/- 10% of the rated input voltage. Additionally, sustained line voltage reductions up to 15% shall not cause the VFD to trip.

q. The VFD shall provide dual built-in DC link reactors to minimize power line harmonics and to provide near unity power factor. VFD's without a DC link reactor shall provide a 5% impedance line side reactor.

C. Protective Features

a. VFD shall have input surge protection utilizing MOV's, spark gaps, and Zemer diodes to withstand surges of 2.3 times line voltage for 1.3 msec. If not a standard part of the VFD, additional surge protection shall be provided.

b. VFD shall include circuitry to detect phase imbalance and phase loss on the input side of the VFD.

c. VFD shall include current sensors on all three output phases to detect and report phase loss to the motor. The VFD will identify which of the output phases is low or lost.

d. VFD shall auto-derate the output voltage and frequency to the motor in the presence of sustained ambient temperatures higher than the normal operating range, so as not to trip on an inverter temperature fault. The use of this feature shall be user-selectable and a warning will be exported during the event.

D. Interface Features

a. VFD shall provide an alphanumeric backlit display keypad which may be remotely mounted using standard cable. VFD may be operated with keypad disconnected or removed entirely. Keypad may be disconnected during normal operation without the need to stop the motor or disconnect power to the VFD.

b. VFD shall display all faults in plain text; VFD's which can display only fault codes are not acceptable.

c. The keypad shall feature a 4-line display, and be capable of digitally displaying up to four separate operational parameters or status values simultaneously (including process values with the appropriate engineering unit) in addition to Hand/Off/Auto, Local/Remote, and operating status.

d. Keypad shall provide an integral H-O-A (Hand-Off-Auto) and Local-Remote selection capability, and manual control of speed locally without the need for adding selector switches, potentiometers, or other devices.

e. All VFD's shall be of the same series, and shall utilize a common control card and LCP (keypad/display unit) throughout the rating range. The control cards and keypads shall be interchangeable.

f. VFD keypad shall be capable of storing drive parameter values in non-volatile RAM uploads to it from the VFD, and shall be capable of downloading stored values to the VFD to facilitate programming of multiple drives in similar applications, or as a means of backing up the programmed parameters.

g. VFD display shall indicate the value of any voltage or current signal connected to the analog input terminals.

h. VFD display shall indicate the value of the current on the analog output terminals.

i. A red FAULT light, a yellow WARNING light and a green POWER-ON light shall be provided. These indications shall be visible both on the keypad and on the VFD when the keypad is removed.

j. A quick setup men with factory preset typical parameters shall be provided on the VFD to facilitate start-up. Use of macros shall not be required.

k. A digital elapsed time meter and kilowatt-hour meter shall be provided in the display.

l. VFD shall provide full galvanic isolation with suitable potential separation from the power sources (control, signal, and power circuitry within the drive) to ensure compliance with PELV requirements and to protect PLC's and other connected equipment from power surges and spikes.

m. All inputs and outputs shall be optically isolated. Isolation boards between the VFD and external control devices shall not be required.

n. There shall be eight fully programmable digital inputs for interfacing with the systems external control and safety interlock circuitry.

o. The VFD shall have two voltage analog signal inputs and one current signal input, and shall accept a direct-or-reverse acting signal. Analog reference inputs accepted shall include 0-10 V dc, 0-20 mA and 4-20 mA.

p. Two programmable analog outputs shall be provided for indication of drive status. These outputs shall be programmable for output speed, voltage, frequency, motor current and output power. The analog output signal shall be 0-20 mA or 4-20 mA.

q. The VFD shall provide two user programmable relays with 31 selectable functions. One form 'A' 50 VAC and one form 'C' 230 VAC/2A rated dry contact relay outputs shall be provided.

r. The VFD shall accept a NC motor temperature over temperature switch input, as well as possess the capability to accept a motor thermistor input.

s. The VFD shall store in memory the last 20 faults and record all operational data.

t. Run permissive circuit shall be provided to accept a "system ready" signal to ensure that the VFD does not start until isolation valves, seal water pumps or other types of auxiliary equipment are in the proper state for VFD operation. The run permissive circuit shall also be capable of sending an output signal as

a start command to actuate external equipment before allowing the VFD to start

E. Adjustments

a. The VFD shall have an adjustable output switching frequency.

b. In each programming set up, independent acceleration and deceleration ramps shall be provided. Acceleration and deceleration time shall be adjustable over the range from 0 to 3,600 seconds to base speed.

c. The VFD shall have four programmable “skip frequencies” with adjustable bandwidths to prevent the driven equipment from running at a mechanically resonant frequency.

d. In each programming setup, independent current limit settings, programmable between 50% and 110% of the drives output current rating, shall be provided.

e. A built-in PID controller shall be able to accept two feedback signals and two set-points. Response to the set-point/feedback differences must be programmable to allow choices between different calculation methods for the feedback signals.

f. PID parameter settings shall be adjustable while the VFD is operating, to aid in tuning the loop at start up. The VFD shall also be capable of simultaneously displaying set-point reference and feedback values with appropriate engineering units, as well as output frequency, output current, and run status while programming the PID function.

g. The VFD shall include a “loss of follower” function to detect the loss of process feedback or reference signals with a live-zero value, with a user-selectable choice of responses (go to set speed, min. speed, max. speed, stop, stop and trip).

h. A Sleep Mode function shall e provided to reduce wear and heating of the pump and other equipment in periods where system demands are minimal. This function shall operate in both open and closed loop modes:

i. In closed loop process control, when the output speed drops to a user-programmed minimum value (“sleep frequency”) for a specified time (“sleep mode timer”), the drive will enter sleep mode and either go into standby or boost mode before entering standby. The drive shall automatically restart the motor once the output of the PID process exceeds a programmable value “wake up frequency”.

j. Boost mode shall prevent short-cycling of the motor by temporarily adjusting the set-point by a user programmable percentage. Upon reaching this valve, the unit will go into standby.

k. In open loop, the drive shall be capable of entering sleep mode if the input reference drops below a user programmable value. When the input reference increases above a programmable reference, the drive will automatically start.

l. The VFD shall include a user selectable Reset function, which enables the selection of between zero and twenty restart attempts after any self-clearing fault condition (under-voltage, over-voltage, current limit, inverter overload and motor overload), or the selection of an infinite number of attempts. The time between attempts shall be adjustable from 0 through 600 seconds.

m. An automatic "on delay" function may be selected from 0 to 120 seconds.

n. The VFD shall include a user-selectable Auto-Restart function which enables the VFD to power up in a running condition after a power loss, to prevent the need to manually reset and restart the VFD.

o. VFD shall catch a rotating motor operating either in forward or reverse at up to full speed.

F. Service Conditions

a. Ambient Temperature of the VFD, -10 to 40°C (14 to 104°F).

b. 0 to 95% relative humidity, non-condensing.

c. Elevation to 3,300 feet without derating.

d. VFD's shall be rated for line voltage of 550 to 600 VAC, 380 to 480 VAC, or 200 to 240 VAC; with a +/- 10% variation. Line frequency variation of +/- 2% shall be acceptable.

e. No side clearance shall be required for cooling of the units.

G. Quality Assurance

a. The manufacturer shall be both ISO-9001 and ISO-14001 certified.

b. All products shall be CE marked, UL labeled, and meet the requirements of UL-508C.

c. To ensure quality and minimize infantile failures on the jobsite, all VFD's shall be completely tested by the manufacturer. The VFD shall operate a dynamometer at full load and speed under elevated temperature conditions.

d. All optional features shall be functionally tested at the factory for proper operation.

e. Factory test documentation shall be available upon request

H. Examination

a. Contractor shall verify that job site conditions for installation meet factory recommended and code-required conditions for VFD installation prior to start-up, including clearance spacing, temperature, contamination, dust, and moisture of the environment. Separate conduit installation of the motor wiring, power wiring, and control wiring, and installation per the manufacturer's recommendations shall be verified.

b. The VFD is to be covered and protected from installation dust and contamination until the environmental is cleaned and ready for operation. The VFD shall not be operated while the unit is covered.

I. Manufacturer shall be ABB and model ACS550.

2.8 PUMP CONTROL SYSTEM

A. Provide control equipment for a duplex pumping system with a NEMA Type 12 metallic enclosure. The operator interface terminal, control switches, pilot lights and elapsed time meters to be mounted on the front of the enclosure observable and operable without accessing the high voltage interior of the enclosure.

B. Provide control system with interlock circuitry to prevent two-pump operation during generator running condition. Only one pump shall be running on the generator.

C. Within the pump control panel, in a separate integral panel, provide thermal magnetic circuit breakers for branch disconnect service and short circuit protection for all environmental systems noted in this specification as well as any other auxiliary circuits within the station such as generator heater, louvers, telemetry system, etc. Design circuit breakers to be operable without accessing the high voltage interior of the control panel. Properly identify or label individual breakers within the panel. Provide a minimum of one spare circuit breaker.

D. Provide non-resetting six digit elapsed time meters for each pump to monitor the cumulative operating time of the pump accessed with VFD keypad remote mount kit, installed on panel door.

E. Supply pilot lights to indicate:

1. Pump running (2) “Green”

2. Pump seal failure (2) “Amber” (Sheraton Station Only)

3. Pump high temperature (2) “Red” (Sheraton Station Only)

4. VFD failure (2) “Red”

F. Provide intrinsically safe barriers for floats and level transmitters.

G. Provide seal leak and high temperature relays.

H. Provide pump monitoring relay in interface with Flygt Pumps. Pump monitoring relay shall be Mini-CAS 120,

I. Provide pumps with time delay starting to prevent overload due to simultaneous pump starting. Set delay to assure that the pumps will start at least five seconds apart.

J. Supply the control system with a lightning and surge arrestor wired into each of the three legs of the three-phase service.

K. Provide a GFI type duplex convenience outlet on the face of the enclosure wired to a separate 15-amp circuit breaker.

L. Provide the following alarm criteria for alarm notification via the telemetry system described later in these specifications.

a. High/Low Wet Well Level
b. Pump 1, 2 Run
c. Pump 1, 2 Failure
d. Generator Running
e. Generator Fault (common alarm)
f. Utility Power Fail
g. Station Flood
h. Primary Level System Fail
i. Wet Well Level – analog
j. Smoke Detector

M. Provide the control panel with a 4-20 mA analog signal correspondence to the wet well level for connection to the telemetry system described later in these specifications.

N. Provide ten spare terminal blocks in the pump control panel for connection of external alarm criteria into pump panel to provide a central interface point.

O. Label and provide coded wiring diagrams for all switches.

2.9 PUMP CONTROLLER

A. Arrange the pump controller to receive a 4-20 mA signal from the operating level sensing system. Provide a master modular programmable logic controller (PLC) installed in the pump control panel and arrange it to control pump operation. PLC shall be programmed in RSLogix5000 Version 19 or greater.

1. CPU: Allen Bradley CompactLogix processor with memory sized by integrator for the application. Alley Bradley 1769-L23E-QB1B.

2. Discrete Input Module: 16-point, 120 Volts DC, Allen Bradley 1769-IQ16.

3. Discrete Output Module: 8-point, 120 Volts AC, to be utilized in conjunction with interposing relays. Allen Bradley 1769-OW8.

4. Analog Input Module: 4-point, 16-bit resolution, 4-20 mA DC input module. Allen Bradley 1769-IF4.

5. Analog Output Module: 4-point, 16-bit resolution, 4-20 mA DC. Allen Bradley 1769-OF4.

6. Memory module

B. The Liebert® GXT3™ is a compact, online uninterruptible power system (UPS) that continuously conditions and regulates its output voltage. The Liebert GXT3 is designed to supply microcomputers and other sensitive equipment with clean sine wave input power. Upon generation, AC power is clean and stable. However, during transmission and distribution it is subject to voltage sags, spikes and complete failure that may interrupt computer operations, cause data loss and damage equipment. The Liebert GXT3 protects equipment from these disturbances. The Liebert GXT3 continuously charges its batteries from utility power, enabling it to supply power to connected loads, even when utility power fails. This section describes the UPS, its features, models, appearance and components, operating principles and operating mode.

1. Provide a UPS outside each PLC or RIO cabinet.

2. UPS shall be of the on-line double conversion style, suitable for remaining on line power when sourced by generator power.

3. UPS shall accept 120 V AC input and provide 120 V AC sine-wave output. UPS shall provide surge protection and backup power.

4. UPS shall be sized to allow 20 minutes operation at full load, 700 VA minimum.

5. Provide all necessary cables, software, and connections.

6. Provide relay interface card to be wired to PLC. Provide interposing relays for proper electrical connection to PLC. The PLC shall monitor, UPS Fault, UPS Low Battery, and On UPS Inverter.

7. Unit shall be GXT3-700RT120 manufactured by Liebert.

C. Arrange the operating system to equalize operating time of the pumps. Design the PLC to be capable of controlling the speed of either one pump or two pumps operating simultaneously.

D. Arrange the operating level sensing system and PLC to start, stop and provide a speed signal to each AFD. Factory program the PLC with the wet well operating elevations, and adjust the program, after initial startup, to meet the final conditions. If the primary level sensing system fails or a signal is lost, control will automatically switch to the redundant level sensing system and an alarm will be activated. Arrange the programmable controller to determine that a level system has failed if any of the following conditions are experienced:

1. A failure signal input directly from the submersible level transmitter.

2. Loss of signal (signal less than 4 mA dc).

3. Low float switch actuation at elevation which conflicts with the submersible level transmitter determined elevation.

4. High float switch actuation at elevation which conflicts with the submersible level transmitter determined elevation.

5. Zero or full scale signals, (4 mA or 20 mA signals), from the level transmitter.

6. In the event a pump is out of service or fails during operation, program the PLC to activate the next available pump.

E. When the HAND-OFF-AUTO selector switch is in the AUTO position, program the controller to operate the pumps from the wet well control scheme described below:

FAIRWAY KNOLLS LIFT STATION

Level Control Condition	Elevation
High Water Alarm (Float Switch - Lag Pump Full Speed)	673’-0”
High Water Alarm	672’-6”
Lag Pump On	672’-0”
Lead Pump (Maximum Speed)	671’-6”
Start Lead Pump (Float Switch – Lead Pump Full Speed)	671’-0”
Start Lead Pump (Minimum Speed)	670’-0”
All Pumps Off	668’-6”
Low Water Alarm (Float Switch – All Pumps Off)	668’-0”

SHERATON LIFT STATION

Level Control Condition	Elevation
High Water Alarm (Float Switch - Lag Pump Full Speed)	661’-6”
High Water Alarm	661’-0”
Lag Pump On	660’-6”
Lead Pump (Maximum Speed)	659’-6”
Start Lead Pump (Float Switch – Lead Pump Full Speed)	658’-0”
Start Lead Pump (Minimum Speed)	657’-6”
All Pumps Off	655’-6”
Low Water Alarm (Float Switch – All Pumps Off)	655’-0”

F. When the HAND-OFF-AUTO selector switch is in the HAND position, manually control the pump operation and AFD speed at the Pump Control Panel.

G. Furnish pump controller with an operator interface with graphics to match existing City of West Lafayette Lift Station OITs and allowing adjustment and viewing of all system parameters and status. The operator interface shall be NEMA 4 rated suitable for front door mounting on pump control panel. Communication shall be via Ethernet/IP. The OIT shall be a Panelview Plus 700 2711P-B7C4D8.

H. The process variables shall be displayed simultaneously on front panel LED bar graphs. Arrange bar graphs to provide relational viewing of all setpoints versus the measured process. Provide each display column with a minimum of 40 segments of resolution.

