

PROJECT MANUAL

City of Valley Center

Standard Specifications for Paving, Drainage, Waterline, and Sanitary Sewer Improvements

PROJECT NO. 35-217013-001-2502



PREPARED BY

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APRIL 2021

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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 Laws and Regulations.

STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

Prepared by



Issued and Published Jointly by



These General Conditions have been prepared for use with the Agreement Between Owner and Contractor for Construction Contract (EJCDC® C-520, Stipulated Sum, or C-525, Cost-Plus, 2013 Editions). Their provisions are interrelated and a change in one may necessitate a change in the other.

To prepare supplementary conditions that are coordinated with the General Conditions, use EJCDC's Guide to the Preparation of Supplementary Conditions (EJCDC® C-800, 2013 Edition). The full EJCDC Construction series of documents is discussed in the Commentary on the 2013 EJCDC Construction Documents (EJCDC® C-001, 2013 Edition).

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STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

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ARTICLE 1 – DEFINITIONS AND TERMINOLOGY

1.01 *Defined Terms*

- A. Wherever used in the Bidding Requirements or Contract Documents, a term printed with initial capital letters, including the term's singular and plural forms, will have the meaning indicated in the definitions below. In addition to terms specifically defined, terms with initial capital letters in the Contract Documents include references to identified articles and paragraphs, and the titles of other documents or forms.
1. *Addenda*—Written or graphic instruments issued prior to the opening of Bids which clarify, correct, or change the Bidding Requirements or the proposed Contract Documents.
 2. *Agreement*—The written instrument, executed by Owner and Contractor, that sets forth the Contract Price and Contract Times, identifies the parties and the Engineer, and designates the specific items that are Contract Documents.
 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. *Bid*—The offer of a Bidder submitted on the prescribed form setting forth the prices for the Work to be performed.
 5. *Bidder*—An individual or entity that submits a Bid to Owner.
 6. *Bidding Documents*—The Bidding Requirements, the proposed Contract Documents, and all Addenda.
 7. *Bidding Requirements*—The advertisement or invitation to bid, Instructions to Bidders, Bid Bond or other Bid security, if any, the Bid Form, and the Bid with any attachments.
 8. *Change Order*—A document 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, or other revision to the Contract, issued on or after the Effective Date of the Contract.
 9. *Change Proposal*—A written request by Contractor, duly submitted in compliance with the procedural requirements set forth herein, seeking an adjustment in Contract Price or Contract Times, or both; contesting an initial decision by Engineer concerning the requirements of the Contract Documents or the acceptability of Work under the Contract Documents; challenging a set-off against payments due; or seeking other relief with respect to the terms of the Contract.
 10. *Claim*—(a) A demand or assertion by Owner directly to Contractor, duly submitted in compliance with the procedural requirements set forth herein: seeking an adjustment of Contract Price or Contract Times, or both; contesting an initial decision by Engineer concerning the requirements of the Contract Documents or the acceptability of Work under the Contract Documents; contesting Engineer's decision regarding a Change Proposal; seeking resolution of a contractual issue that Engineer has declined to address; or seeking other relief with respect to the terms of the Contract; or (b) a demand or assertion by Contractor directly to Owner, duly submitted in compliance with the procedural requirements set forth herein, contesting Engineer's decision regarding a Change Proposal; or seeking resolution of a contractual issue that Engineer has declined to address. A demand for money or services by a third party is not a Claim.

11. *Constituent of Concern*—Asbestos, petroleum, radioactive materials, polychlorinated biphenyls (PCBs), hazardous waste, and any substance, product, waste, or other material of any nature whatsoever that is or becomes listed, regulated, or addressed pursuant to (a) the Comprehensive Environmental Response, Compensation and Liability Act, 42 U.S.C. §§9601 et seq. (“CERCLA”); (b) the Hazardous Materials Transportation Act, 49 U.S.C. §§5501 et seq.; (c) the Resource Conservation and Recovery Act, 42 U.S.C. §§6901 et seq. (“RCRA”); (d) the Toxic Substances Control Act, 15 U.S.C. §§2601 et seq.; (e) the Clean Water Act, 33 U.S.C. §§1251 et seq.; (f) the Clean Air Act, 42 U.S.C. §§7401 et seq.; or (g) any other federal, state, or local statute, law, rule, regulation, ordinance, resolution, code, order, or decree regulating, relating to, or imposing liability or standards of conduct concerning, any hazardous, toxic, or dangerous waste, substance, or material.
12. *Contract*—The entire and integrated written contract between the Owner and Contractor concerning the Work.
13. *Contract Documents*—Those items so designated in the Agreement, and which together comprise the Contract.
14. *Contract Price*—The money that Owner has agreed to pay Contractor for completion of the Work in accordance with the Contract Documents. .
15. *Contract Times*—The number of days or the dates by which Contractor shall: (a) achieve Milestones, if any; (b) achieve Substantial Completion; and (c) complete the Work.
16. *Contractor*—The individual or entity with which Owner has contracted for performance of the Work.
17. *Cost of the Work*—See Paragraph 13.01 for definition.
18. *Drawings*—The part of the Contract that graphically shows the scope, extent, and character of the Work to be performed by Contractor.
19. *Effective Date of the Contract*—The date, indicated in the Agreement, on which the Contract becomes effective.
20. *Engineer*—The individual or entity named as such in the Agreement.
21. *Field Order*—A written order issued by Engineer which requires minor changes in the Work but does not change the Contract Price or the Contract Times.
22. *Hazardous Environmental Condition*—The presence at the Site of Constituents of Concern in such quantities or circumstances that may present a danger to persons or property exposed thereto. The presence at the Site of materials that are necessary for the execution of the Work, or that are to be incorporated in the Work, and that are controlled and contained pursuant to industry practices, Laws and Regulations, and the requirements of the Contract, does not establish a Hazardous Environmental Condition.
23. *Laws and Regulations; Laws or Regulations*—Any and all applicable laws, statutes, rules, regulations, ordinances, codes, and orders of any and all governmental bodies, agencies, authorities, and courts having jurisdiction.
24. *Liens*—Charges, security interests, or encumbrances upon Contract-related funds, real property, or personal property.
25. *Milestone*—A principal event in the performance of the Work that the Contract requires Contractor to achieve by an intermediate completion date or by a time prior to Substantial Completion of all the Work.
26. *Notice of Award*—The written notice by Owner to a Bidder of Owner’s acceptance of the Bid.