I. The display unit shall incorporate a high contrast LCD panel for viewing higher level functions including the following:

1. Time and Date Stamped Alarms and Events

2. Pump Statistics (run time, number of starts, etc.)

3. System Diagnostics

4. Controller Security

5. Unauthorized Station Entry

J. Provide pump controller with one Ethernet communications port for telemetry communications. The Ethernet port shall support Ethernet/IP. Unit shall support communication data rates of 100 Mbps. Provide onboard communication diagnostic LEDs for troubleshooting.

2.10 SUBMERSIBLE LEVEL TRANSMITTER (PRIMARY CONTROL)

1. Provide submersible level transmitter consisting of a submersible level element, support piping, stilling well piping and supports if required, connecting cable and panel assembly. Provide Type 316 stainless steel wall brackets and anchor bolts.

2. Provide level element of the solid-state head-pressure sensing type, suitable for continuous submergence and operation. Install level element in accordance with the manufacturer's instructions. Install the wet well sensor cable supported in the wet well in a manner to facilitate removal and calibration. Provide a scale calibration of 0 to 10 feet.

3. Fabricate the level element housing of Type 316 stainless steel with a bottom diaphragm 2-5/8" diameter of heavy-duty, foul-free, molded Teflon bonded to a synthetic rubber back/seal.

4. Provide a hydraulic fill liquid behind the diaphragm to transmit the sensed pressure to a solid-state variable capacitance element to convert the sensed pressure to a corresponding electrical value. The sensed media exerts its pressure against the diaphragm that flexes minutely so as to vary the proximity between an internal ceramic diaphragm and a ceramic substrate to vary the capacitance of an electrical field created between the two surfaces. Incorporate a stable, hybrid, operational amplifier assembly in the transducer to excite and demodulate the sensing mechanism. Design the transducer to incorporate laser-trimmed, temperature compensated and high quality components, construct the unit to provide a precise, reliable, stable output signal directly proportional to the sensed pressure over a factory-calibrated range.

5. Incorporate high over-pressure protection in the level element, and design it

to withstand intermittent over-pressure five times the full-scale range being sensed. Metallic diaphragms are not acceptable. Sensing principles employing LVDT's resistive or pneumatic elements are not acceptable.

6. Design the transducer/transmitter to include easily accessible offset and span adjustments. Provide a span adjustable from 100 percent down to 15 percent of the sensor range. Provide fine and coarse adjustments for both span and offset, using 25-turn potentiometers. Make the offset and span adjustments non-interactive, for ease of calibration.

7. Relieve the internal pressure of the level element assembly to atmospheric pressure through a heavy-duty urethane jacketed hose/cable assembly and a slack PVC bellows mounted in the NEMA 3R fiberglass transmitter assembly. Arrange the sealed breather system to compensate for variations in barometric pressure and expansion and contraction of air due to temperature changes and altitude as well as prevent fouling from moisture and other corrosive elements.

8. Arrange the submersible level transducer to use a 4-20 mA dc, 2-wire, 15 to 40 V dc loop powered transmitter with its output signal directly proportional to the measured level excursion over the factory calibrated range.

9. Accuracy: +/- 0.3 percent best straight line of full span, with a pressure range of 0 to 10 psig.

10. Transmitter operating temperature range 0 to 70 degrees C, with relative humidity 0 to 95 percent noncondensing.

11. Manufacturer shall be Siemens. Model A100i.

2.11 FLOAT SWITCHES (REDUNDANT CONTROL)

A. General: The Pump Controller shall be capable of being configured to operate the pumps and alarm on the backup floats. Provide an independent, redundant three-float (High Level, Lead and Low Level) control system in addition to the specified primary control system. The backup float shall be activated when the PLC faults or on primary level controller failure. Provide direct-acting, level-responsive float switches as described.

1. Provide single-pole, double-throw float switches mounted from Type 316 stainless steel wall brackets. All hardware for mounting float switches provided by the float switch manufacturer.

2. Attach the wall brackets to the walls with Type 316 stainless steel anchor bolts.

3. Provide suspended type float switches with internal stabilizing weights. Provide adjustable level float switches arranged to perform the functions specified.

4. Mount the wall brackets just below the access openings to facilitate level adjustments without dewatering the structures.

5. The control panel shall be UL698 Industrial Control Panel standards.

B. Operation: When the high float is activated, the controller will call the lead pump and signal the alarm. If the float does not deactivate in a predetermined adjustable time the lag pump will also start. When the low float is deactivated, the pump(s) will be turned off. Each subsequent activation of the lead on float will turn the lead pump on and subsequent activation of the high float will turn the lag pumps on. The alarm will remain on until manually reset.

1. Arrange a single high level float switch in the wet well at a higher elevation than the normal operating range of the primary control and alarm. The front face of the controller shall incorporate a High Level Alarm LED, a Control Turn-On LED, a Control-Hold LED, Control Contacts LED and a time adjustment with a 0 to 5-minute range.

2. During a high level condition sensed by the high alarm float, the High Level Alarm red LED shall light, a form C SPDT alarm output contact circuit will transfer to operate the specified alarm devices and three (3) form A, normally-open, redundant control (10 amp/240 VAC) circuits will close to provide redundant pump operation. These control circuits will be wired in parallel with the primary control system two-wire control circuits to provide a redundant capability. As the level recedes from the high level float, the alarm contact will return to its normal state; however, the redundant control contacts are to continue to operate during the time period setting of the off-delay timer. After that time interval (which is to commence following the lowering of the high level float) the control relay contacts are to re-open.

3. The redundant control/alarm capability will be completely integrated in the specified control panel and system as described and in accordance with all applicable code requirements.

2.12 MAGNETIC FLOW METER

A. General: Provide magnetic flow elements of the pulsed dc type electromagnetic, volumetric flow rate measuring type. Provide flow meters of the short form design. Design the flow meter to produce a high accuracy signal directly and linearly proportional to the liquid flow rate. Provide flow meters insensitive to changes in fluid viscosity and density. Design flow meter for continuous zero

stability. Design flow meter for operation of 120-volt, 60-hertz, single-phase power supply. Design flow meter with empty pipe detection to turn off logging or recording instruments when the pipe is dewatered.

B. Conduit and wiring installation to the magnetic flow meter shall be sealed with non-setting compound, and be watertight; suitable for accidental submergence in 30 feet of water for an indefinite period. Final conduit connection to flow meter shall be through sealed, watertight, flexible conduit.

C. Provide power to the magnetic flow meter through the flow meter converter, which shall receive 120 VAC power through a combination disconnect switch and surge protector, mounted in a non-metallic enclosure.

D. Furnish tubes with 150-pound ANSI flanged end connections, capable of withstanding the test pressure of the line it is installed in without damage. Provide each meter tube with Teflon lining. Provide Type 316 stainless steel meter electrodes. Provide metering tube that is resistant to exposure to raw sewage and up to 10 ppm chlorine solution.

E. Provide flow transmitter/converter of the microprocessor type to convert the output of the magnetic flow elements into a 4-20 mA dc signal linearly proportional to flow. Provide transmitter with output impedance of 750 ohms. Provide transmitter with a 24-volt dc scaled pulse output, 150 mA minimum, calibrated 100 gallons per pulse for driving a remote totalizer/counter.

F. Furnish transmitter/converter in a NEMA 4X enclosure factory mounted and wired within the enclosure. Furnish cable and conduit between each flow element and each signal transmitter as part of the work by the manufacturer of the magnetic flow meter. Provide each transmitter with a local flow indicator calibrated in engineering units as scheduled. Provide each transmitter with empty pipe detection.

G. The system shall be installed, wired, and calibrated in strict compliance with the manufacturer's instructions.

1. Manufacturer shall be Siemens,

H. Flow Element:

FAIRWAY KNOLLS LIFT STATION

a. Size: 4-inch
b. Operating Range: 0-1,000 gpm

a. Size: 6-inch
b. Operating Range: 0-1,500 gpm

I. Provide a spool piece for replacement of each different size flow meter.

2.13 TELEMETRY SYSTEM

A. Connection to the WWTP and lift stations is provided by the local internet service provider, Wintek. Provide an industrial network switch to connect to Wintek Cisco equipment.

1. Provide 5 port, autosensing, and auto negotiating switch.

2. 10 Base T/100 Base TX compliant with plug and play operation.

3. Switch suitable for DIN or panel mounting.

4. Power: 24vdc.

5. Network switch to be installed in the PLC cabinet.

B. Installation:

1. Contractor to integrate the lift station alarms and status into the existing iFix SCADA system at the WWTP. This integration includes 3-D graphic rendering of the lift stations. The lift station graphic renderings shall match existing graphics. Submit the lift station graphic for approval with a maximum of two revisions by the customer.

2. The lift station control panel and WWTP SCADA integration shall be by Toric Engineering (contact: Eric Walts at 317-718-1800).

2.14 ENGINE GENERATOR SET

A. General:

1. Engine generator set shall be designed to operate one pump and station environmental loads.

2. The generator set will operate at 1,800 rpm and at a voltage of 480/277 volts AC, 3-phase, 4-wire at 60 hertz.

3. The generator set shall be rated at:

a. FAIRWAY KNOLLS LIFT STATION
60 kW, 75 KVA at 0.8 PF, standby rating

b. SHERATON LIFT STATION
85 kW, 106 KVA at 0.8 PF, standby rating

B. Performance:

1. Engine Equipment shall include:

a. Electric starter as required by the manufacturer.
b. Fuel filter with replaceable element.
c. Engine driven mechanical positive displacement fuel pump.
d. Replaceable dry element air cleaner.
e. Positive displacement mechanical full pressure, lubrication oil pump with full flow lubrication of oil filters.
f. Engine speed shall be controlled by an isochronous electric governor system which will automatically control frequency to 2% or less of the rated frequency from full load to no load.

2. Engine generator set will accept a single step load of 100% nameplate kW and power factor, less applicable derating factors, with the engine-generator set at operating temperature.

3. The generator set will be capable of recovering to a minimum of 90% of rated no load voltage following the application of the specified kVA load at near zero power factor applied to the generator set. Maximum voltage dip on application of this load, considering both alternator performance and engine speed changes will not exceed 25%. Motor starting capability shall be a minimum of:

a. FAIRWAY KNOLLS LIFT STATION – 423 kVA
b. SHERATON LIFT STATION – 607 kVA

4. The alternator will produce a clean AC voltage waveform, with not more than 5% total harmonic distortion at full linear load, when measured from line to neutral, and with not more than 3% in any single harmonic, and no 3rd order harmonics or their multiples. Telephone influence factor will be less than 40.

5. The generator set shall be certified by the engine manufacturer to be suitable for use at the installed location, and will meet all applicable exhaust emission requirements at the time of commissioning.

C. Construction:

1. Mount engine generator set on a heavy-duty steel base to maintain alignment between components. The base will incorporate a battery tray with hold-down clamps within the rails.

2. Provide all switches, lamps, and meters in the control system that are oil-tight and dust-tight. Install all active control components within a UL/NEMA 3R enclosure. There will be no exposed points in the control (with the door open) that operate in excess of 50 volts.

3. The engine shall be stationary, liquid cooled, designed for use with natural gas fuel. The engine shall be 4-cycle inner cooled, turbocharged or naturally aspirated, as required by engine manufacturer. Engine shall be certified as capable of developing the following minimum horsepower at 1800 rpm:

   a. FAIRWAY KNOLLS LIFT STATION – 97.5 hp
   b. SHERATON LIFT STATION – 176 hp

4. Maximum fuel consumption at full load:

   a. FAIRWAY KNOLLS LIFT STATION – 861 cubic feet
   b. SHERATON LIFT STATION – 945 cubic feet

5. Engine protective devices to indicate alarm and engine shutdown for the following:

   a. Low coolant temperature alarm
   b. Low coolant level shutdown
   c. Low lubrication oil pressure alarm and shutdown
   d. High coolant temperature alarm and shutdown
   e. Overspeed shutdown
   f. Overcrank lockout

6. Engine mounted thermostatically controlled water jacket heaters rated for 1500 watts, 120 volts, single phase, 60 hertz.

7. Provide battery charging alternator with solid state regulator.

8. Provide an engine mounted radiator system including belt driven pusher fan, coolant pump, and thermostat temperature control cooling engine. Provide radiator with a duct adaptor flange.

9. Provide engine exhaust of the spiral type and rated for residential silencing. Mount muffler so that its weight is not supported by the engine and utilize

flexible stainless steel exhaust connectors. Route exhaust piping through the side wall of the steel base and terminate outside the housing. Provide piping external to the housing of minimum 2-inch thick calcium silicate thermal insulation with aluminum shroud.

10. Provide engine with all fuel system piping required for an automatic operation of the system. Supply all piping of black iron and sized to provide proper fuel flow for the engine. Equip engine with all supply, return, vent, and fill lines as required. Fuel connections to be factory assembled and terminate at a heavy wall coupling on the perimeter frame of the pump station structure for field connection. Completed assembly to include an isolation valve, strainer, solenoid valve, and fuel flex sized per the specific generator requirements.

11. Provide connections for connecting fuel system to the engine in compliance with applicable codes and regulations.

12. Provide a 5 amp S.C.R. voltage regulated current limited, battery float charger, to maintain fully charged cranking batteries.

D. AC Generator:

1. The AC generator will be synchronous, four pole, 2/3 pitch, revolving field, drip-proof construction, single pre-lubricated sealed bearing, air cooled by a direct drive centrifugal blower fan, and directly connected to the engine with flexible drive disc. Provide insulation system components meeting NEMA MG1 temperature limits for Class H and UL1446 listed. Actual temperature rise measured by resistance method at full load will not exceed 105 degrees Celsius.

2. The generator will be capable of delivering rated output kVA at rated frequency and power factor, at any voltage not more than 5 percent above or below rated voltage.

3. A permanent magnet generator (PMG) will be included to provide a reliable source of excitation power for optimum motor starting and short circuit performance. Provide PMG and controls capable of sustaining and regulating current supplied to a single phase or three phase fault at approximately 300% of rated current for not more than 10 seconds.

E. Generator Set Control:

1. Provide the generator set with a microprocessor-based control system (Generator Control Panel) that is designed to provide automatic starting, monitoring, and control functions for the generator set. Design the control

system to allow local monitoring and control of the generator set, and remote monitoring and control as described in this specification.

2. Mount the control on the generator set, or mount in a free-standing NEMA 4X panel next to the generator set. The control will be vibration isolated and prototype tested to verify the durability of all components in the system under the vibration conditions encountered.

F. Generator Set Control Features:

1. Mode Select Switch. The mode select switch will initiate the following control modes. When in the RUN or MANUAL position the generator set will start, and accelerate to rated speed and voltage as directed by the operator. A separate push-button to initiate starting is acceptable. In the OFF position, the generator set shall immediately stop, bypassing all time delays. In the AUTO position the generator set will be ready to accept a signal from a remote device to start and accelerate to rated speed and voltage.

2. Emergency Stop Switch. Provide a red-colored push-button. Depressing the emergency stop switch will cause the generator set to immediately shut down, and be locked out from automatic restarting.

3. Reset Switch. Provide a reset switch to clear a fault and allow restarting the generator set after it has shut down for any fault condition.

4. Panel Lamp Switch. Depressing the panel lamp switch shall cause the entire panel to be lighted with DC control power. The panel lamps shall automatically be switched off 10 minutes after the switch is depressed, or after the switch is depressed a second time. Pressing and holding this button will test all front panel LED's and meters. The meters will light one bar at a time.

5. Generator Set AC Output Metering. Provide the generator set with a metering set including the following features and functions:

a. Digital metering set, 1% accuracy, to indicate generator RMS voltage and current, frequency, output current, output KW, KW-hours, and power factor. Generator output voltage will be available in line-to-line and line-to-neutral voltages, and will display all three-phase voltages (line to neutral or line to line) simultaneously.

b. Analog voltmeter, ammeter, frequency meter, power factor meter, and kilowatt (KW) meter. Voltmeter and ammeter shall display all three phases. Meter scales shall be color coded in the following fashion:

green shall indicate normal operating condition, amber shall indicate operation in ranges that indicate potential failure, and red shall indicate failure impending. Metering accuracy shall be within 1% at rated output. Both analog and digital metering are required.

c. The control system will monitor the total load on the generator set, and maintain data logs of total operating hours at specific load levels ranging from 0 to 110% of rated load, in 10% increments. The control will display hours of operation at less than 30% load and total hours of operation at more than 90% of rated load.

d. The control system will log total number of operating hours, total kWh, and total control on hours, as well as total values since reset.