27. *Notice to Proceed*—A written notice 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.
28. *Owner*—The individual or entity with which Contractor has contracted regarding the Work, and which has agreed to pay Contractor for the performance of the Work, pursuant to the terms of the Contract.
29. *Progress Schedule*—A schedule, prepared and maintained by Contractor, describing the sequence and duration of the activities comprising the Contractor’s plan to accomplish the Work within the Contract Times.
30. *Project*—The total undertaking to be accomplished for Owner by engineers, contractors, and others, including planning, study, design, construction, testing, commissioning, and start-up, and of which the Work to be performed under the Contract Documents is a part.
31. *Project Manual*—The written documents prepared for, or made available for, procuring and constructing the Work, including but not limited to the Bidding Documents or other construction procurement documents, geotechnical and existing conditions information, the Agreement, bond forms, General Conditions, Supplementary Conditions, and Specifications. The contents of the Project Manual may be bound in one or more volumes.
32. *Resident Project Representative*—The authorized representative of Engineer assigned to assist Engineer at the Site. As used herein, the term Resident Project Representative or “RPR” includes any assistants or field staff of Resident Project Representative.
33. *Samples*—Physical examples of materials, equipment, or workmanship that are representative of some portion of the Work and that establish the standards by which such portion of the Work will be judged.
34. *Schedule of Submittals*—A schedule, prepared and maintained by Contractor, of required submittals and the time requirements for Engineer’s review of the submittals and the performance of related construction activities.
35. *Schedule of Values*—A schedule, prepared and maintained by Contractor, allocating portions of the Contract Price to various portions of the Work and used as the basis for reviewing Contractor’s Applications for Payment.
36. *Shop Drawings*—All drawings, diagrams, illustrations, schedules, and other data or information that are specifically prepared or assembled by or for Contractor and submitted by Contractor to illustrate some portion of the Work. Shop Drawings, whether approved or not, are not Drawings and are not Contract Documents.
37. *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, and such other lands furnished by Owner which are designated for the use of Contractor.
38. *Specifications*—The part of the Contract that consists of written requirements for materials, equipment, systems, standards, and workmanship as applied to the Work, and certain administrative requirements and procedural matters applicable to the Work.
39. *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.
40. *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.

41. *Successful Bidder*—The Bidder whose Bid the Owner accepts, and to which the Owner makes an award of contract, subject to stated conditions.
42. *Supplementary Conditions*—The part of the Contract that amends or supplements these General Conditions.
43. *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 a Subcontractor.
44. *Technical Data*—Those items expressly identified as Technical Data in the Supplementary Conditions, with respect to either (a) subsurface conditions at the Site, or physical conditions relating to existing surface or subsurface structures at the Site (except Underground Facilities) or (b) Hazardous Environmental Conditions at the Site. If no such express identifications of Technical Data have been made with respect to conditions at the Site, then the data contained in boring logs, recorded measurements of subsurface water levels, laboratory test results, and other factual, objective information regarding conditions at the Site that are set forth in any geotechnical or environmental report prepared for the Project and made available to Contractor are hereby defined as Technical Data with respect to conditions at the Site under Paragraphs 5.03, 5.04, and 5.06.
45. *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 but not limited to those that convey electricity, gases, steam, liquid petroleum products, telephone or other communications, fiber optic transmissions, cable television, water, wastewater, storm water, other liquids or chemicals, or traffic or other control systems.
46. *Unit Price Work*—Work to be paid for on the basis of unit prices.
47. *Work*—The entire construction or the various separately identifiable parts thereof required to be provided under the Contract Documents. Work includes and is the result of performing or providing all labor, services, and documentation necessary to produce such construction; furnishing, installing, and incorporating all materials and equipment into such construction; and may include related services such as testing, start-up, and commissioning, all as required by the Contract Documents.
48. *Work Change Directive*—A written directive to Contractor issued on or after the Effective Date of the Contract, signed by Owner and recommended by Engineer, ordering an addition, deletion, or revision in the Work.

1.02 Terminology

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

authority to undertake responsibility contrary to the provisions of Article 10 or any other provision of the Contract Documents.

C. *Day:*

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

D. *Defective:*

1. The word “defective,” when modifying the word “Work,” refers to Work that is unsatisfactory, faulty, or deficient in that it:
 - a. does not conform to the Contract Documents; or
 - b. does not meet the requirements of any applicable inspection, reference standard, test, or approval referred to in the Contract Documents; or
 - c. has been damaged prior to Engineer’s recommendation of final payment (unless responsibility for the protection thereof has been assumed by Owner at Substantial Completion in accordance with Paragraph 15.03 or 15.04).

E. *Furnish, Install, Perform, Provide:*

1. The word “furnish,” when used in connection with services, materials, or equipment, shall mean to supply and deliver said services, materials, or equipment to the Site (or some other specified location) ready for use or installation and in usable or operable condition.
2. The word “install,” when used in connection with services, materials, or equipment, shall mean to put into use or place in final position said services, materials, or equipment complete and ready for intended use.
3. The words “perform” or “provide,” when used in connection with services, materials, or equipment, shall mean to furnish and install said services, materials, or equipment complete and ready for intended use.
4. If the Contract Documents establish an obligation of Contractor with respect to specific services, materials, or equipment, but do not expressly use any of the four words “furnish,” “install,” “perform,” or “provide,” then Contractor shall furnish and install said services, materials, or equipment complete and ready for intended use.