G. Generator Set Alarm and Status Display:

1. The generator set control will include LED alarm and status indication lamps. The lamps will be high-intensity LED type. The lamp condition will be clearly apparent under bright room lighting conditions. Functions indicated by the lamps will include:

   a. Running
   b. Remote Start
   c. Not in Auto
   d. Shutdown
   e. Warning

2. The control will include five (5) configurable alarm-indicating lamps. The lamps will be field adjustable for any status, warning, or shutdown function monitored by the Genset. They will also be configurable for color, and control action (status, warning, or shutdown).

3. The control will include green lamps to indicate that the generator set is running at rated frequency and voltage, and that a remote start signal has been received at the generator set. Base the running signal on actual sensed voltage and frequency on the output terminals of the generator set.

4. Include a flashing red lamp to indicate that the control is not in automatic state, and red common shutdown lamp.

5. Include an amber common warning indication lamp.

6. The generator set control will indicate the existence of the warning and shutdown conditions on the control panel. All conditions indicated below for warning will be field-configurable for shutdown. Conditions required to be annunciated will include:

a. Engine Menu to display real time information on the current state of the generator's engine. Information available for display will include:

(1) Engine coolant temperature
(2) Engine oil pressure
(3) Engine oil temperature
(4) Engine speed
(5) Battery voltage
(6) Governor duty cycle

b. Alternator Menu to display real time information on the current state of the generator's alternator. Information available for display will include:

(1) Line-to-line voltage
(2) Line-to-neutral voltage
(3) Amperage for all phases
(4) Total power output
(5) Power output per line

c. Adjust Menu will allow user control of the generator. If parameters are adjusted beyond preset factory limitations, the entry will not be accepted. User adjustments will include:

(1) Output voltage
(2) Output frequency
(3) Engine start delay
(4) Engine stop delay

d. Faults Menu to display current and up to twenty (20) historical faults for the engine and alternator. The display will indicate if the fault is active, a fault code, the total engine operation time when fault occurred, whether the fault was/is a Warning or Shutdown fault, and a brief description of the fault. A partial list of the faults that can be monitored/recorded are:

(1) low oil pressure (warning)
(2) low oil pressure (shutdown)
(3) oil pressure sender failure (warning)
(4) low coolant temperature (warning)
(5) high coolant temperature (warning)
(6) high coolant temperature (shutdown)
(7) high oil temperature (warning)
(8) engine temperature sender failure (warning)

(9) low coolant level (warning or shutdown)
(10) fail to crank (shutdown)
(11) overspeed (shutdown)
(12) low battery DC voltage (warning)
(13) high battery DC voltage (warning)
(14) weak battery (warning)
(15) low fuel-daytank (warning)
(16) high AC voltage (shutdown)
(17) low AC voltage (shutdown)
(18) under frequency (shutdown)
(19) over current (warning)
(20) over current (shutdown)
(21) short circuit (shutdown)
(22) over load (warning)
(23) emergency stop (shutdown)

H. Engine Status Monitoring: The following information will be available from a digital status panel on the generator set control:

1. engine oil pressure (psi or kPA)
2. engine coolant temperature (degrees F or C)
3. engine oil temperature (degrees F or C)
4. engine speed (rpm)
5. number of hours of operation (hours)
6. number of start attempts
7. battery voltage (DC volts)

The control system will also incorporate a data logging and display provision to allow logging of the last 10 warning or shutdown indications on the generator set, as well as total time of operation at various loads, as a percent of the standby rating of the generator set.

I. Engine Control Functions:

1. Provide the control system with a cycle cranking system, which allows for user selected crank time, rest time, and # of cycles. Initial settings will be for 3 cranking periods of 15 seconds each, with 15-second rest period between cranking periods.

2. Include an idle mode control, which allows the engine to run in idle mode in the RUN position only. In this mode, the alternator excitation system will be disabled.

3. Include an engine governor control, which functions to provide steady state frequency regulation as noted elsewhere in this specification. The governor

control will include adjustments for gain, damping, and a ramping function to control engine speed and limit exhaust smoke while the unit is starting.

4. Include time delay start (adjustable 0-300 seconds) and time delay stop (adjustable 0-600 seconds) functions.

5. Include sender failure monitoring logic for speed sensing, oil pressure, and engine temperature which is capable of discriminating between failed sender or wiring components, and an actual failure conditions.

J. Alternator Control Functions:

1. The generator set will include a full wave rectified automatic digital voltage regulation system that is matched and prototype tested by the engine manufacturer with the governing system provided. It will be immune from mis-operation due to load-induced voltage waveform distortion and provide a pulse width modulated output to the alternator exciter. The voltage regulation system will be equipped with three-phase line to neutral RMS sensing and will control buildup of AC generator voltage to provide a linear rise and limit overshoot. The system will include a torque-matching characteristic, which will reduce output voltage in proportion to frequency below an adjustable frequency threshold. Torque matching characteristic shall be adjustable for roll-off frequency and rate, and be capable of being curve-matched to the engine torque curve with adjustments in the field. The voltage regulator will include adjustments for gain, damping, and frequency roll-off. Adjustments will be broad range, and made via digital raise-lower switches, with an alphanumeric LED readout to indicate setting level. Rotary potentiometers for system adjustments are NOT acceptable.

2. Provide controls to monitor the output current of the generator set and initiate an alarm (over current warning) when load current exceeds 110% of the rated current of the generator set on any phase for more than 60 seconds. The controls will shut down and lock out the generator set when output current level approaches the thermal damage point of the alternator (over current shutdown). Provide protective functions meeting the requirements of NFPA70 article 445.

3. Controls shall be provided to individually monitor all three phases of the output current for short circuit conditions. The control/protection system shall monitor the current level and voltage. The controls shall shut down and lock out the generator set when output current level approaches the thermal damage point of the alternator (short circuit shutdown). The protective functions provided shall be in compliance to the requirements of NFPA70 article 445.

4. Provide controls to monitor the KW load on the generator set, and initiate an alarm condition (over load) when total load on the generator set exceeds the generator set rating for in excess of 5 seconds. Include a load shed control, to operate a set of dry contacts (for use in shedding customer load devices) when the generator set is overloaded.

5. Provide an AC over/under voltage monitoring system that responds only to true RMS voltage conditions. Design system to initiate shutdown of the generator set when alternator output voltage exceeds 110% of the operator-set voltage level for more than 10 seconds, or with no intentional delay when voltage exceeds 130%. Under voltage shutdown will occur when the output voltage of the alternator is less than 85% for more than 10 seconds.

6. The generator set control will include a 120VAC-control heater.

K. Other Control Functions:

1. Provide the generator set with a network communication module to allow Ethernet/IP communication with the generator set controller to PLC. The control will communicate all engine and alternator data. Data should include:
   a. Run
   b. Fault (Including all faults listed in section 2.14.G.6.d)
   c. Not in Auto
   d. Low Fuel

2. Provide a battery monitoring system which initiates alarms when the DC control and starting voltage is less than 75% or more than 115% of normal operating voltage. During engine cranking (starter engaged), the low voltage limit will be disabled, and DC voltage will be monitored as load is applied to the battery, to detect impending battery failure or deteriorated battery condition.

L. Main Circuit Breaker:

1. Provide the generator set with a mounted main line circuit breaker, sized to carry the rated output current of the generator set. The circuit breaker will incorporate an electronic trip unit that operates to protect the alternator under all overcurrent conditions, or a thermal-magnetic trip with other overcurrent protection devices that positively protect the alternator under overcurrent conditions. The supplier will submit time overcurrent characteristic curves and thermal damage curve for the alternator, demonstrating the effectiveness of the protection provided.

M. Sequence of Operation:

1. Generator set will start on receipt of a start signal from remote equipment. The start signal will be via hardwired connection to the generator set control.

2. The generator set will complete a time delay start period as programmed into the control.

3. The generator set control will initiate the starting sequence for the generator set. The starting sequence will include the following functions:

   a. The control system will verify that the engine is rotating when the starter is signaled to operate. If the engine does not rotate after two attempts, the control system will shut down and lock out the generator set, and indicate “fail to crank” shutdown.

   b. The engine will start and accelerate as quickly as practical to start disconnect speed. If the engine does not start, it will complete a cycle cranking process as described elsewhere in this specification. If the engine has not started by the completion of the cycle cranking sequence, it will be shut down and locked out, and the control system will indicate “fail to start”.

   c. The engine will accelerate to rated speed and the alternator to rated voltage. Excitation will be disabled until the engine has exceeded programmed idle speed, and regulated to prevent over voltage conditions and oscillation as the engine accelerates and the alternator builds to rated voltage.

   d. On reaching rated speed and voltage, the generator set will operate as dictated by the control system in isochronous state.

   e. When all start signals have been removed from the generator set, it will complete a time delay stop sequence. The duration of the time delay stop period will be adjustable by the operator.

   f. On completion of the time delay stop period, the generator set control will switch off the excitation system and will shut down.

   g. Any start signal received after the time stop sequence has begun will immediately terminate the stopping sequence and return the generator set to isochronous operation.

N. Factory Testing:

1. Manufacturer will perform a complete operational test on the generator set prior to shipping from the factory. Provide 3 copies of the certified test report. Equipment supplied will be fully tested at the factory for function and performance specified herein.

2. Factory testing may be witnessed by the OWNER and ENGINEER. Provide OWNER and ENGINEER two weeks notice prior to testing.

3. Generator set factory tests on the equipment will be performed at rated load and rated power factor. Generator sets that have not been factory tested at rated power factor will NOT be acceptable. Tests will include: run at full load, maximum power, voltage regulation, transient and steady-state governing, single step load pickup, and function of safety shutdowns.

O. On-Site Acceptance Test:

1. Test the completed installation for compliance with the specification following completion of all site work. Conduct testing by representatives of the manufacturer. Notify the ENGINEER in advance to witness the tests.

2. Installation acceptance tests to be conducted on-site will include a "cold start" test, a two-hour full load test, and a one step rated load pickup test in accordance with NFPA 110. Provide a resistive load bank and make temporary connections for full load test, if necessary.

2.15 AUTOMATIC TRANSFER SWITCH

A. General: The complete microprocessor controlled automatic transfer switch to be designed and manufactured by the manufacturer of the generator set. Provide schematic and wiring diagrams for the automatic transfer switch and interconnection wiring diagram for the entire standby system. Provide test reports certified by the manufacturer for the entire engine/generator/transfer switch system.

B. Power Transfer Switch:

1. Transfer switch to be rated 225 amps and 600 Volts AC minimum.

2. Provide transfer switch mounted in a NEMA 12 metallic enclosure.

3. Transfer switches will be rated to carry 100 percent of rated current continuously in the enclosure supplied, in ambient temperatures of -40 to 60 degrees C, relative humidity up to 95% (non-condensing), and altitudes up

to 10,000 feet (3000M).

4. Transfer switch equipment will have withstand and closing ratings (WCR) in RMS symmetrical amperes greater than the available fault currents and at the specified voltage. The transfer switch and its upstream protection will be coordinated. The transfer switch will be third party listed and labeled for use with the specific protective device(s) installed in the application.

C. Construction:

1. Transfer switches to be double-throw, electrically and mechanically interlocked, and mechanically held in the source 1 and source 2 positions. The transfer switch shall be specifically designed to transfer to the best available source if it inadvertently stops in a neutral position.

2. Transfer switches rated through 1000 amperes will be equipped with permanently attached manual operating handles and quick-break, quick-make over-center contact mechanisms.

3. Construct main switch contacts of high-pressure silver alloy. Provide contact assemblies with arc chutes for positive arc extinguishing. Provide insulating covers for arc chutes to prevent inter-phase flashover.

4. Transfer switch internal wiring shall be composed of pre-manufactured harnesses that are permanently marked for source and destination. Harnesses shall be connected to the control system by means of locking disconnect plug(s), to allow the control system to be easily disconnected and serviced without disconnecting power from the transfer switch mechanism.

5. Equip power transfer switch with flame retardant transparent cover to allow viewing of switch contact operation but prevent direct contact with components that could be operating at line voltage levels.

6. Transfer switches designated as 4-pole will be provided with a switched neutral pole. The neutral pole will be of the same construction and have the same ratings as the phase poles. All poles will be switched simultaneously using a common crossbar. Substitute equipment using overlapping neutral contacts is NOT acceptable.

7. Transfer switches that are designated as 3-pole will be provided with a neutral bus and lugs. The neutral bus will be sized to carry 100% of the current designated on the switch rating.

D. Connections:

1. Make field control connections on a common terminal block that is clearly and permanently labeled.

2. Provide transfer switch with AL/CU mechanical lugs sized to accept the full output rating of the switch. Lugs will be suitable for the number and size of conductors required.

E. Transfer Switch Control:

1. Provide each transfer switch with a control panel to allow the operator to view the status and control operation of the transfer switch. The operator panel will be a sealed membrane panel rated NEMA 3R/IP53 or better (regardless of enclosure rating) that is permanently labeled for switch and control functions. Provide the operator panel with the following features and capabilities:

a. High intensity LED lamps to indicate the source that the load is connected to (source 1 or source 2); and which source(s) are available. Source available LED indicators will operate from the control microprocessor to indicate the true condition of the sources as sensed by the control.

b. High intensity LED lamps to indicate that the transfer switch is “not in auto” (due to control being disabled or due to bypass switch (when used) enabled or in operation) and “Test/Exercise Active” to indicate that the control system is testing or exercising the generator set.

c. “OVERRIDE” pushbutton to cause the transfer switch to bypass any active time delays for start, transfer, and retransfer and immediately proceed with its next logical operation.

d. “TEST” pushbutton to initiate a preprogrammed test sequence for the generator set and transfer switch. The transfer switch will be programmable for test with load or test without load.

e. “RESET/LAMP TEST” pushbutton that will clear any faults present in the control, or simultaneously test all lamps on the panel by lighting them.

f. The control system to continuously log information on the number of hours each source has been connected to the load, the number of times transferred, and the total number of times each source has failed. Provide this information via the service tool or an operator

display panel.

F. Internal Controls:

1. The transfer switch control system will be configurable in the field for any operating voltage level up to 600VAC. Provide RMS voltage sensing and metering that is accurate to within plus or minus 1% of nominal voltage level. Frequency sensing will be monitored based on the normal voltage at the site. Systems that utilize voltage monitoring based on standard voltage conditions that are not field configurable are NOT acceptable.
2. Transfer switch voltage sensors will be close differential type, providing source availability information to the control system based on the following functions:

    a. Monitoring all phases of the normal service (source 1) for under voltage conditions (adjustable for pickup in a range of 85 to 98% of the normal voltage level and dropout in a range of 75 to 98% of normal voltage level).

    b. Monitoring all phases of the emergency service (source 2) for under voltage conditions (adjustable for pickup in a range of 85 to 98% of the normal voltage level and dropout in a range of 75 to 98% of pickup voltage level).

3. The transfer switch will be configurable from a Windows 95 or NT PC-based service tool, to allow setting of levels, enabling or disabling of features and functions. Selected functions including voltage sensing levels and time delays to be configurable using the operator panel. Designs using DIP switches or other electromechanical devices are not acceptable. The transfer control will incorporate a series of diagnostic LED lamps.