- F. Unless stated otherwise in the Contract Documents, words or phrases that have a well-known technical or construction industry or trade meaning are used in the Contract Documents in accordance with such recognized meaning.

ARTICLE 2 – PRELIMINARY MATTERS

2.01 *Delivery of Bonds and Evidence of Insurance*

- A. *Bonds:* When Contractor delivers the executed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner such bonds as Contractor may be required to furnish.
- B. *Evidence of Contractor’s Insurance:* When Contractor delivers the executed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner, with copies to each named insured and additional insured (as identified in the Supplementary Conditions or elsewhere in the Contract), the certificates and other evidence of insurance required to be provided by Contractor in accordance with Article 6.
- C. *Evidence of Owner’s Insurance:* After receipt of the executed counterparts of the Agreement and all required bonds and insurance documentation, Owner shall promptly deliver to Contractor, with copies to each named insured and additional insured (as identified in the

Supplementary Conditions or otherwise), the certificates and other evidence of insurance required to be provided by Owner under Article 6.

2.02 *Copies of Documents*

- A. Owner shall furnish to Contractor four printed copies of the Contract (including one fully executed counterpart of the Agreement), and one copy in electronic portable document format (PDF). Additional printed copies will be furnished upon request at the cost of reproduction.
- B. Owner shall maintain and safeguard at least one original printed record version of the Contract, including Drawings and Specifications signed and sealed by Engineer and other design professionals. Owner shall make such original printed record version of the Contract available to Contractor for review. Owner may delegate the responsibilities under this provision to Engineer.

2.03 *Before Starting Construction*

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

2.04 *Preconstruction Conference; Designation of Authorized Representatives*

- A. Before any Work at the Site is started, a conference attended by Owner, 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 2.03.A, procedures for handling Shop Drawings, Samples, and other submittals, processing Applications for Payment, electronic or digital transmittals, and maintaining required records.
- B. At this conference Owner and Contractor each shall designate, in writing, a specific individual to act as its authorized representative with respect to the services and responsibilities under the Contract. Such individuals shall have the authority to transmit and receive information, render decisions relative to the Contract, and otherwise act on behalf of each respective party.

2.05 *Initial Acceptance of Schedules*

- A. At least 10 days before submission of the first Application for Payment a conference, attended by Contractor, Engineer, and others as appropriate, will be held to review for acceptability to Engineer as provided below the schedules submitted in accordance with Paragraph 2.03.A. Contractor shall have an additional 10 days to make corrections and adjustments and to complete and resubmit the schedules. No progress payment shall be made to Contractor until acceptable schedules are submitted to Engineer.
 - 1. The Progress Schedule will be acceptable to Engineer if it provides an orderly progression of the Work to completion within the Contract Times. Such acceptance will not impose on Engineer responsibility for the Progress Schedule, for sequencing, scheduling, or progress of the Work, nor interfere with or relieve Contractor from Contractor's full responsibility therefor.

2. Contractor's Schedule of Submittals will be acceptable to Engineer if it provides a workable arrangement for reviewing and processing the required submittals.
3. Contractor's Schedule of Values will be acceptable to Engineer as to form and substance if it provides a reasonable allocation of the Contract Price to the component parts of the Work.

2.06 *Electronic Transmittals*

- A. Except as otherwise stated elsewhere in the Contract, the Owner, Engineer, and Contractor may transmit, and shall accept, Project-related correspondence, text, data, documents, drawings, information, and graphics, including but not limited to Shop Drawings and other submittals, in electronic media or digital format, either directly, or through access to a secure Project website.
- B. If the Contract does not establish protocols for electronic or digital transmittals, then Owner, Engineer, and Contractor shall jointly develop such protocols.
- C. When transmitting items in electronic media or digital format, the transmitting party makes no representations as to long term compatibility, usability, or readability of the items resulting from the recipient's use of software application packages, operating systems, or computer hardware differing from those used in the drafting or transmittal of the items, or from those established in applicable transmittal protocols.

ARTICLE 3 – DOCUMENTS: INTENT, REQUIREMENTS, REUSE

3.01 *Intent*

- A. The Contract Documents are complementary; what is required by one is as binding as if required by all.
- B. It is the intent of the Contract Documents to describe a functionally complete project (or part thereof) to be constructed in accordance with the Contract Documents.
- C. Unless otherwise stated in the Contract Documents, if there is a discrepancy between the electronic or digital versions of the Contract Documents (including any printed copies derived from such electronic or digital versions) and the printed record version, the printed record version shall govern.
- D. The Contract supersedes prior negotiations, representations, and agreements, whether written or oral.
- E. Engineer will issue clarifications and interpretations of the Contract Documents as provided herein.

3.02 *Reference Standards*

- A. Standards Specifications, Codes, Laws and Regulations
 1. Reference in the Contract Documents to standard specifications, manuals, reference standards, 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, reference standard, code, or Laws or Regulations in effect at the time of opening of Bids (or on the Effective Date of the Contract 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, reference standard, 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 part of the Contract Documents prepared by or for Engineer. No such provision or instruction shall be effective to assign to Owner,

Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, 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 part of the Contract Documents prepared by or for Engineer.

3.03 *Reporting and Resolving Discrepancies*

A. *Reporting Discrepancies:*

1. *Contractor's Verification of Figures and Field Measurements:* Before undertaking each part of the Work, Contractor shall carefully study the Contract Documents, and check and verify pertinent figures and dimensions therein, particularly with respect to applicable field measurements. Contractor shall promptly report in writing to Engineer any conflict, error, ambiguity, or discrepancy that Contractor discovers, or has actual knowledge of, and shall not proceed with any Work affected thereby until the conflict, error, ambiguity, or discrepancy is resolved, by a clarification or interpretation by Engineer, or by an amendment or supplement to the Contract Documents issued pursuant to Paragraph 11.01.
2. *Contractor's Review of Contract Documents:* If, before or during the performance of the Work, Contractor discovers any conflict, error, ambiguity, or discrepancy within the Contract Documents, or between the Contract Documents and (a) any applicable Law or Regulation, (b) actual field conditions, (c) any standard specification, manual, reference standard, or code, or (d) any instruction of any Supplier, then Contractor shall promptly report it to Engineer in writing. Contractor shall not proceed with the Work affected thereby (except in an emergency as required by Paragraph 7.15) until the conflict, error, ambiguity, or discrepancy is resolved, by a clarification or interpretation by Engineer, or by an amendment or supplement to the Contract Documents issued pursuant to Paragraph 11.01.
3. Contractor shall not be liable to Owner or Engineer for failure to report any conflict, error, ambiguity, or discrepancy in the Contract Documents unless Contractor had actual knowledge thereof.

B. *Resolving Discrepancies:*

1. Except as may be otherwise specifically stated in the Contract Documents, the provisions of the part of the Contract Documents prepared by or for Engineer shall take precedence in resolving any conflict, error, ambiguity, or discrepancy between such provisions of the Contract Documents and:
 - a. the provisions of any standard specification, manual, reference standard, or code, or the instruction of any Supplier (whether or not specifically incorporated by reference as a Contract Document); 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 *Requirements of the Contract Documents*

- A. During the performance of the Work and until final payment, Contractor and Owner shall submit to the Engineer all matters in question concerning the requirements of the Contract Documents (sometimes referred to as requests for information or interpretation—RFIs), or relating to the acceptability of the Work under the Contract Documents, as soon as possible after such matters arise. Engineer will be the initial interpreter of the requirements of the Contract Documents, and judge of the acceptability of the Work thereunder.

- B. Engineer will, with reasonable promptness, render a written clarification, interpretation, or decision on the issue submitted, or initiate an amendment or supplement to the Contract Documents. Engineer's written clarification, interpretation, or decision will be final and binding on Contractor, unless it appeals by submitting a Change Proposal, and on Owner, unless it appeals by filing a Claim.
- C. If a submitted matter in question concerns terms and conditions of the Contract Documents that do not involve (1) the performance or acceptability of the Work under the Contract Documents, (2) the design (as set forth in the Drawings, Specifications, or otherwise), or (3) other engineering or technical matters, then Engineer will promptly give written notice to Owner and Contractor that Engineer is unable to provide a decision or interpretation. If Owner and Contractor are unable to agree on resolution of such a matter in question, either party may pursue resolution as provided in Article 12.

3.05 *Reuse of Documents*

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

ARTICLE 4 – COMMENCEMENT AND PROGRESS OF THE WORK

4.01 *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 Contract 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 Contract. 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 Contract, whichever date is earlier.

4.02 *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 such date.

4.03 *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.

4.04 *Progress Schedule*

- A. Contractor shall adhere to the Progress Schedule established in accordance with Paragraph 2.05 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 2.05) proposed adjustments in the Progress Schedule that will not result in changing the Contract Times.
 - 2. Proposed adjustments in the Progress Schedule that will change the Contract Times shall be submitted in accordance with the requirements of Article 11.
- B. 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, or during any appeal process, except as permitted by Paragraph 16.04, or as Owner and Contractor may otherwise agree in writing.

4.05 *Delays in Contractor's Progress*

- A. If Owner, Engineer, or anyone for whom Owner is responsible, delays, disrupts, or interferes with the performance or progress of the Work, then Contractor shall be entitled to an equitable adjustment in the Contract Times and Contract Price. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times.
- B. Contractor shall not be entitled to an adjustment in Contract Price or Contract Times for delay, disruption, or interference caused by or within the control of Contractor. Delay, disruption, and interference attributable to and within the control of a Subcontractor or Supplier shall be deemed to be within the control of Contractor.
- C. If Contractor's performance or progress is delayed, disrupted, or interfered with by unanticipated causes not the fault of and beyond the control of Owner, Contractor, and those for which they are responsible, then Contractor shall be entitled to an equitable adjustment in Contract Times. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times. Such an adjustment shall be Contractor's sole and exclusive remedy for the delays, disruption, and interference described in this paragraph. Causes of delay, disruption, or interference that may give rise to an adjustment in Contract Times under this paragraph include but are not limited to the following:
 - 1. severe and unavoidable natural catastrophes such as fires, floods, epidemics, and earthquakes;
 - 2. abnormal weather conditions;
 - 3. acts or failures to act of utility owners (other than those performing other work at or adjacent to the Site by arrangement with the Owner, as contemplated in Article 8); and
 - 4. acts of war or terrorism.
- D. Delays, disruption, and interference to the performance or progress of the Work resulting from the existence of a differing subsurface or physical condition, an Underground Facility that was not shown or indicated by the Contract Documents, or not shown or indicated with reasonable accuracy, and those resulting from Hazardous Environmental Conditions, are governed by Article 5.
- E. Paragraph 8.03 governs delays, disruption, and interference to the performance or progress of the Work resulting from the performance of certain other work at or adjacent to the Site.

- F. Contractor shall not be entitled to an adjustment in Contract Price or Contract Times for any delay, disruption, or interference if such delay is concurrent with a delay, disruption, or interference caused by or within the control of Contractor.
- G. Contractor must submit any Change Proposal seeking an adjustment in Contract Price or Contract Times under this paragraph within 30 days of the commencement of the delaying, disrupting, or interfering event.

ARTICLE 5 – AVAILABILITY OF LANDS; SUBSURFACE AND PHYSICAL CONDITIONS; HAZARDOUS ENVIRONMENTAL CONDITIONS

5.01 *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.
- 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 permanent improvements are to be made 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.