4. The transfer switch will be configurable to control the operation time from source to source (program transition operation). The control system will be capable of enabling or disabling this feature, and adjusting the time period to a specific value. A phase band monitor or similar device is NOT an acceptable alternate for this feature.

5. The transfer switch will incorporate adjustable time delays for generator set start (adjustable in a range from 0-15 seconds); transfer (adjustable in a range from 0-120 seconds); retransfer (adjustable in a range from 0-30 minutes); and generator stop (cool-down) (adjustable in a range of 0-30 minutes).

6. The transfer switch will be configurable to accept a relay contact signal and a network signal from an external device to prevent transfer to the generator

service.

7. Design the control system and prototype test for operation in ambient temperatures from –40 to 70 degrees C. Design and test to comply with the requirements of the noted voltage and RFI/EMI standards.

8. The control system will have optically isolated logic inputs, high isolation transformers for AC inputs, and relays on all outputs, to provide optimum protection from line voltage surges, RFI and EMI.

9. Provide the transfer switch with a battery charger for the generator set starting batteries. Battery charger to be of the float type charger rated 2 amps. Provide battery charger with an ammeter for display of charging current and fused AC inputs and DC outputs.

G. Control Interface:

1. The transfer switch will provide an isolated relay contact for starting of a generator set. The relay will be normally held open, and close to start the generator set. Output contacts will be form C, for compatibility with any generator set.

2. Provide one set Form C auxiliary contacts on both sides, operated by transfer switch position, rated 10 amps 250 VAC.

3. Provide relay contacts to indicate the following conditions: source 1 available, load connected to source 1, source 2 available, load connected to source 2.

H. Operation:

1. Transfer switch normally connects an energized utility power source (source 1) to loads and a generator set (source 2) to the loads when normal source fails. The normal position of the transfer switch is source 1 (connected to the utility), and no start signal is supplied to the generator set.

2. Generator Set Exercise (Test) With Load Mode. The control system will be configurable to test the generator set under load. In this mode, the transfer switch will control the generator set in the following sequence:

a. Transfer switch will initiate the exercise sequence at a time indicated in the exercise timer program, or when manually initiated by the operator.

b. Transfer switch will issue a compatible start command to the

generator set.

c. When the control systems senses the generator set at rated voltage and frequency, it will operate to connect the loads to the generator set by opening the normal source contacts, and closing the alternate source contacts a predetermined time period later. The timing sequence for the contact operation will be programmable in the controller.

d. The generator set will operate connected to the load for the duration of the exercise period. If the generator set fails during this period, the transfer switch will automatically reconnect the generator set to the normal service.

e. On completion of the exercise period, the transfer switch will operate to connect the loads to the normal source by opening the alternate source contacts, and closing the normal source contacts a predetermined time period later. The timing sequence for the contact operation will be programmable in the controller.

f. The transfer switch will operate the generator set unloaded for a cool-down period, and then remove the start signal from the generator set. If the normal power fails at any time when the generator set is running, the transfer switch will immediately connect the system loads to the generator set.

3. Generator Set Exercise (Test) Without Load Mode. The control system will be configurable to test the generator set without transfer switch load connected. In this mode, the transfer switch will control the generator set in the following sequence:

a. Transfer switch will initiate the exercise sequence at a time indicated in the exercise timer program, or when manually initiated by the operator.

b. Transfer switch will issue a compatible start command to the generator set.

c. When the control systems senses the generator set at rated voltage and frequency, it will operate the generator set unloaded for the duration of the exercise period.

d. At the completion of the exercise period, the transfer switch will remove the start signal from the generator set. If the normal power fails at any time when the generator set is running, the transfer switch will immediately connect the system loads to the generator set.

I. Factory Testing:

1. The transfer switch manufacturer will perform a complete operational test on the transfer switch prior to shipping from the factory. The test shall include simulated power outage and operation test of all components as a completed system related to generator, transfer switch, environmental panel and wiring to pump panel. Provide 3 copies of certified test reports. Test process will include calibration of voltage sensors.

2.16 MODULAR SOUND ATTENUATING ENCLOSURE

A. Enclosure

1. The generator, automatic transfer switch and other associated equipment to be enclosed in a Walk-in enclosure with one (1) double entry door and structural steel base.

2. Enclosure shall be all welded construction with a minimum 16 gauge galvanized structural shapes and plate. All structural components to be welded at all intersections to create a unitized framework.

3. Exterior siding shall be constructed of poly vinyl chloride (PVC) compounds meeting ASTM D 3679 requirements. Vinyl siding shall meet the minimum fire and performance standards:
   a. Flame Spread Index: No more than 25, when tested in accordance with ASTM E 84.
   b. Smoke Developed Index: No greater than 450, when tested in accordance with ASTM E 84.
   c. Ignition Temperature: When tested in accordance with ASTM D 1929, no self ignition and no flaming; no smoldering at less than 875 degrees F.
   d. Average Time of Burning: Less than 5 seconds, when tested in accordance with ASTM D 635.
   e. Average Extent of Burning: Less than 5 mm, when tested in accordance with ASTM D 635.
   f. Camber: Meet all requirements for camber per ASTM D 3679.
   g. Heat Shrinkage: Meet all requirements for heat shrinkage per ASTM D 3679.
   h. Weatherability: No surface or structural defects such as peeling, cracking, or chipping or blistering when tested per ASTM D 3679.
   i. Surface Distortion: No distortion at 120 degrees F (40.5 degrees C), per ASTM D 3679.
   j. Impact Resistance: 60 ft-lbs/in at 20 degrees C when tested in accordance with ASTM D 256.

k. Color Formulation: All colors to be formulated with acrylic capstock for fade protection. Customer shall be provided with pattern and color samples for selection of finish.

4. Interior of enclosure shall have minimum 3/8-inch CDX plywood surface and finished with FRP overlay installed over a 6 mill poly vapor barrier. FRP interior panels shall be a white textured finish. Panels shall be water and stain resistant.

5. Roof structure shall be a gable style roof of wood construction with standard dimensional lumber. Rafters and joints shall be minimum 2” x 6” material. Roof cavities shall be insulated to a value of R30. Sheathing shall be 5/8-inch CDX and finished with roofing felt and 25-year asphalt 3-tab shingles. Roof pitch to be minimum 1” rise to 3” run. Roof shall be provided with a drip edge.

6. Provide 0.051-inch thick ASTM B 209, Alloy 3003-H14 aluminum gutters, 5 inches high and 6 inches wide with end caps to match the profile of the gutters. Provide aluminum rectangular downspouts 4 inches by 5 inches. Provide downspout nozzle sized to match downspout and a precast concrete splash block at the bottom of each downspout. Finish gutters, downspouts, straps, nozzles and end caps in a Kynar 500 finish in color as selected by Engineer and Owner from the full range of supplier’s product line. Install gutters and downspouts in accordance with the SMACNA Architectural Sheet Metal Manual and as follows:

   a. Gutters: Pitch gutters 1/16-inch per foot to drain and lap ends 3 inches in the direction of flow. Rivet seams at 2-inch centers and caulk. Fasten gutters to the fascia with spikes and ferrules (strap hangers) at a maximum of 36-inch centers. Rivet or weld outlet to gutters and extend 2 inches into leaders or downspouts. Provide for expansion and contraction.

   b. Downspouts: Support downspouts with 1/8- by 3-inch aluminum straps at top and bottom and a maximum of 6 feet on center. Extend straps on wall surface or around posts 2 inches each side of downspout. Secure to masonry with expansion shields and stainless steel machine bolts and to wood with stainless steel lag screws. Provide removable screen at the top of the downspouts and an elbow at the bottom.

7. Entry doors shall be double-door, 1-3/4” thick cold rolled steel with insulated core. Hinge side shall be welded, filled and ground smooth for the full height of the door. Lock side of the door shall be reinforced with a single-piece 14 gauge stiffener. Provide 12” x 12” viewing windows in both

doors. Doors shall come with lockset, closer and entry door sensor. Door shall be equipped with a weatherproof neoprene door gasket and drip cap.

8. Design enclosure to withstand a wind load of 90 miles per hour. Design roof to withstand a minimum loading of 80 pounds per square foot.

9. Design enclosure so that the maximum sound level generated is does not exceed 82 Db at a distance of twenty-five (25) feet from the intake or the exhaust louver. Sound readings shall be taken with generator operating under full load condition.

10. Provide two (2) wall mounted shelving units measuring 2 feet wide by 1 foot deep. Shelves are to be water and stain resistant. Coordinate final location with Engineer and Owner.

B. Steel Base Assembly

1. Provide type 304 stainless steel base designed to support the fiberglass enclosure. Construct the steel base of standard sizes of rectangular tube formed steel members meeting ASTM A 36. Minimum wall thickness for steel members shall be ¼-inch thickness. Construct floor plating of minimum ¼-inch thickness meeting ASTM A 36. Design base with adequate lifting points for installation and anchoring. Lifting points shall be removable after installation for aesthetic reasons.

2. Secure enclosure to steel base assembly by using stainless steel fasteners and a closed cell neoprene gasket. Design shall preclude moisture from entering the housing at the union of the enclosure and steel base.

3. The floor area of the base will receive an additional non-skid coating system.

2.17 ELECTRICAL ASSEMBLY

1. Provide all conduit and wiring in accordance with the latest edition of the National Electric Code and Division 16 of these Specifications.

2. All couplings for field connection of conduits will be heavy wall steel construction and will be continuously welded around their circumference. External conduits will be rigid galvanized steel with threaded connections. Conduits that enter the wet well area will be fitted with seal off fittings and sealing compound provided by Lift Station Manufacturer.

3. CONTRACTOR shall be responsible for providing all conduit and wires as required. CONTRACTOR shall coordinate with the Lift Station

Manufacturer regarding conduit and wiring requirements. Provide conduit and wiring between the automatic transfer switch and the generator as required by the Lift Station Manufacturer. Provide conduit and wiring between the transfer switch and the Pump Control Panel as required by the Lift Station Manufacturer. Provide conduit and wiring between the Pump Control Panel and the wet well access as required by the Lift Station Manufacturer. Conduit and wiring between the aforementioned locations will be furnished and installed by CONTRACTOR.

4. CONTRACTOR will furnish and install a fused, main disconnect switch adequately sized for the equipment at the Lift Station. The disconnect switch will be located within a NEMA 4X stainless steel enclosure with provisions for locking the switch in either the open or close position.

2.18 INTAKE AND EXHAUST LOUVERS

1. Provide a complete intake and exhaust louver system designed to supply an adequate amount of air for both cooling and combustion. The system shall consist of intake and exhaust louvers, motorized operators, and radiator duct discharge assembly.

2. Provide louvers meeting the certified AMCA Standard 500 at a maximum of 0.35” WG while the engine generator set is operating a full load. Louvers to be 6-inch, multi-blade, minimum 13-gauge extruded aluminum, 6063-T5 alloy, with 5/8-inch thick aluminum mesh removable bird screen. Provide louvers of the powered type with fixed and adjustable blades motorized to the closed position with a spring return. Furnish adjustable louver blades with a closed cell gasket to insure minimum air infiltration while closed. The gasket shall be replaceable.

3. Provide UL labeled motorized actuator of the two position design that rotate clockwise when power is supplied. Supply actuator rated for 120 volts, single phase, 60 hertz and a minimum 60 inch-pound torque rating. Environmental systems control panel to include relay logic to control actuation of the louvers. Louvers shall remain open for a user adjustable period of time after generator operation to allow for cooling within the enclosure.

4. Provide a duct assembly between the engine radiator and the exhaust louver. Design duct assembly to provide a minimum amount of restrictions and a smooth airflow from the radiator to the exhaust louver.

2.19 ENVIRONMENTAL SYSTEMS

1. Provide a step down transformer of a minimum 10 KVA capacity for

operation of the environmental controls when an external single-phase power source is not available.

2. Provide a minimum of four (4) dual element, 20 watt, LED tube light fixtures mounted in the ceiling of the housing. Lighting control shall operate when the entry hatch is open and shall have a manual override.

3. Provide a minimum of two (2) exterior LED light fixtures with photocell operators, located as shown on the plans.

4. Provide ventilation blower wall mounted inside the housing and associated ductwork to the outside atmosphere. Design blower to be capable of one air change every 10 minutes. Control relay logic shall control the ventilation blower as follows:

   a. Constant run when access hatch is open or when automatic switch is overridden
   b. Repeat cycle operation with adjustable on-off settings
   c. Constant run for user adjustable on time after generator operation
   d. Constant run upon temperature rise to user adjustable thermostat set point within station

5. Provide a minimum 5 kW unit heater with internal thermostat designed to operate on a single phase, 60 hertz, 240 volt electrical service. The heater shall also be ‘locked out’ when the generator is running.

6. Equip station with a wall mounted float switch to detect a station flooding condition and actuate the alarm system if water accumulates in the station to a level one-inch above the floor level.

7. Provide a 30-pint per day dehumidifier within the housing and its discharge piped to the sump pump for continuous drainage. Design humidifier to be automatically controlled through an integral, adjustable, humidstat.

8. Provide a 1/3 HP, cast iron sump pump with integral float switch capable of 1,000 GPH at 15 feet TDH. The pump discharge shall be 1-1/2” NPT and discharge shall be fitted with a check valve and isolation valve. CONTRACTOR to install sump pump and discharge piping.

9. Provide a standalone wall mounted smoke detector with battery backup. Use the dry contacts on the smoke detector to provide alarm notification to the telemetry system. Smoke detector shall be Edwards 517 Series or equivalent.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install all equipment in accordance with the manufacturer's recommendations. Complete all wiring and piping and make all necessary adjustments to equipment to provide a complete operational pumping installation.

3.2 FIELD QUALITY CONTROL

A. Manufacturer's Field Services: Furnish the services of a qualified representative of the manufacturer of the pump station equipment and generator set to inspect the installation, make any necessary adjustments, participate in the startup of the equipment, participate in the field testing of the equipment, place the equipment in trouble-free operation, and instruct the operating personnel in its operation and maintenance. Provide ENGINEER with a written start-up report prepared by the technician at the job site.

B. Tests: After installation of the pumping units, generator set, pump control panel, control equipment and all appurtenances, subject each unit to a field running test as specified in Division 1, under actual operating conditions. Perform the field tests in the presence of and as directed by the ENGINEER. Demonstrate that under all conditions of operation each pumping unit:

1. Has not been damaged by transportation or installation.
2. Has been properly installed.
3. Has no mechanical defects.
4. Has been properly connected.
5. Is free of overheating of any parts.
6. Is free of overloading of any parts.
7. Is free of all objectionable vibration.

C. Test the pumps to demonstrate that the pumps and control system operate as specified. Promptly correct any defects in the equipment or failure to meet the requirements of the Specifications.

3.3 WARRANTY

A. The station manufacturer shall warrant for one year from the date of start-up, not to exceed eighteen months from date of shipment, that the structure and all equipment will be free from defects in design, material and workmanship.

B. The generator set manufacturer will provide a prorated five (5) year warranty or fifteen hundred hours (1500) operation whichever comes first against defects in design, material and workmanship under normal use, operation and service.

C. The pump manufacturer will provide a prorated five (5) year warranty against defects in design, material and workmanship under normal use, operation and service.

END OF SECTION

SECTION 16050

BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: General requirements for providing basic electrical materials and methods.

B. Related Work Specified in Other Sections Includes, But is Not Limited to, the Following:

1. Certain equipment, control devices, conduit and wiring are shown on electrical drawings, but are specified in other sections pertaining to plumbing, heating, ventilating, air conditioning, temperature control systems, process equipment, process control systems and instrumentation. Install and connect these items to the electrical system as indicated or required in accordance with the Contract Documents.

C. Overall Application of Specifications: This Section applies to all Division 16 sections and to other sections that include requirements for electrical equipment. Irrespective of where the electrical requirements are specified, provide and install all materials necessary for a complete operational system.