5.02 *Use of Site and Other Areas*

- A. *Limitation on Use of Site and Other Areas:*
 - 1. Contractor shall confine construction equipment, temporary construction facilities, the storage of materials and equipment, and the operations of workers to the Site, adjacent areas that Contractor has arranged to use through construction easements or otherwise, and other adjacent areas permitted by Laws and Regulations, and shall not unreasonably encumber the Site and such other adjacent areas with construction equipment or other materials or equipment. Contractor shall assume full responsibility for (a) damage to the Site; (b) damage to any such other adjacent areas used for Contractor's operations; (c) damage to any other adjacent land or areas; and (d) for injuries and losses sustained by the owners or occupants of any such land or areas; provided that such damage or injuries result from the performance of the Work or from other actions or conduct of the Contractor or those for which Contractor is responsible.
 - 2. If a damage or injury claim is made by the owner or occupant of any such land or area because of the performance of the Work, or because of other actions or conduct of the Contractor or those for which Contractor is responsible, Contractor shall (a) take immediate corrective or remedial action as required by Paragraph 7.12, or otherwise; (b) promptly attempt to settle the claim as to all parties through negotiations with such owner or occupant, or otherwise resolve the claim by arbitration or other dispute resolution proceeding, or at law; and (c) to the fullest extent permitted by Laws and Regulations, indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against any such claim, and against all 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 directly or indirectly, in whole or in part by, or based upon, Contractor's performance of the

Work, or because of other actions or conduct of the Contractor or those for which Contractor is responsible.

- B. *Removal of Debris During Performance of the Work:* During the progress of the Work the Contractor shall keep the Site and other adjacent areas free from accumulations of waste materials, rubbish, and other debris. Removal and disposal of such waste materials, rubbish, and other debris shall conform to applicable Laws and Regulations.
- C. *Cleaning:* Prior to Substantial Completion of the Work Contractor shall clean the Site and the Work and make it ready for utilization by Owner. At the completion of the Work Contractor shall remove from the Site and adjacent areas 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 of 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 structures or land to stresses or pressures that will endanger them.

5.03 *Subsurface and Physical Conditions*

- A. *Reports and Drawings:* The Supplementary Conditions identify:
 - 1. those reports known to Owner of explorations and tests of subsurface conditions at or adjacent to the Site;
 - 2. those drawings known to Owner of physical conditions relating to existing surface or subsurface structures at the Site (except Underground Facilities); and
 - 3. Technical Data contained in such reports and drawings.
- B. *Reliance by Contractor on Technical Data Authorized:* Contractor may rely upon the accuracy of the Technical Data expressly identified in the Supplementary Conditions with respect to such reports and drawings, but such reports and drawings are not Contract Documents. If no such express identification has been made, then Contractor may rely upon the accuracy of the Technical Data (as defined in Article 1) contained in any geotechnical or environmental report prepared for the Project and made available to Contractor. Except for such reliance on Technical Data, Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, 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.

5.04 *Differing Subsurface or Physical Conditions*

- A. *Notice by Contractor:* If Contractor believes that any subsurface or physical condition that is uncovered or revealed at the Site 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 5.03 is materially inaccurate; or
 - 2. is of such a nature as to require a change in the Drawings or Specifications; 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 7.15), notify Owner and Engineer in writing about such condition. Contractor shall not further disturb such condition or perform any Work in connection therewith (except with respect to an emergency) until receipt of a written statement permitting Contractor to do so.

- B. *Engineer's Review:* After receipt of written notice as required by the preceding paragraph, Engineer will promptly review the subsurface or physical condition in question; determine the necessity of Owner's obtaining additional exploration or tests with respect to the condition; conclude whether the condition falls within any one or more of the differing site condition categories in Paragraph 5.04.A above; obtain any pertinent cost or schedule information from Contractor; prepare recommendations to Owner regarding the Contractor's resumption of Work in connection with the subsurface or physical condition in question and the need for any change in the Drawings or Specifications; and advise Owner in writing of Engineer's findings, conclusions, and recommendations.
- C. *Owner's Statement to Contractor Regarding Site Condition:* After receipt of Engineer's written findings, conclusions, and recommendations, Owner shall issue a written statement to Contractor (with a copy to Engineer) regarding the subsurface or physical condition in question, addressing the resumption of Work in connection with such condition, indicating whether any change in the Drawings or Specifications will be made, and adopting or rejecting Engineer's written findings, conclusions, and recommendations, in whole or in part.
- D. *Possible Price and Times Adjustments:*
 1. Contractor shall be entitled to an equitable adjustment in Contract Price or Contract Times, or both, to the extent that the existence of a differing subsurface or physical condition, or any related delay, disruption, or interference, 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 fall within any one or more of the categories described in Paragraph 5.04.A;
 - 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 Paragraph 13.03; and,
 - c. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times.
 2. Contractor shall not be entitled to any adjustment in the Contract Price or Contract Times with respect to a subsurface or physical condition if:
 - a. Contractor knew of the existence of such condition at the time Contractor made a commitment to Owner with respect to Contract Price and Contract Times by the submission of a Bid or becoming bound under a negotiated contract, or otherwise; or
 - b. the existence of such condition reasonably could have been discovered or revealed as a result of any examination, investigation, exploration, test, or study of the Site and contiguous areas expressly required by the Bidding Requirements or Contract Documents to be conducted by or for Contractor prior to Contractor's making such commitment; or

- c. Contractor failed to give the written notice as required by Paragraph 5.04.A.
- 3. If Owner and Contractor agree regarding Contractor's entitlement to and the amount or extent of any adjustment in the Contract Price or Contract Times, or both, then any such adjustment shall be set forth in a Change Order.
- 4. Contractor may submit a Change Proposal regarding its entitlement to or the amount or extent of any adjustment in the Contract Price or Contract Times, or both, no later than 30 days after Owner's issuance of the Owner's written statement to Contractor regarding the subsurface or physical condition in question.