D. Temporary Requirements: This Section applies to any temporary circuits, overcurrent devices, conduit, wiring, and other equipment required during changeover from the existing electrical system to a new electrical system. This Section also applies to temporary rewiring of lighting circuits, power circuits, instruments and devices.

1.2 DEFINITIONS

A. Hazardous Areas: Hazardous areas as defined by the NEC as Class I, Division 1, Group D, or Class I, Division 2, Group D. The following areas are designated hazardous:

1. Class 1, Division 1, Group D

a. Wet Well

2. Class 1, Division 2, Group D

a. Meter Vault

B. Corrosive Areas: The following areas are designated corrosive areas:

1. Outdoors
2. Below Grade

1.3 SYSTEM DESCRIPTION

A. Design Requirements: Design requirements are specified in the applicable sections.

B. Performance Requirements: Performance requirements are specified in the applicable sections.

1.4 SUBMITTALS

A. General: Furnish all submittals, including the following, as specified in Division 1.

B. Product Data and Information: Furnish a complete list of electrical equipment and materials to be furnished that shows the manufacturer, catalog number, size, type, capacity, voltage rating and other pertinent information related to each item on the list.

1. Furnish catalog data on the manufacturer's standard equipment and materials. Clearly indicate on the catalog data the equipment and devices specifically being proposed.

2. Identification: Furnish a complete schedule or listing of system and equipment identification labels with legends.

C. CONTRACTOR's Shop Drawings: Furnish shop drawings on items manufactured for the Contract.

1. Furnish a connection diagram and schematic for each piece of electrical equipment. A manufacturer's standard connection diagram or schematic showing more than one method of wiring is not acceptable unless, the intended method is clearly marked.

2. Furnish diagram that show connections to field equipment. Clearly differentiate between manufacturer's wiring and field wiring.

3. Furnish raceway layout drawings that show conduits, boxes, and panels which contain the conductors to be provided. Include schedules listing conduit sizes and conductor content and identification.

4. Where additions and modifications are made to existing equipment, furnish drawings which clearly identify the existing equipment that remains and the new Work.

D. Coordination Drawings: Furnish coordination drawings that have a scale of 1/4"=1'-0" or larger; that show major elements, components, and systems of electrical equipment as they relate to other systems, installations, and building components. Indicate locations where access space is limited and where sequencing and coordination of installations are required for the efficient flow of the Work, including (but not limited to) the following:

1. Indicate the proposed locations of major raceway systems, equipment, and materials. Include the following:

a. Clearances for servicing equipment, including space for equipment disassembly as required for periodic maintenance.

b. Exterior wall and foundation penetrations.

c. Fire-rated wall and floor penetrations.

d. Equipment connections and support details.

e. Sizes and location of required concrete pads and bases.

2. Indicate scheduling, sequencing, movement, and positioning of large equipment into the building during construction.

3. Prepare floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.

4. Prepare reflected ceiling plans to coordinate the installation of air outlets and inlets, light fixtures, communications systems components, sprinklers, and other ceiling-mounted devices.

E. Record Documents: Furnish record documents, and in addition to the requirements specified in Division 1, indicate installed conditions for:

1. Interior and exterior major raceway systems' sizes and locations; locations of control devices; distribution and branch electrical circuitry; and fuse and circuit breaker sizes and arrangements.

2. Exposed and concealed equipment locations dimensioned from prominent building lines.

3. Approved substitutions, and actual equipment and materials installed.

F. Maintenance Manuals: Furnish maintenance manuals, and in addition to the requirements specified in Division 1, include the following information for equipment items:

1. Functional description, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and catalog numbers of replacement parts.

2. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.

3. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.

4. Servicing instructions and lubrication charts and schedules.

1.5 QUALITY ASSURANCE

A. Codes: Provide all electrical Work in accordance with applicable local codes, regulations and ordinances. If there is a conflict between the requirements specified in the Contract Documents and the codes, follow the more stringent requirements as determined and approved.

B. Testing: As a minimum, provide standard factory and field tests for each type of equipment. Other tests may be specified in the applicable equipment section.

C. Labeling: Provide electrical equipment and materials that are listed and approved by Underwriters Laboratories or other OSHA recognized testing laboratories with the testing agency's label attached.

D. Standard Products: Unless otherwise indicated, provide electrical materials and equipment which are the standard products of manufacturers regularly engaged in the production of such materials and equipment. Provide the manufacturer's latest

standard design that conforms to these Specifications. Provide the products of the same manufacturer when two or more units of the same class of material and equipment are required.

1.6 DELIVERY, STORAGE AND HANDLING

A. General: Deliver, store and handle all products and materials as specified in Division 1.

B. Shipping and Packing: Provide materials and equipment suitably boxed, crated or otherwise completely enclosed and protected during shipment, handling, and storage. Clearly label such boxes, crates or enclosures with manufacturer's name, and name of material or equipment enclosed.

C. Acceptance at Site: Conform to acceptance requirements as required in Division 1.

1. Repair or replace all materials and equipment damaged by handling and storage as directed at no additional Contract cost.

D. Storage and Protection: Protect materials and equipment from exposure to the elements and keep them dry at all times. Handle and store to prevent damage and deterioration in accordance with manufacturer's recommendations.

1.7 PROJECT CONDITIONS

A. General: The Drawings indicate the extent and general arrangement of the principal electrical elements, outlets, devices and circuit layouts. Install and connect all electrical elements and devices to form a complete workable system as required by the Contract Documents, regardless of whether all system components are specifically stated in the Specifications or shown. Provide necessary materials and installation wherever required to conform to the specific requirements of the furnished equipment and for proper installation of the Work.

B. Schematics: In general the runs of feeders are shown schematically and are not intended to show exact routing and locations of raceways. Verify actual and final arrangement, equipment locations, and prepare circuit and raceway layouts before ordering materials and equipment. Equipment locations are approximate and are subject to modifications as determined by approved equipment dimensions.

C. Coordination of Work: Coordinate the Work so that the electrical equipment may be installed without altering building components, other equipment or installations.

D. Departure from Design: If departures are deemed necessary due to structural conditions, obstructions or other problems, provide details of such departures and the reasons for requesting approval as soon as practicable but not later than the

submittal of the raceway layout drawings. Do not make any departures without written approval.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.1 ROUGH-IN

A. Final Location: Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.

3.2 ELECTRICAL INSTALLATIONS

A. General: Sequence, coordinate, and integrate the various elements of electrical systems, materials, and equipment. Comply with the following requirements:

1. Coordinate electrical systems, equipment, and materials installation with other building components.

2. Verify all dimensions by making field measurements.

3. Arrange for chases, slots, and openings in other building components as construction progresses to provide for electrical installations.

4. Coordinate the installation of required supporting devices and sleeves to be set in cast-in-place concrete and other structural components, as they are constructed.

5. Sequence, coordinate, and integrate installations of electrical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the building.

6. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum possible headroom.

7. Coordinate connection of electrical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide all required connections for each service.

8. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the ENGINEER for resolution.

9. Where installed exposed in finished spaces, install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components.

10. Provide electrical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.

11. Provide access panels or doors where units are concealed behind finished surfaces.

12. Install systems, materials, and equipment providing right-of-way priority to systems required to be installed at a specified slope.

3.3 CUTTING AND PATCHING

A. General: Perform cutting and patching as specified in Division 1. In addition to the requirements specified in Division 1, the following requirements apply:

1. Perform cutting, fitting, and patching of electrical equipment and materials required to:

a. Uncover Work to provide for installation of ill-timed Work.

b. Remove and replace defective Work.

c. Remove and replace Work not conforming to requirements of the Contract Documents.

d. Remove samples of installed Work as specified for testing.

e. Install equipment and materials in existing structures.

f. Locate existing structural reinforcing with a pachometer where core drilled penetrations are required so as not to cut the steel reinforcing.

2. Cut, remove, and properly dispose of selected electrical equipment, components, and materials as indicated. Included are the removal of

electrical items indicated to be removed and items made obsolete by the new Work. Deliver all removed serviceable apparatus to the OWNER as directed.

3. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.

4. Provide and maintain adequate temporary partitions or dust barriers that prevent the spread of dust and dirt to adjacent areas.

5. Protection of Installed Work: During cutting and patching operations, protect adjacent installations.

6. Patch finished surfaces and building components using new materials that are compatible with the original installation and applied by experienced installers

END OF SECTION

SECTION 16060

GROUNDING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Requirements for providing a complete grounding system as specified and shown. Grounding includes but is not limited to: electric equipment enclosures, transformers, generators, disconnect switches, automatic transfer switches, adjustable frequency drives, duplex control panels, motor control centers, ground grid systems, grounding rods, grounding conductors, bonding jumpers, water pipe connections, and structure metal frames as required.

B. Related Work Specified in Other Sections Includes:

1. Section 16050 - Basic Electrical Materials and Methods
2. Section 16121 - Wires and Cables - 600 Volts and Below
3. Section 16130 - Electrical Raceway Systems

1.2 REFERENCES

A. Codes and Standards: The following codes and standards are referred to in this Section:

1. NEC - National Electrical Code

1.3 SUBMITTALS

A. General: Furnish all submittals, including the following, as specified in Division 1.

B. Product Data and Information: Furnish manufacturer's catalog data for the following:

1. Grounding and grounded conductors
2. Grounding connectors, clamps and bushings
3. Grounding rods
4. Bonding jumpers

C. Shop Drawings: Furnish shop drawings showing the locations and length of grounding rods. Label the size and material used for grounding rods. Furnish details pertaining to grounding electrode conductors, grounding and grounded conductors, grounding connections and the ground grid for buildings, structures, and lighting units.

D. Quality Control: Furnish a field report of the system ground impedance test results.

1.4 QUALITY ASSURANCE

A. Codes and Standards: Construct a complete grounding system in accordance with applicable ANSI, IEEE Standards and the NEC and local codes.

1.5 DELIVERY, STORAGE AND HANDLING

A. General: Deliver, store and handle all products and materials as specified in Division 1.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers: Acceptable manufacturers are listed below. Other manufacturers of equivalent products may be submitted for review.

1. Grounding and Grounded Conductors

a. American Insulated Wire Corporation
b. Southwire Company

2. Ground Plates

a. Burndy Corporation
b. OZ/Gedney Company
c. Erico Products
d. Thomas & Betts

3. Grounding Rods

a. Harger Lightning Protection, Inc.
b. Thomson Industries, Inc.
c. Carolina Galvanizing Utility Products Division
d. Erico Products

e. Superior Grounding Systems

4. Ground Rod Access Box

a. Hubbell Power Systems – Quazite
b. Hartford Concrete Products, Inc.

2.2 MATERIALS

A. General: Provide conductor sizes as shown or required.

B. Materials: Provide conductors in accordance with the requirements specified in Section 16121.

C. Bare conductors: Provide bare copper conductor where buried in earth, embedded in concrete or exposed.

D. Insulated Conductors: Provide copper conductor with green color insulation rated at 600 volts where installed in conduits or other enclosed raceways.

2.3 CONNECTORS

A. Grounding Clamps and Bolted Connectors: Provide grounding clamps and bolted connectors suitable for devices or cables being connected.

B. Ground Plates: Provide two-hole, cast, copper alloy, ground plates suitable for installation in concrete. Fabricate the ground plates with two ½-inch diameter threaded holes and a 4/0 stud for connection to the grounding system.

C. Welding: Provide the exothermic welding process for buried, concealed and accessible connections to structural members, ground rods, and case grounds. Clean and paint welds embedded in the ground or encased in concrete with asphalt base paint.

D. Bolted Connectors: Provide bolted connectors for grounding to ground buses and equipment.

E. Pipe Grounding: Provide copper, brass, or bronze grounding clamps for grounding pipes. Do not provide strap type clamps.

F. Grounding Bushings: Provide grounding bushings for conduits where conduits are not effectively grounded by firm contact to the grounded enclosure.

2.4 GROUNDING RODS

A. Length and Size: Provide grounding rods 3/4-inch in diameter and 10 feet long.

B. Grounding Rod Material: Stainless steel.

PART 3 EXECUTION

3.1 INSTALLATION

A. General:

1. Install conductors to preclude exposure to physical damage.

2. Install connections firm and tight.

3. Arrange conductors and connectors without placing strain on the connections.

4. Bury equipment grounding conductors as shown, or at a minimum of 12 inches below grade.

5. Bring loops or taps up for connection to equipment or other items to be grounded.

6. Install an insulated grounding conductor in all conduits.

7. When raceways are used to contain and protect grounding conductors, install in accordance with Section 16130 and NEC.

8. Where conductors are installed in nonmetallic raceway, provide the grounding conductor in addition to the neutral wire, sized in accordance with NEC or as scheduled.

9. Perform exothermic welding with properly sized molds.

B. Grounding Rod Installation:

1. Install grounding rods as shown with the top of the rod a minimum of 12 inches below grade.

2. Drive grounding rods into permanently moist soil.

3. Provide additional ground rod sections as required to reach permanently moist soil.

4. Provide cast iron junction box without bottom for access to grounding rod and conductor where shown.

C. Equipment Grounding: Ground each piece of electrical equipment using a conductor in the raceway feeding the equipment in accordance with NEC.

1. Unless specified otherwise, connect transformer enclosures and neutrals to the grounding system. Connect the neutral ground connection at the transformer terminal. Make the connection from the ground grid to the ground bus and enclosures of switchboards, switchgears and motor control centers, lighting and distribution panelboards, and control, relay and instrumentation panels.

2. Provide two separate, independent, diagonally opposite connections for power transformers so removal of one connection will not impair continuity of the ground system. Provide ground plates that are imbedded in the concrete pad so that transformers can be removed without damaging grounding system. Install a copper ground connect between ground plates and the transformers.

D. Grounding Conductors: Connect the grounding conductor between the equipment and the grounding system. Where a ground bar is furnished with the panelboard, connect the grounding conductor to the bar.

E. Miscellaneous Grounding: Provide grounding for the following:

1. Ground receptacles and switches and their metal plates through positive ground connection to the yoke/strap, outlet box and grounding system grounding wire installed in the conduit.

2. Ground racks, supports, frames, covers and metal parts in control panels, generators, disconnect switches, automatic transfer switches, controllers, motor frames, surge capacitors, arrestors, lighting fixtures, metal structures, exposed noncurrent carrying metal, mechanical equipment, hoist beams, cranes and similar items.

3. Provide ground connections to equipment using ground plates imbedded in the concrete pad so that the equipment can be removed without damaging grounding system. Provide a copper ground connection between ground plates and the equipment.

3.2 FIELD QUALITY CONTROL

A. Tests: Conduct a witnessed test to determine the ground impedance for the entire system using a ground loop impedance tester. Provide a maximum impedance of 2 ohms at any point of the test. Add additional grounding rods if necessary to meet this requirement.

END OF SECTION

SECTION 16121

WIRES AND CABLES - 600 VOLTS AND BELOW

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Requirements for providing all wires and cables rated at 600 volts and below for complete electrical systems as shown.

B. Related Work Specified In Other Sections Includes:

1. Section 16050 - Basic Electrical Materials and Methods

1.2 REFERENCES

A. Codes and standards referred to in this Section are:

1. ASTM B 3 - Standard Specifications for Soft or Annealed Copper Wire

2. ASTM B 8 - Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft

3. TIA/EIA 568-A - Commercial Building Telecommunications Cabling Standard

1.3 SUBMITTALS

A. General: Furnish all submittals, including the following, as specified in Division 1 and Section 16050.

B. Product Data and Information: Furnish manufacturer's catalog data for each type of wire and cable furnished.

1.4 QUALITY ASSURANCE

A. General: Furnish wire and cable in accordance with applicable IEEE and NEMA standards, meeting the requirements of the NEC and UL listed.

B. Tests: Furnish cables factory tested prior to shipment in accordance with ICEA standards for the insulation specified.

1.5 DELIVERY, STORAGE AND HANDLING

A. General: Deliver, store and handle wire and cable in accordance with the manufacturer's instructions and as specified in Division 1.

B. Storage: Store cable reels on concrete or other hard surface or on 2x4 wood laggings.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers: Acceptable manufacturers are listed below. Other manufacturers of equivalent products may be submitted for review.

1. Wire and Cable

   a. American Insulated Wire Corporation
   b. Southwire Company

2. Instrumentation Cable

   a. Belden
   b. Dekoron
   c. The Okonite Company

3. Multiconductor Cable

   a. The Okonite Company
   b. Rome Cable Corporation
   c. Southwire Company

4. Wire Connectors

   a. Thomas & Betts
   b. 3 M/Electrical Products Division
   c. Ideal

5. Color Coding Marker

   a. W. H. Brady Company
   b. Thomas & Betts

2.2 MATERIALS

A. Conductors: Provide soft drawn or annealed copper conductors with 98 percent minimum conductivity, meeting requirements of ASTM B 3 (solid) or ASTM B 8 (stranded). Use stranded conductors except solid No. 12 and No. 10 AWG may be used in lighting fixture and convenience outlet wiring.

B. Insulation: Provide wires and cables with insulation as follows:

1. Power, control and lighting wiring

a. Single Conductor: Provide insulation as follows:

NEC Type Letter	Insulation Material
XHHW	Cross-linked Polyethylene

b. Multiconductor Cables: Insulate individual conductors with 15 mils of polyethylene or PVC and 4-mil nylon jacket. Wrap the conductors with type binder and an outer jacket not less than 45 mils of PVC. Use ICEA Method 1 for color coding wires.

2. Instrumentation Wiring: The manufacturers' name and catalog number shown below are for the purpose of establishing quality and general configuration.

a. Two conductor or single pair: Stranded No. 16 AWG wire, 600 volt polyethylene insulation, twisted conductors, tinned copper drain wire, overlapped metalized tape overall shield providing 100 percent shield coverage and outer jacket of PVC. Belden Cat. No. 8719.

b. Three Conductor: Stranded No. 16 wire, 600 volt polyethylene insulation, twisted conductors, tinned copper drain wire, overlapped metalized tape overall shield providing 100 percent shield coverage and outer jacket of PVC. Belden Cat. No. 8618.

c. Multiple Pairs or Triads: Provide individually shielded pairs or triad of stranded No. 16 AWG wire with overall shield. Insulate each wire for 600 volts with 15 mils of PVC and a 4-mil nylon jacket. Assemble pairs or triads with tinned copper drain wire and metalized tape shield providing 100 percent shield coverage. Cable pairs or triads together with tinned copper drain wire and overall metalized tape shield.

3. Data (Local Area Network) Cable: The manufacturers' name and catalog number shown below are for the purpose of establishing quality and general configuration.

   a. Category 6: Provide cable having third party verification to TIA/EIA 568-B.2-1 Category 6 requirements and constructed of four pair of solid No. 23 AWG solid copper wire, polyolefin insulation, film tape separator and outer jacket of black industrial grade sunlight and oil resistant PVC. Belden Cat. No. 2412.

C. Printed Data on Covering: Provide the following information printed on the surface of all wires and cables at regular intervals throughout the entire length.

1. Manufacturer or trade name.
2. Size of conductor.
3. Type of insulation.
4. Voltage classification.

2.3 WIRE CONNECTIONS AND CONNECTING DEVICES

A. Connectors for No. 10 AWG and Smaller: Provide insulated compression type butt connectors.

B. Connectors for No. 8 AWG and Larger: Provide UL, Inc. listed compression type tube connectors for parallel or butt splices. Provide companion preformed plastic insulating covers or tape to provide insulation equal to conductor insulation.

C. Miscellaneous Connectors: Provide preinsulated spring connectors for lighting and receptacle splices and pigtails.

D. Solderless Lugs: Provide solderless terminal lugs for stranded and multiple solid conductors at connection to terminals or use UL listed crimp tool compression style lugs.

E. Control Wire Terminations: Provide spade lug or pressure type control conductor connection terminations for control wiring terminations. Provide lug bolting at devices or bus bars with a flat washer, a Belleville washer and a locknut.

2.4 COLOR CODING

A. General: Use a vinyl impregnated cloth tape resistant to oil, dirt and heat for conductor color coding.

PART 3 EXECUTION

3.1 INSTALLATION

A. General: Swab new and existing conduits to be used to clear debris and remove moisture before conductor installation. Install conductors in raceways with no splices between boxes.

B. Pulling Equipment: Pull conductors using proper equipment without exceeding manufacturer's recommendation for maximum pulling tension. Protect conductor insulation jacket at all times from twists, kinks, scrapes, punctures and other damage. Replace damaged conductors. Pull wires and cables into ducts and conduit without the use of lubricants, except where such use is necessary and approved by the cable manufacturer and the ENGINEER. Use UL listed lubricating compound compatible with the conductor insulated jacket and with the raceway.

Use lines of nylon or polypropylene, propelled by carbon dioxide, or compressed air, to snake or pull wire and cable into conduits. Do not use flat steel tapes or steel cables.

C. Conductor Support: Support conductors in vertical risers with woven grips to prevent loading on conductor connectors.

D. Seals: Provide a seal between the conductor and conduit for conduits entering buildings or from areas where the temperature change may cause condensation or moisture. Seal the conduits after the conductors are in place.

E. Color Coded Tape: Apply color coding tape at all terminations and splices with overlapping turns for a minimum length of two inches, starting two inches back from the termination point. Provide color code tape in all boxes.

Provide color coding throughout the entire network for service, feeder, branch, control and low energy signal circuit conductors. Use the following color code for conductors.

COLOR CODING

SYSTEM	PHASE A	PHASE B	PHASE C	NEUTRAL	GROUND
208/120 three phase	Black	Red	Blue	White	Green
480/277 three phase	Brown	Orange	Yellow	White	Green
Control and low-energy signal	Red	---	---	White	Green
Gas and Fire De-tection Systems	Pink	---	---	---	---
Instru-mentation	Tan	---	---	---	---
dc circuits	Olive	---	---	---	---

F. Terminations: Leave a minimum of six inches of free conductor at each connected outlet and a minimum of nine inches at unconnected outlets.

G. NEC Requirements: Install wiring in accordance with applicable provisions of National Electrical Code, and as indicated.

H. Conductor Sizing: Size conductors in accordance with the NEC and the following:

1. Size for branch lighting circuits so that the greatest voltage drop between lighting panel and center of load does not exceed two percent at rated load.

2. Size conductors to limit the maximum conductor temperature to less than 75 degrees C, except where specifically stated otherwise.

3. Use minimum conductor sizes as follows:

a. Power and lighting branch circuits, No. 12 AWG.

b. 120-volt control circuits, No. 14 AWG.

c. Instrumentation and signal wiring, 2 or 3 conductors No. 16 AWG stranded shielded.

4. Conductor Derating: Derate the conductor ampacity for installation in an ambient temperature of 40 degrees C.

5. Size conductors as shown or as required by the actual load to be served, whichever is larger.

I. Splicing: Install continuous cables without splices in all duct systems.

J. Instrumentation wiring: Install instrumentation wiring as follows:

1. Wherever possible provide continuous instrumentation wiring without splices from field device to instrument. Where connections are required, make all connections in terminal boxes.

2. Terminate instrumentation wiring at terminal blocks only.

3. Where instrumentation wire is required to be connected in a terminal box, provide an isolated terminal for each shield.

4. Ground instrumentation shields and drain wires only at the panel end of loop.

5. Install clear, heat-shrink, seamless tubing over exposed shields and drain wires in all terminal boxes, junction boxes, panels and field devices.

K. Hazardous Areas: Seal all conduits in hazardous areas before admission of possible hazardous gases to the area.

L. Accuracy of Information: The number and sizes of wires and conduits indicated are for guidance only and are not necessarily the correct number and sizes necessary for actual equipment installed. Install as many wires and conduits of the required size as necessary for a complete electrical system, and provide adequately for the equipment actually installed.

3.2 CONDUCTOR IDENTIFICATION

A. Labeling: Label each wire at both termination points and at each splice point in junction boxes. Carry individual conductor or circuit identification throughout, with circuit numbers or other identification clearly stamped on terminal boards and printed on directory cards in distribution cabinets and panelboards.

B. Identification: Where the total number of control and signal wires is three or more and no terminal board is provided, identify each wire in junction boxes and cabinets by means of plastic slip-on wire marker.

C. Plastic Tags: In manholes, identify each wire by laminated plastic tag located so it can be easily seen.

D. Color Coordination: Connect circuit conductors of the same color to the same phase throughout the installation.

3.3 WIRE AND CABLE CONNECTIONS TO EQUIPMENT

A. General: Provide electrical connections to all equipment in strict accordance with the manufacturer's approved wiring diagrams, the Plans, or as approved. Repair or replace any damaged equipment resulting from erroneous connections.

3.4 CONNECTOR AND TERMINAL LUG INSTALLATION

A. UL Requirements: Install all connectors and terminal lugs in accordance with UL requirements and manufacturer's recommendations.

3.5 QUALITY ASSURANCE

A. Field Tests: Test the following 600-volt wires and cables after installation but before final connections are made up:

1. All secondary feeders from TIPMONT REMC distribution transformers to service entrance disconnect switch and from Disconnect Switch to Automatic Transfer Switch (ATS).

2. All feeders from Generator to Automatic Transfer Switch (ATS).

3. All feeders from Automatic Transfer switch to Duplex Control panel.

4. All feeders from Duplex control panels to all motors, variable speed drive panels and all other panels.

5. All feeders from variable speed drive units.

6. All feeders from Duplex control panels to dry-type transformers.

7. All feeders from dry type transformers to lighting panels.

8. All feeders from lighting panels to all loads.

9. For the above listed cables, apply a test voltage of 1,500 volts ac for a period of 1 minute between all conductors in the same conduit, and between each conductors and ground.

B. Test Results: Make all tests and submit certified test results. Replace any cables that fail the tests.

C. Continuity Test: Perform continuity test to demonstrate proper cable connection.

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 16130

ELECTRICAL RACEWAY SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Requirements for providing electrical raceway systems as indicated, in accordance with the Contract Documents.

B. Related Work Specified in Other Sections Includes:

1. Section 16050 - Basic Electrical Materials and Methods
2. Section 16132 - Underground Electrical Distribution System

1.2 REFERENCES

A. Codes and standards referred to in this Section are:

1.	ANSI C80.1	-	Specifications for Rigid Steel Conduit, Zinc Coated
2.	ANSI/NFPA 70	-	National Electrical Code
3.	NEMA RN1	-	Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.
4.	UL 1	-	Flexible Metal Conduit
5.	UL 6	-	Rigid Metal Conduit
6.	UL 360	-	Liquid-Tight Flexible Steel Conduit
7.	Federal Specification WW-C-540C	-	Conduits, Metal, Rigid (Electrical, Aluminum)
8.	Intertek ETL SEMKO PVC-001	-	High Temperature H2O PVC Coating Adhesion Test Procedure

1.3 SUBMITTALS

A. General: Furnish all submittals, including the following, as specified in Division 1 and Section 16050.

1.4 QUALITY ASSURANCE

A. Codes: Provide all materials and workmanship to meet the requirements of ANSI/NFPA 70 National Electrical Code.

B. Regulatory Requirements: Provide UL listed components.

1.5 DELIVERY, STORAGE AND HANDLING

A. General: Deliver, store and handle all products and materials as specified in Division 1.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers: Acceptable manufacturers are listed below. Other manufacturers of equivalent products may be submitted for review.

1. Rigid steel conduits:

a. Allied Tube and Conduit
b. Wheatland Tube Company
c. LTV Steel Tubular Products Company

2. PVC coated steel conduits fitting and boxes:

a. Robroy Industries
b. Occidental Coating Company
c. KorKap
d. Perma-Cote Industries

3. Liquidtight flexible steel conduit:

a. Electri-Flex Company
b. The International Metal Hose Co.
c. Alflex Corp.
d. Anamet, Inc.

4. Conduit Fitting and Connectors

    a. Appleton Electric Company
    b. Thomas & Betts
    c. Crouse Hinds Company
    d. OZ/Gedney Company
    e. Killark
    f. Adalet-PLM

5. Boxes and Enclosures:

    a. Appleton Electric Company
    b. Raco/Bell
    c. Crouse Hinds Company
    d. Thomas & Betts
    e. Hoffman
    f. Hope
    g. OZ/Gedney Company

6. Strut Channel and Fittings

    a. Allied Tube and Conduit
    b. B-Line Systems, Inc.
    c. Kindorf
    d. Enduro
    e. Strut Tech
    f. Unistrut

7. Fire Stop System

    a. 3M/Electrical Products Division
    b. International Protective Coatings
    c. Nelson Electric

8. Terminal Blocks

    a. Phoenix Contact
    b. Entrelec
    c. Weidmuller

2.2 RACEWAYS

A. General: Provide minimum 3/4-inch raceways.

B. Raceway Requirements: Provide raceways meeting the following requirements:

1. Provide rigid steel, heavy wall, hot-dip galvanized in accordance with the requirements of UL-6 and ANSI C80.1.

2. Provide PVC coated rigid steel in accordance with the requirements for rigid steel raceway herein and with 40 mils bonded PVC exterior coating meeting requirements of UL-6 and NEMA RN-1. Provide PVC coated rigid steel conduit that is listed and performance verified to ETL PVC-001 for 200 hours. Provide a nominal 2 mil urethane interior coating and a clear urethane coating over the galvanized threads.

3. Provide liquidtight flexible single strip steel, hot-dip galvanized conduit with PVC jacket in accordance with requirements of UL 1. Provide a continuous copper bonding conductor wound spirally between convolutions on the inside of the conduit meeting requirements of UL 360 for conduit sizes 1-1/4-inch and smaller.

4. Provide explosion-proof, heavy duty construction, flexible conduit, with internal insulation liner for Class I, Division 1, Group D hazardous areas.

2.3 FITTINGS

A. General: Provide fittings of similar material as raceways.

B. Fittings Requirements: Provide fittings meeting the following requirements:

1. Set screw or indenter type fittings are not acceptable. Provide threaded connectors for all rigid metal conduits.

2. Provide insulated connectors for liquidtight flexible conduit.

3. Expansion/Deflection Fittings:

a. Provide a deflection and expansion coupling for rigid metal conduits that have a ¾ inch movement in all directions from normal and a 30 degree angular deflection. Provide coupling that includes internal bonding jumper.

b. Provide a nonmetallic expansion coupling for nonmetallic conduits that have a 4-inch maximum expansion.

4. Bushings

a. Provide insulated nonmetallic bushing rated 105 degrees C for all installations where bonding is not required.

b. Provide insulated metallic grounding and bonding bushing rated 150 degrees C where bonding is required.

5. Fittings for Hazardous Locations:

a. Provide fittings that conform to the requirements of NEC Chapter 5 for Class I, Division 1or 2, Group D hazardous locations as defined in Section 16050 or as shown.

b. Provide seal fittings designed for 40 percent fill capacity suitable for either horizontal or vertical installation.

2.4 WALL AND FLOOR PENETRATIONS

A. Watertight:

1. For conduit penetrations in new exterior walls or floors provide watertight sealing sleeves consisting of a steel sleeve with pressure ring and clamps.

2. For conduit penetrations in existing walls or floors, provide watertight sealing bushing consisting of a neoprene sealing ring between two PVC coated steel pressure discs. Provide stainless steel captive screws for sealing ring compression.