5.05 *Underground Facilities*

- A. *Contractor's Responsibilities:* The information and data shown or indicated in the Contract Documents with respect to existing Underground Facilities at or adjacent 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 do not warrant or guarantee the accuracy or completeness of any such information or data provided by others; 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 information and data regarding existing Underground Facilities at the Site;
 - b. locating all Underground Facilities shown or indicated in the Contract Documents as being at the Site;
 - c. coordination of the Work with the owners (including Owner) of such Underground Facilities, during construction; and
 - d. the safety and protection of all existing Underground Facilities at the Site, and repairing any damage thereto resulting from the Work.
- B. *Notice by Contractor:* If Contractor believes that an Underground Facility that is uncovered or revealed at the Site was not shown or indicated in the Contract Documents, or was not shown or indicated with reasonable accuracy, then 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 7.15), identify the owner of such Underground Facility and give written notice to that owner and to Owner and Engineer.
- C. *Engineer's Review:* Engineer will promptly review the Underground Facility and conclude whether such Underground Facility was not shown or indicated in the Contract Documents, or was not shown or indicated with reasonable accuracy; obtain any pertinent cost or schedule information from Contractor; prepare recommendations to Owner regarding the Contractor's resumption of Work in connection with the Underground Facility in question; determine the extent, if any, to which a change is required in the Drawings or Specifications to reflect and document the consequences of the existence or location of the Underground Facility; and advise Owner in writing of Engineer's findings, conclusions, and recommendations. During such time, Contractor shall be responsible for the safety and protection of such Underground Facility.
- D. *Owner's Statement to Contractor Regarding Underground Facility:* After receipt of Engineer's written findings, conclusions, and recommendations, Owner shall issue a written statement to Contractor (with a copy to Engineer) regarding the Underground Facility in question, addressing the resumption of Work in connection with such Underground Facility,

indicating whether any change in the Drawings or Specifications will be made, and adopting or rejecting Engineer's written findings, conclusions, and recommendations in whole or in part.

E. *Possible Price and Times Adjustments:*

1. Contractor shall be entitled to an equitable adjustment in the Contract Price or Contract Times, or both, to the extent that any existing Underground Facility at the Site that was not shown or indicated in the Contract Documents, or was not shown or indicated with reasonable accuracy, or any related delay, disruption, or interference, causes an increase or decrease in Contractor's cost of, or time required for, performance of the Work; subject, however, to the following:
 - a. Contractor did not know of and could not reasonably have been expected to be aware of or to have anticipated the existence or actual location of the Underground Facility in question;
 - 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 Paragraph 13.03;
 - c. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times; and
 - d. Contractor gave the notice required in Paragraph 5.05.B.
2. If Owner and Contractor agree regarding Contractor's entitlement to and the amount or extent of any adjustment in the Contract Price or Contract Times, or both, then any such adjustment shall be set forth in a Change Order.
3. Contractor may submit a Change Proposal regarding its entitlement to or the amount or extent of any adjustment in the Contract Price or Contract Times, or both, no later than 30 days after Owner's issuance of the Owner's written statement to Contractor regarding the Underground Facility in question.

5.06 *Hazardous Environmental Conditions at Site*

A. *Reports and Drawings:* The Supplementary Conditions identify:

1. those reports and drawings known to Owner relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site; and
2. Technical Data contained in such reports and drawings.

B. *Reliance by Contractor on Technical Data Authorized:* Contractor may rely upon the accuracy of the Technical Data expressly identified in the Supplementary Conditions with respect to such reports and drawings, but such reports and drawings are not Contract Documents. If no such express identification has been made, then Contractor may rely on the accuracy of the Technical Data (as defined in Article 1) contained in any geotechnical or environmental report prepared for the Project and made available to Contractor. Except for such reliance on Technical Data, Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors 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 removing or remediating any Hazardous Environmental Condition encountered, uncovered, or revealed at the Site unless such removal or remediation is expressly identified in the Contract Documents to be within the scope of the Work.
- D. Contractor shall be responsible for controlling, containing, and duly removing all Constituents of Concern brought to the Site by Contractor, Subcontractors, Suppliers, or anyone else for whom Contractor is responsible, and for any associated costs; and for the costs of removing and remediating any Hazardous Environmental Condition created by the presence of any such Constituents of Concern.
- E. If Contractor encounters, uncovers, or reveals a Hazardous Environmental Condition whose removal or remediation is not expressly identified in the Contract Documents as being within the scope of the Work, or if Contractor or anyone for whom Contractor is responsible creates a Hazardous Environmental Condition, then Contractor shall immediately: (1) secure or otherwise isolate such condition; (2) stop all Work in connection with such condition and in any area affected thereby (except in an emergency as required by Paragraph 7.15); and (3) 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. Promptly after consulting with Engineer, Owner shall take such actions as are necessary to permit Owner to timely obtain required permits and provide Contractor the written notice required by Paragraph 5.06.F. If Contractor or anyone for whom Contractor is responsible created the Hazardous Environmental Condition in question, then Owner may remove and remediate the Hazardous Environmental Condition, and impose a set-off against payments to account for the associated costs.
- F. Contractor shall not resume Work in connection with such Hazardous Environmental Condition or in any affected area until after Owner has obtained any required permits related thereto, and delivered written notice to Contractor either (1) specifying that such condition and any affected area is or has been rendered safe for the resumption of Work, or (2) specifying any special conditions under which such Work may be resumed safely.
- G. 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, then within 30 days of Owner's written notice regarding the resumption of Work, Contractor may submit a Change Proposal, or Owner may impose a set-off.
- H. 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, following the contractual change procedures in Article 11. Owner may have such deleted portion of the Work performed by Owner's own forces or others in accordance with Article 8.
- I. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to a Hazardous Environmental Condition, provided that such Hazardous Environmental Condition (1) was not shown or indicated in the Drawings, Specifications, or other Contract Documents, identified as Technical Data entitled to limited reliance pursuant to Paragraph 5.06.B, or identified in the Contract Documents to

be included within the scope of the Work, and (2) was not created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 5.06.H shall obligate Owner to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.

- J. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to the failure to control, contain, or remove a Constituent of Concern brought to the Site by Contractor or by anyone for whom Contractor is responsible, or to a Hazardous Environmental Condition created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 5.06.J shall obligate Contractor to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.
- K. The provisions of Paragraphs 5.03, 5.04, and 5.05 do not apply to the presence of Constituents of Concern or to a Hazardous Environmental Condition uncovered or revealed at the Site.