B. Fire-proofing Through Fire Rated Construction:

1. Provide a permanent fire stop system for all penetrations through fire-rated walls, partitions and floors.

2. Design fire stop system to maintain the integrity of the wall or floor assembly for its rated time period.

3. Arrange fire stop system to allow normal pipe movement without being displaced.

4. Do not utilize asbestos in fire stop systems.

5. Provide an intumescent fire stop system when exposed to flame or heat.

2.5 BOXES AND CABINETS

A. Outlet Box Requirements:

1. Provide galvanized cast iron boxes for galvanized rigid steel conduit systems.

2. Provide PVC coated steel boxes and covers in PVC coated rigid galvanized steel conduit systems.

3. Provide boxes located in Class I, Division 1 hazardous areas meeting NEMA 7 requirements.

4. Provide corrosion-resistant fiberglass reinforced polyester boxes with stainless steel hardware in corrosive areas as defined in Section 16050 or as shown.

5. Provide watertight gasketed covers held with nonferrous screws for all cast metal boxes.

B. Junction and Pull Box Requirements:

1. Provide cast aluminum boxes with mounting lugs, threaded hubs and gasket covers for surface mounted boxes

2. Provide fabricated sheet metal boxes when cast metal box weight exceeds 50 pounds. Construct box from 1/8-inch thick galvanized sheet steel or aluminum with sides return channel flanged around cover opening. Provide angle or channel supporting frame. Provide continuously welded and ground smooth seams. Provide mounting lugs and threaded conduit hubs.

3. Provide cast steel or fabricated 10-gauge Type 316 stainless steel for boxes either partially or fully encased in concrete. For partially encased boxes provide sides return channel flanged around cover opening. For fully encased boxes provide flush covers. Provide continuously welded and ground smooth seams. Provide mounting lugs and threaded conduit hubs.

4. Provide watertight gasketed covers held with stainless-steel captive screw slot bolts.

5. Provide steel barriers in all boxes that isolates instrumentation wiring from all other wiring systems

6. Provide fabricated boxes located indoors meeting NEMA 13 requirements.

7. Provide all boxes located outdoors meeting NEMA 4X requirements.

8. Provide boxes located in Class I, Division 1 hazardous areas meeting NEMA 7 requirements.

C. Terminal Box Requirements:

1. Provide minimum 12 gauge stainless steel fabricated box with mounting lugs, floor stand, and hinged doors.

2. Provide the door with continuous piano hinge and 3 point lockable latch. Provide print pocket on inside of door.

3. Provide back plate fabricated from 12 gauge minimum steel with white enamel finish for mounting terminals and wire troughs.

4. Provide wire troughs consisting of plastic ducts with snap slot design and removable covers. Run all wiring within wire troughs.

5. Furnish a schedule of terminals with the following information

   a. Source
   b. Type of Signal
   c. Function

6. Provide removable jumpers to allow operation of the equipment.

7. Separate analog terminals from all other terminals.

8. Provide number of terminals shown. Where the number of terminals are not shown, provide sufficient terminals for each wire entering the terminal box plus 20 percent but not less than 10 spare terminals.

9. Terminals:

   a. All catalog numbers refer to Phoenix Contact Type for the purpose of establishing the standard of quality and general configuration desired.

   b. Provide symmetrical type steel mounting rails, DIN-EN50022.

   c. Analog Signals: Provide terminals in enclosed housing suitable for wires from 22 to 12 AWG rated 600 volts with gray body, knife disconnect and test connection socket on both sides of disconnect, Phoenix Contact Type UK 5-MTK-P/P.

d. Control and Alarm Signals: Provide terminals suitable for wires from 30 to 10 AWG rated 18 amperes at 600 volts, blue body, Phoenix Contact Type UK5N BU.

e. 120-Volt Power Wiring: Provide terminals suitable for wires from 18 to 10 AWG rated 30 amperes at 600 volts, hot (black body), neutral (white body), ground (green body) , Phoenix Contact Type UK5N BK, UK5N WH & UK5N GN, respectively.

2.6 SUPPORTING DEVICES

A. Raceway Supports: Provide raceway supports meeting the following requirements:

1. Do not use perforated straps or plumbers tape for conduit supports.

2. Provide expansion bolts or inserts for fasteners in concrete, toggle bolts for hollow masonry or frame construction, and preset inserts for prestressed concrete.

3. Conduit Straps and Backs:

a. For metallic conduits, provide steel or malleable iron.

b. For PVC coated conduits, provide PVC coated malleable iron with stainless steel anchors and bolts.

4. Conduit Hangers

a. For metallic conduits, provide steel adjustable conduit hangers or clevis hangers.

b. For PVC coated conduits, provide PVC coated adjustable conduit hangers with stainless steel hardware.

5. Beam Clamps:

a. For metallic conduits, provide malleable iron with steel bolt.

b. For and PVC coated conduit, provide PVC coated malleable iron with stainless steel bolt.

6. Trapeze Hangers:

a. For metallic conduits provide 12 gauge 1-1/2-inch square steel channels with steel channel straps to secure conduits.

b. For or PVC coated conduit, provide either PVC coated 12 gauge 1-1/2-inch square steel channels or 1-5/8-inch square fiberglass channels. Provide PVC coated straps with stainless steel bolts for securing conduits.

c. Provide addition channels welded together to limit the deflection to 1/240th of span.

7. Thread Rod

a. Provide thread rod with the minimum size as follows:

(1) Conduit Hangers

(a) 3/4-inch to 1-1/2-inch conduit: 1/4-inch thread rod

(b) 2-inch to 3-1/2-inch conduit: 3/8-inch thread rod

(c) 4-inch and larger: 1/2-inch thread rod

(2) Trapeze Hangers: Provide thread rod of sufficient size to support the load. Provide a minimum of 3/8-inch thread rod.

b. For Metallic Conduit Systems: Provide continuous threaded galvanized steel rod.

c. For Nonmetallic or PVC Coated Conduit Systems: Provide continuous threaded PVC coated galvanized steel rod.

PART 3 EXECUTION

3.1 PREPARATION

A. General: Install electrical equipment and material of the size, type and general routing as shown or required.

B. Coordination with Reinforcing: Install raceway, fittings, boxes and cabinets free from direct contact with reinforcing steel.

C. Alignment: Provide fasteners, anchor bolts, anchorage items and supports as required to insure proper and rigid alignment. Attach equipment with fasteners

sized according to size and weight of the equipment and the thickness of the supporting surface.

D. Aluminum Coating: Where aluminum is placed in contact with dissimilar metal or concrete, separate contact surfaces with gasket, nonabsorptive tape or coating to prevent corrosion.

E. Grounding: Make metallic raceways electrically and mechanically continuous and ground as required. Install conduits continuous between outlets, boxes, cabinets and panels.

3.2 INSTALLATION

A. General: Unless otherwise indicated, install conduits exposed, parallel or perpendicular to building floors, ceilings and walls, and to avoid interference with other work. In architecturally finished areas, conceal conduits within finished walls, ceilings and floors. Cut conduits square and deburr the cuts to the same degree as the conduit manufacturer. Fasten conduit securely to outlets, junction, pull and terminal boxes. Provide caps and seals to prevent the entrance of foreign material and moisture during installation and before pulling wire.

1. Where conduit size is not shown, provide conduits one size larger than indicated in Table 4, Chapter 9 of the NEC.

2. Support raceways concealed above suspended ceilings from the slab above suspended ceiling in same manner as exposed raceways. Do not support raceways from suspended ceiling supports.

3. Keep conduit at least six inches away from high temperature piping, ducts, flues and surfaces. For mounting on concrete and masonry surfaces provide a minimum of 1/4 inch air space between conduit and mounting surface. Support and fasten conduit to building structural members spaced in accordance with electrical codes. Support conduit at least every eight feet or less in accordance with NEC requirements.

4. When two or more exposed conduits are in the same general routing, provide parallel installation with symmetrical bends and for three or more provide trapeze hangers. Size trapeze hangers with space for 25 percent additional conduits.

5. Make changes in direction with bends or fittings. Use factory-made bends or elbows wherever possible. Make field bends and offsets with a hand bender or conduit-bending machine.

6. Run conduit in buildings with no more than the equivalent of (three) 90 degree bends between pull points. Provide no more than (125) feet of conduit runs between pull points. Provide pull boxes where shown, specified or wherever required to install conductors and to meet the above requirement.

7. Install pull and junction boxes in accessible locations with working space in front of and around the installation. Obtain approval to locate boxes in finished areas.

8. Install an expansion fitting when a conduit crosses a building structural expansion joint.

9. Unless otherwise approved, install conduits to cross at right angles to building structural expansion joints.

10. Where approved for encased installation, install conduits in slabs as close to the middle of concrete slabs as practicable without disturbing reinforcement. Do not use conduit with an outside diameter exceeding one-third of the slab thickness. Do not place conduits closer than three diameters on centers, except at cabinet locations where the slab thickness is increased.

11. Pitch conduits to outlet boxes to avoid trapping moisture. Where dips are unavoidable in exposed conduit runs, install drain fitting at low point.

B. Conduit Material Types: Provide conduit as follows:

1. Provide rigid steel conduits in all exposed indoor structures, concealed in structures, concrete encased within structures or under structures except as described below.

2. Provide rigid steel, conduits for all instruments, and electronic equipment signal wiring in all exposed or concealed noncorrosive installations. For corrosive location use PVC coated galvanized rigid steel conduits

3. Provide PVC coated galvanized rigid steel conduits for power in underground, direct buried system, unless specifically detailed otherwise. For control and instrumentations use PVC coated galvanized rigid steel conduit for underground direct buried systems.

4. Corrosive Locations

a. Corrosive locations are defined in Section 16050 or are as shown:

b. Provide PVC coated rigid steel conduit in all installations in corrosive locations and exposed outdoor locations.

5. Hazardous Locations:

a. Hazardous locations are defined in Section 16050 or as shown.

b. Install all conduits and appurtenances in accordance with the requirements of Chapter 5 in NEC.

c. Provide seal fittings for all conduits that enter or leave a hazardous location.

C. Connections to Equipment

1. Provide double locknuts and bushing for all boxes, enclosures and cabinets located in dry areas.

2. Provide watertight hub fittings for all boxes, enclosures and cabinets located below grade or in wet, damp or corrosive areas.

3. Provide rigid conduit connection where equipment is fixed and not subject to adjustment, mechanical movement or vibration. Provide union fittings to permit removal of equipment without cutting or breaking conduit.

4. Provide liquidtight flexible conduit connection where equipment is subject to adjustment, mechanical movement or vibration.

5. Coat all threads in steel conduit runs with zinc dust in oil or other corrosion-preventive compound before making connections.

D. Underground Conduits: Provide PVC coated galvanized steel conduits for all direct buried underground conduit systems. Provide underground conduits meeting the requirements of Section 16132.

E. Penetrations: Make concealed penetrations for single conduits not more than 1/4-inch larger than the diameter of the conduit. Make penetrations through walls, ceilings and floors other than concrete for exposed conduits not more than 1/4-inch larger than the diameter of the conduit. Fill the voids around conduit with caulking compound and finish the surface the same as the wall, ceiling or floor.

1. Where a conduit enters through a concrete roof or membrane waterproofed wall, floor or ceiling, provide a watertight sealing sleeve that can be tightened from one or both sides. If the sealing sleeve is not placed with the

concrete, core drill the proper size hole to provide a mechanically watertight installation.

2. Where a conduit enters through a concrete non-waterproofed wall, floor or ceiling, provide a galvanized steel sleeve, Schedule 40, and fill the space between the conduit and sleeve with a plastic expandable compound. If the sleeve is not placed with the concrete, drill the hole not less than 1/2-inch nor more than one inch larger than the sleeve, center the sleeve and grout the sleeve for the total depth of penetrated concrete with non-shrink grout, polyurethane or silicone sealant.

F. Spare Conduit: Provide spare conduits for future use as shown or required. Provide a minimum 200 pound strength nylon pull line in each spare conduit and identify the origin and termination of the conduit at each end. Terminate spare conduits in equipment, boxes or by couplings plugged flush with the inside of building surfaces.

G. Boxes: Provide boxes of the proper dimensions for the size and quantity of conductors enclosed.

1. For boxes mounted on steel, concrete and masonry surface, provide a minimum 1/4-inch non-metallic spacer to hold the box away from the surface.

2. Provide pressed metal boxes in all partition constructed walls.

3. Provide separate support for boxes and bolt units to buildings with expansion anchors, toggle bolts or appropriate screws. For lighting fixture outlet boxes, provide supports adequate to support the weight of the fixture to be mounted on the box.

4. Remove debris including dust, dirt, wire clippings and insulation from the interior of boxes. Replace boxes with open conduit holes. Repair or replace damaged boxes as directed.

5. Unless otherwise indicated, mount outlet boxes flush with the finished wall or ceiling, with the long axis vertical. Unless otherwise shown or specified, provide mounting heights measured from the finished floor to centerline of the outlet box as follows:

   a. For switches: 4'-6". Mount the box for lighting switches on the strike side of the door.
   b. For duplex convenience outlets: Finished areas 12 inches and unfinished areas 2 feet.
   c. For clock receptacles outlets: 8 feet.
   d. For fixtures and equipment: As shown.
   e. For desk telephone outlets: 12 inches.

f. For wall telephone outlets: 57 inches.

END OF SECTION

SECTION 16132

UNDERGROUND ELECTRICAL DISTRIBUTION SYSTEM

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Requirements for providing and installing underground electrical raceway system consisting of direct buried conduits and cables, and outdoor electrical equipment pads as shown.

B. Related Work Specified in Other Section Includes:

1. Section 02316 - Earth Excavation
2. Section 02317 - Backfilling
3. Section 02900 - Landscaping Work
4. Section 03100 - Concrete Formwork
5. Section 03200 - Concrete Reinforcement
6. Section 03250 - Concrete Accessories
7. Section 03310 - Cast-In-Place Concrete
8. Section 16050 - Basic Electrical Materials and Methods
9. Section 16060 - Grounding
10. Section 16130 - Electrical Raceway Systems
11. Section 16121 - Wire and Cable - 600 Volts and Below

1.2 SYSTEM DESCRIPTION

A. Performance Requirements: Route conduits to allow pulling-in of conductors as indicated without exceeding the conductor's tension limits.

1.3 SUBMITTALS

A. General: Furnish all submittals, including the following, as specified in Division 1.

B. Product Data and Information: Furnish manufacturer's data for conduits, and all accessories.

C. Contractors Shop Drawings: Furnish working drawings for underground electrical raceway system showing conduits, electrical equipment pads and reinforcing. Indicate designation, type, size, location, elevations and slope.

1.4 DELIVERY, STORAGE AND HANDLING

A. General: Deliver, store and handle all products and materials as specified in Division 1.

1.5 PROJECT CONDITIONS

A. Existing Conditions: Examine record drawings to determine the location of all obstructions along the conduit or cable route and at the sites of outdoor electrical equipment pads.

B. Field Measurements: Field survey, and in critical areas, excavate test pits to verify locations of probable obstacles along the conduit or cable route and at the sites of outdoor electrical equipment pads.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers: Acceptable manufacturers are listed below. Other manufacturers of equivalent products may be submitted for review.

1. Conduit Spacers

a. Carlon Company
b. Underground Devices, Inc.

2. Buried warning tape

a. Thomas & Betts
b. W. H. Brady Company

2.2 MATERIALS

A. Conduit: Provide conduits meeting the requirements of Section 16130.

B. Cable: Provide cables meeting the requirements of Section 16121.

C. Spacers: Provide rigid plastic, conduit spacers to maintain conduit separation as indicated.

D. Reinforcing Steel: Provide reinforcing steel meeting the requirements of Section 03200.

E. Concrete: Provide concrete meeting the requirements of Section 03310.

F. Grounding: Provide grounding meeting the requirements of Section 16060.

G. Underground Warning Tape: Provide 6-inch wide detectable type plastic tape in red (electric), yellow (utility) and orange (communications) colors with suitable warning describing the type of buried electrical lines.

PART 3 EXECUTION

3.1 CONDUIT INSTALLATION

A. General: Install underground direct buried conduits as indicated.

B. Conduit Route: Establish and mark exactly conduit or cable routing. Resolve routing near existing obstacles and coordinate with other sitework. Maintain a 12-inch minimum longitudinal clearance from the direct buried conduit to adjacent utility lines. Maintain a 6-inch minimum vertical clearance from the direct buried conduit to utility lines at crossovers. Adhere to lines, grades, elevations and dimensions as shown.

C. Trench Excavation: Perform excavation work in accordance with the requirements of Section 02316.

D. Bedding: Provide a sand cover on trench bottoms for a firm and smooth surface for direct buried conduits.

E. Spacers: Locate spacers at intervals of approximately four feet and stagger locations at each conduit tier to provide not less than 12-inches of longitudinal separation.

F. Conduit: Place conduit in straight lines and with a minimum slope of 0.25 percent (3 inches per 100 feet). Slope conduit down to structures. Install expansion fittings in straight runs exceeding 100-feet. Secure conduits in place to prevent floating and movement.

G. Bends: Install 12-foot minimum radius bends in horizontal turns and vertical deflections. For bends used at ends of conduit runs install elbows with 4-foot minimum radius for 6-inch and 5-inch conduits, and elbows with 3-foot minimum radius for 4-inch and smaller conduits.

H. Inside Cleaning: Pull a standard flexible mandrel not less than 12-inches long, having a diameter approximately 1/4-inch less than the inside diameter of the conduit, through each conduit, then pull a brush with stiff bristles through each conduit. Replace conduit runs that do not allow the passage of the mandrel at no

increase in Contract Price. Use the pneumatic method to draw into conduit the nylon or polypropylene pull line. Plug and seal all conduits after cleaning.

I. Outside Cleaning: Remove dirt, sand and debris around conduits and from workmat, prior to concrete placement.

J. Concrete Placement: Place concrete meeting the requirements of Section 03310.

K. Connections to Structures: Install as shown.

L. Backfilling: Backfill meeting the requirements of Section 02317. Provide a sand cover that is 6 inches over direct buried conduits or cables.

M. Underground Warning Tape: Install one underground warning tape for each trench up to 18 inches wide. For trenches wider than 18 inches provide two underground warning tapes, one at each edge of the trench. Place the tape or tapes 12 inches below the finished grade.

N. Markers: Provide 4-inch round, 6-inch thick, concrete markers identified with the letter "E" and directional arrows. Place these markers approximately every 200 feet along straight portions of conduit and cable runs, at each change in direction and at the conduit run end. Install markers to protrude 1-inch above adjacent ground. Allow markers to protrude 1/2-inch in finished lawns. Do not place conduit markers at structures and at conduit risers.

O. Surface Finish: Restore existing pavements and curbs with materials and construction to match existing. Restore landscaped areas meeting the requirements of Section 02900.

3.2 OUTDOOR ELECTRICAL EQUIPMENT PADS

A. General: Provide reinforced concrete pads for supporting Outdoor Electrical Equipment as shown.

B. Location: Establish and mark pad locations exactly. Resolve locations near existing obstacles and coordinate with other sitework under this Contract. Adhere to orientation, elevations and dimensions as shown.

C. Site Excavation: Provide site excavation meeting the requirements of Section 02316.

D. Pad Construction: Install pad construction meeting the requirements of Sections 03100, 03200 and 03310.

E. Conduit Entrances: Install conduit risers and laterals under pads prior to placement of pads. Separate conduits from pads as shown.

F. Grounding: Install grounding conductors through pads meeting the requirements of Section 16060.

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 16210

ELECTRICAL UTILITY COORDINATION AND REQUIREMENTS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Requirements for arrangement and coordination with the Utility Company for the permanent electrical power service.

B. Related Work Specified in Other Sections Includes, But is Not Limited to, the Following:

1. Section 03310 - Cast-In-Place Concrete

1.2 SYSTEM DESCRIPTION

A. Utility Company: Duke Energy
3395 Greenbush St.
Lafayette, Indiana 47905

B. Utility Company Contact: Mr. Jordan Wallpe
Telephone: (765) 446-4010

C. System Characteristics:

1. 480/277 Volts

2. 3 Phase

3. 4 Wire

4. Solidly Grounded Neutral

1.3 SUBMITTALS

A. General: Provide all submittals, including the following, as specified in Division 1.

B. Correspondence: Furnish copies of all correspondence with the Utility Company including available short circuit currents and X/R ratings for each feeder.

C. Utility Company Drawings: Furnish Utility Company prepared drawings.

D. Layout Drawings: Furnish the following drawings:

1. Equipment pad details
2. Equipment mounting details.

1.4 QUALITY ASSURANCE

A. General: Perform Work in accordance with Utility Company's written requirements and standards.

1.5 PROJECT CONDITIONS

A. Field Measurements: Verify that field measurements are as indicated on Utility Company drawings.

PART 2 PRODUCTS

2.1 UTILITY METERING

A. Revenue Meters: Meters will be furnished by Utility Company.

B. Meter Base: Provide meter base in accordance with the requirements of the Utility Company.

C. Metering Transformer Cabinet: Provide a metering transformer cabinet in accordance with the requirements of the Utility Company.

PART 3 EXECUTION

3.1 EXAMINATION

A. General: Verify that service equipment is ready to be connected and energized.

3.2 PREPARATION

A. Utility Company Arrangements: Make arrangements with Utility Company to obtain permanent electric service to the Project.

B. Utility Company Access: Coordinate location of Utility Company's facilities to provide proper access.

C. Coordination: Coordinate schedule of Utility Company's facilities with all other work.

3.3 INSTALLATION

A. General: Install Electrical Power Service in accordance with the Utility Company's recommendations and approved shop drawings and as specified in Division 1.

B. Metering Transformer Cabinet and Meter Base: Install metering transformer cabinet and meter base in accordance with the Utility Company requirements and as shown.

C. Concrete Pads: Provide cast-in-place concrete pads for Utility Company transformers and other equipment.

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 16413

DISCONNECT CIRCUIT BREAKERS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Requirements for providing and installing enclosed, disconnecting circuit breakers for use as main incoming service disconnect, feeder and branch circuit switching and disconnect devices for motors and equipment. Circuit breaker used for incoming service shall be rated for Service Entrance Duty.

B. Related Work Specified in Other Sections Includes, But is Not Limited to, the Following:

1. Section 16050 - Basic Electrical Materials and Methods
2. Section 16060 - Grounding

1.2 REFERENCES

A. Codes and standards referred to in this Section are:

1. NEC - National Electrical Code
2. UL 486A - Wire Connectors and Soldering Lugs for Use with Copper Conductors

1.3 SUBMITTALS

A. General: Furnish all submittals, including the following, as specified in Division 1 and Section 16050.

B. Product Data and Information: Furnish manufacturer's data indicating circuit breakers ratings, enclosure type and dimensions.

1.4 QUALITY ASSURANCE

A. Codes: Provide disconnect circuit breakers meeting the requirements of NFPA Standards, the National Electrical Code and local codes.

B. Regulatory Requirements: Provide all circuit breakers designed, manufactured and tested in accordance with latest ANSI, IEEE and NEMA Standards, and UL listed.

1.5 DELIVERY, STORAGE AND HANDLING

A. General: Deliver, store and handle all products and materials as specified in Division 1.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers: Acceptable manufacturers are listed below. Other manufacturers of equivalent products may be submitted for review.

1. Square D Company
2. Cutler Hammer
3. General Electric Company

2.2 MATERIALS

A. General: Provide molded case, thermal magnetic, automatic, adjustable trip disconnect circuit breakers.

B. Breaker Ratings: Provide disconnect circuit breakers with the voltage, number of poles and current ratings based on the connected load and a withstand capacity of not less than 65,000 amperes rms symmetrical at 480 volts ac.

C. Breaker Housings: Provide disconnect circuit breakers housed in NEMA rated enclosures with provisions to padlock the operating handle in the OFF position as follows:

AREA	ENCLOSURE
All areas listed Class 1, Division 1 and 2, Group D as defined in Section 16050 or as shown.	NEMA 7 - Explosion-proof
Outdoor and below grade elevation indoors	NEMA 4X – Watertight, corrosion resistant, stainless steel
Above grade indoor	NEMA 12 - Industrial

PART 3 EXECUTION

3.1 INSTALLATION

A. General: Install all disconnect circuit breakers in accordance with the manufacturer's recommendation and approved shop drawings and as specified in Division 1. Comply with requirements of NEC and local electrical codes.

B. Coordination: Coordinate with other work including cabling and wiring.

C. Torque Requirements: Tighten electrical connectors and terminals including screws and bolts, in accordance with equipment manufacturers', published torque tightening recommendations. Where manufacturers' torquing requirement are not available, tighten connectors and terminals in accordance with UL Standard 486 A.

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 16443

PANELBOARDS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Requirements for providing lighting and distribution panelboards including circuit breakers and cabinets.

B. Related Work Specified in Other Sections Includes, But is Not Limited to, the Following:

1. Section 16050 - Basic Electrical Materials and Methods
2. Section 16060 - Grounding

1.2 REFERENCES

A. Codes and standards referred to in this Section are:

1. NEMA PB 1 - Panelboards

2. UL 67 - Panelboards

3. Fed. Spec. W-P-115 - Power Distribution Panel

4. UL 486A - Wire Connectors and Soldering Lugs for Use With Copper Conductors

5. NEC - National Electrical Code

1.3 SUBMITTALS

A. General: Furnish all submittals, including the following, as specified in Division 1 and Section 16050.

B. Product Data and Information: Furnish the manufacturer's catalog data for panelboards, circuit breakers and accessories.

C. Operations and Maintenance Manuals: Furnish operation and maintenance manuals for the panelboards as specified in Division 1.

1.4 QUALITY ASSURANCE

A. Codes: Provide all materials and workmanship meeting the requirements of the NFPA, the National Electrical Code and local codes.

1. Design, fabricate and test the panelboards in accordance with applicable ANSI, IEEE and NEMA standards.

2. Provide panelboards suitable for operation at their standard nameplate ratings in accordance with ANSI standards.

1.5 DELIVERY, STORAGE AND HANDLING

A. General: Deliver, store and handle all products and materials as specified in Division 1.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers: Acceptable manufacturers are listed below. Other manufacturers of equivalent products may be submitted for review.

1. Panelboards

a. General Electric Company
b. Square D Company
c. Cutler Hammer

2.2 MATERIALS

A. General: Provide factory-assembled fully rated dead-front type, panelboards, suitable for surface or flush mounting with branch circuit breakers and a main circuit breaker or main lugs as indicated.

1. Provide panelboards with a full capacity separate ground bus and connected to a three-phase four-wire or a single-phase three-wire service with insulated neutral buses as indicated.

2. Provide panelboards with the voltage, frequency and current ratings as indicated conforming to NEMA Standard PB 1, Fed. Spec. W-P-115, UL 67 and the NEC.

3. Provide panelboards with copper main, neutral and ground buses.

4. Where required, label panelboards suitable for use as service entrance equipment

B. Bracing: Provide main bus bracing exceeding the lowest interrupting rating of any circuit breaker installed.

C. Fabrication: Fabricate panelboards using galvanized steel, continuously welded. Provide cabinet fronts with doors over the circuit breakers. Provide doors fastened with concealed hinges and equipped with flush type catches.

1. Provide panelboards at least 20 inches wide, 5-3/4 inches deep, with wiring gutters on both sides.

2. Provide all panelboard trims exceeding five square feet in area with an inside permanently secured angle to support the trim during fastening.

2.3 COMPONENTS

A. Circuit Breakers: Provide bolt-on type branch and main circuit breakers.

1. Furnish the frame sizes, trip settings and number of poles as indicated. Mark ampere trip rating on the circuit breakers clear and visible.

a. For lighting panelboards, provide 20-ampere, single-pole, 120 or 277 volt circuit breakers unless otherwise shown or scheduled.

b. For distribution panelboards, provide 20-ampere, three-pole, 600-volt circuit breaker, unless otherwise shown or scheduled.

2. Provide all breakers with quick-make, quick-break, toggle mechanisms with automatic thermal-magnetic, inverse time-limit overload and instantaneous short circuit protection on all poles, unless otherwise indicated. Indicate automatic tripping by the breaker handle assuming a clearly distinctive position from the manual ON and OFF position. Design the breaker handle to be trip-free on overloads.

3. Interrupting Rating: 10,000 rms symmetrical amperes for circuit breakers on 240 volt systems or less, and 65,000 rms symmetrical amperes for circuit breakers on 277 or 480 volt systems.

4. Provide multipole breakers that utilize a common tripping bar.

5. Provide ground fault interrupter circuit breakers for all circuits serving receptacles located below grade and outdoors and as scheduled.

6. Provide full module size single-pole breakers. Do not install two-pole breakers in a single-pole module.

B. Surge Protection Devices (SPD): Provide each panelboard with a surge protection device as specified below:

1. Provide SPD equipment that complies with UL 1449 and UL 1283. Provide units with a maximum continuous operating voltage that exceeds 115 percent of the nominal system operating voltage.

2. Provide SPD equipment suitable for wye configured systems. Provide SPD equipment having directly connected suppression elements between line-neutral (L-N), line-ground (L-G) and neutral-ground (N-G). Provide SPD equipment that distributes the surge current to all MOV components to ensure equal stressing and maximum performance and provides equal impedance paths to each match MOV.

3. Provide high-performance EMI/RFI noise rejection filters that attenuate the electric line noise at least 55dB at 100 kHz using MIL-STD-220A insertion loss test method. Wire internal components with connections utilizing low impedance conductors and compression fittings.

4. Provide a monitoring panel for each system that incorporates the following features:

   a. Green/Red solid state indicator lights to indicate which phase(s) have been damaged. A flashing trouble light to indicate fault detection. Transient event counter. Audible alarm. Form C contacts for remote monitoring of the unit status.

5. Provide SPD suitable for location, application and minimum surge current per mode as follows:

   a. 480V and 480Y/277V Panelboard: UL 1449, Type 1/2, 150kA

6. Location: Install SPD as follows:

   a. Panelboard: Mount SPD internally or externally to minimize lead length. Provide a branch circuit breaker disconnect sized in accordance with the manufacturer’s recommendations. Locate the SPD unit branch circuit breaker immediately downstream of the main circuit breaker or main lugs.

2.4 ACCESSORIES

A. Directories: Provide directories in accordance with Section 16075.

B. Circuit Breaker Handle Lock: Where shown provide circuit breakers with handle clamp that holds the circuit breaker handle in the ON position.

C. Keying: Key all panelboards alike.

PART 3 EXECUTION

3.1 INSTALLATION

A. General: Install all panelboards in accordance with manufacturer's recommendations and approved shop drawings and as specified in Division 1 and in compliance with the requirements of NEMA standards, NEC, and applicable ANSI Publications.

B. Mounting Height: Mount all panelboards either surface or flush mounted as shown such that the height of the top operating handle does not exceed 6 feet 6 inches from the floor.

C. Coordination: Coordinate with other Work including cabling and wiring work to interface the installation of the panelboards.

D. Torque Requirements: Tighten electrical connectors and terminals, including screws and bolts, in accordance with the equipment manufacturer's published torque tightening values for the equipment connectors. Where manufacturer's torque requirements are not indicated, tighten connectors and terminals in accordance with UL 486A.

E. Circuit Breaker Handle Lock: Install circuit breaker handle clamp on each circuit breaker as shown.

F. Directory: Provide a laminated typewritten directory with the following information:

1. Circuit number
2. Area served
3. Utilizing equipment

3.2 CLEANING AND PAINTING

A. Field Painting: Touch up scratched and marred surfaces to match the original finish.

END OF SECTION