ARTICLE 6 – BONDS AND INSURANCE

6.01 *Performance, Payment, and Other Bonds*

- A. Contractor shall furnish a performance bond and a payment bond, each in an amount at least equal to the Contract Price, as security for the faithful performance and payment of all of Contractor's obligations under the Contract. These bonds shall remain in effect until one year after the date when final payment becomes due or until completion of the correction period specified in Paragraph 15.08, whichever is later, except as provided otherwise by Laws or Regulations, the Supplementary Conditions, or other specific provisions of the Contract. Contractor shall also furnish such other bonds as are required by the Supplementary Conditions or other specific provisions of the Contract.
- B. All bonds shall be in the form prescribed by the Contract except as provided otherwise by Laws or Regulations, and shall be executed by such sureties as are named in "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" as published in Circular 570 (as amended and supplemented) by the Financial Management Service, Surety Bond Branch, U.S. Department of the Treasury. A bond signed by an agent or attorney-in-fact must be accompanied by a certified copy of that individual's authority to bind the surety. The evidence of authority shall show that it is effective on the date the agent or attorney-in-fact signed the accompanying bond.
- C. Contractor shall obtain the required bonds from surety companies that are duly licensed or authorized in the jurisdiction in which the Project is located to issue bonds in the required amounts.
- D. If the surety on a bond furnished by Contractor is declared bankrupt or becomes insolvent, or its right to do business is terminated in any state or jurisdiction where any part of the Project is located, or the surety ceases to meet the requirements above, then Contractor shall promptly notify Owner and Engineer and shall, within 20 days after the event giving rise to such notification, provide another bond and surety, both of which shall comply with the bond and surety requirements above.
- E. If Contractor has failed to obtain a required bond, Owner may exclude the Contractor from the Site and exercise Owner's termination rights under Article 16.

- F. Upon request, Owner shall provide a copy of the payment bond to any Subcontractor, Supplier, or other person or entity claiming to have furnished labor or materials used in the performance of the Work.

6.02 *Insurance—General Provisions*

- A. Owner and Contractor shall obtain and maintain insurance as required in this Article and in the Supplementary Conditions.
- B. All insurance required by the Contract to be purchased and maintained by Owner or Contractor shall be obtained from insurance companies that are duly licensed or authorized, in the state or jurisdiction in which the Project is located, to issue insurance policies for the required limits and coverages. Unless a different standard is indicated in the Supplementary Conditions, all companies that provide insurance policies required under this Contract shall have an A.M. Best rating of A-VII or better.
- C. Contractor shall deliver to Owner, with copies to each named insured and additional insured (as identified in this Article, in the Supplementary Conditions, or elsewhere in the Contract), certificates of insurance establishing that Contractor has obtained and is maintaining the policies, coverages, and endorsements required by the Contract. Upon request by Owner or any other insured, Contractor shall also furnish other evidence of such required insurance, including but not limited to copies of policies and endorsements, and documentation of applicable self-insured retentions and deductibles. Contractor may block out (redact) any confidential premium or pricing information contained in any policy or endorsement furnished under this provision.
- D. Owner shall deliver to Contractor, with copies to each named insured and additional insured (as identified in this Article, the Supplementary Conditions, or elsewhere in the Contract), certificates of insurance establishing that Owner has obtained and is maintaining the policies, coverages, and endorsements required of Owner by the Contract (if any). Upon request by Contractor or any other insured, Owner shall also provide other evidence of such required insurance (if any), including but not limited to copies of policies and endorsements, and documentation of applicable self-insured retentions and deductibles. Owner may block out (redact) any confidential premium or pricing information contained in any policy or endorsement furnished under this provision.
- E. Failure of Owner or Contractor to demand such certificates or other evidence of the other party's full compliance with these insurance requirements, or failure of Owner or Contractor to identify a deficiency in compliance from the evidence provided, shall not be construed as a waiver of the other party's obligation to obtain and maintain such insurance.
- F. If either party does not purchase or maintain all of the insurance required of such party by the Contract, 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.
- G. If Contractor has failed to obtain and maintain required insurance, Owner may exclude the Contractor from the Site, impose an appropriate set-off against payment, and exercise Owner's termination rights under Article 16.
- H. Without prejudice to any other right or remedy, if a party has failed to obtain required insurance, the other party may elect to obtain equivalent insurance to protect such other party's interests at the expense of the party who was required to provide such coverage, and the Contract Price shall be adjusted accordingly.
- I. Owner does not represent that insurance coverage and limits established in this Contract necessarily will be adequate to protect Contractor or Contractor's interests.

- J. The insurance and insurance limits required herein shall not be deemed as a limitation on Contractor's liability under the indemnities granted to Owner and other individuals and entities in the Contract.

6.03 *Contractor's Insurance*

- A. *Workers' Compensation*: Contractor shall purchase and maintain workers' compensation and employer's liability insurance for:
1. claims under workers' compensation, disability benefits, and other similar employee benefit acts.
 2. United States Longshoreman and Harbor Workers' Compensation Act and Jones Act coverage (if applicable).
 3. claims for damages because of bodily injury, occupational sickness or disease, or death of Contractor's employees (by stop-gap endorsement in monopolist worker's compensation states).
 4. Foreign voluntary worker compensation (if applicable).
- B. *Commercial General Liability—Claims Covered*: Contractor shall purchase and maintain commercial general liability insurance, covering all operations by or on behalf of Contractor, on an occurrence basis, against:
1. claims for damages because of bodily injury, sickness or disease, or death of any person other than Contractor's employees.
 2. claims for damages insured by reasonably available personal injury liability coverage.
 3. 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.
- C. *Commercial General Liability—Form and Content*: Contractor's commercial liability policy shall be written on a 1996 (or later) ISO commercial general liability form (occurrence form) and include the following coverages and endorsements:
1. Products and completed operations coverage:
 - a. Such insurance shall be maintained for three years after final payment.
 - b. Contractor shall furnish Owner and each other additional insured (as identified in the Supplementary Conditions or elsewhere in the Contract) evidence of continuation of such insurance at final payment and three years thereafter.
 2. Blanket contractual liability coverage, to the extent permitted by law, including but not limited to coverage of Contractor's contractual indemnity obligations in Paragraph 7.18.
 3. Broad form property damage coverage.
 4. Severability of interest.
 5. Underground, explosion, and collapse coverage.
 6. Personal injury coverage.
 7. Additional insured endorsements that include both ongoing operations and products and completed operations coverage through ISO Endorsements CG 20 10 10 01 and CG 20 37 10 01 (together); or CG 20 10 07 04 and CG 20 37 07 04 (together); or their equivalent.
 8. For design professional additional insureds, ISO Endorsement CG 20 32 07 04, "Additional Insured—Engineers, Architects or Surveyors Not Engaged by the Named Insured" or its equivalent.

- D. *Automobile liability*: Contractor shall purchase and maintain automobile liability insurance against 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. The automobile liability policy shall be written on an occurrence basis.
- E. *Umbrella or excess liability*: Contractor shall purchase and maintain umbrella or excess liability insurance written over the underlying employer's liability, commercial general liability, and automobile liability insurance described in the paragraphs above. Subject to industry-standard exclusions, the coverage afforded shall follow form as to each and every one of the underlying policies.
- F. *Contractor's pollution liability insurance*: Contractor shall purchase and maintain a policy covering third-party injury and property damage claims, including clean-up costs, as a result of pollution conditions arising from Contractor's operations and completed operations. This insurance shall be maintained for no less than three years after final completion.
- G. *Additional insureds*: The Contractor's commercial general liability, automobile liability, umbrella or excess, and pollution liability policies shall include and list as additional insureds Owner and Engineer, and any individuals or entities identified in the Supplementary Conditions; include coverage for the respective officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of all such additional insureds; and the insurance afforded to these additional insureds shall provide primary coverage for all claims covered thereby (including as applicable those arising from both ongoing and completed operations) on a non-contributory basis. Contractor shall obtain all necessary endorsements to support these requirements.
- H. *Contractor's professional liability insurance*: If Contractor will provide or furnish professional services under this Contract, through a delegation of professional design services or otherwise, then Contractor shall be responsible for purchasing and maintaining applicable professional liability insurance. This insurance shall provide protection against claims arising out of performance of professional design or related services, and caused by a negligent error, omission, or act for which the insured party is legally liable. It shall be maintained throughout the duration of the Contract and for a minimum of two years after Substantial Completion. If such professional design services are performed by a Subcontractor, and not by Contractor itself, then the requirements of this paragraph may be satisfied through the purchasing and maintenance of such insurance by such Subcontractor.
- I. *General provisions*: The policies of insurance required by this Paragraph 6.03 shall:
1. include at least the specific coverages provided in this Article.
 2. be written for not less than the limits of liability provided in this Article and in the Supplementary Conditions, or required by Laws or Regulations, whichever is greater.
 3. contain a provision or endorsement that the coverage afforded will not be canceled, materially changed, or renewal refused until at least 10 days prior written notice has been given to Contractor. Within three days of receipt of any such written notice, Contractor shall provide a copy of the notice to Owner, Engineer, and each other insured under the policy.
 4. remain in effect at least until final payment (and longer if expressly required in this Article) and at all times thereafter when Contractor may be correcting, removing, or replacing defective Work as a warranty or correction obligation, or otherwise, or returning to the Site to conduct other tasks arising from the Contract Documents.
 5. be appropriate for the Work being performed and provide protection from claims that 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.

- J. The coverage requirements for specific policies of insurance must be met by such policies, and not by reference to excess or umbrella insurance provided in other policies.

6.04 *Owner's Liability Insurance*

- A. In addition to the insurance required to be provided by Contractor under Paragraph 6.03, 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.
- B. Owner's liability policies, if any, operate separately and independently from policies required to be provided by Contractor, and Contractor cannot rely upon Owner's liability policies for any of Contractor's obligations to the Owner, Engineer, or third parties.

6.05 *Property Insurance*

- A. *Builder's Risk:* Unless otherwise provided in the Supplementary Conditions, Contractor shall purchase and maintain builder's risk insurance upon the Work on a completed value basis, in the amount of the full insurable 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 Owner and Contractor as named insureds, and all Subcontractors, and any individuals or entities required by the Supplementary Conditions to be insured under such builder's risk policy, as insureds or named insureds. For purposes of the remainder of this Paragraph 6.05, Paragraphs 6.06 and 6.07, and any corresponding Supplementary Conditions, the parties required to be insured shall collectively be referred to as "insureds."
 - 2. be written on a builder's risk "all risk" policy form that shall at least include insurance for physical loss or damage to the Work, temporary buildings, falsework, and materials and equipment in transit, and shall insure against at least the following perils or causes of loss: fire; lightning; windstorm; riot; civil commotion; terrorism; vehicle impact; aircraft; smoke; theft; vandalism and malicious mischief; mechanical breakdown, boiler explosion, and artificially generated electric current; earthquake; volcanic activity, and other earth movement; flood; collapse; explosion; debris removal; demolition occasioned by enforcement of Laws and Regulations; water damage (other than that caused by flood); and such other perils or causes of loss as may be specifically required by the Supplementary Conditions. If insurance against mechanical breakdown, boiler explosion, and artificially generated electric current; earthquake; volcanic activity, and other earth movement; or flood, are not commercially available under builder's risk policies, by endorsement or otherwise, such insurance may be provided through other insurance policies acceptable to Owner and Contractor.
 - 3. cover, as insured property, at least the following: (a) the Work and all materials, supplies, machinery, apparatus, equipment, fixtures, and other property of a similar nature that are to be incorporated into or used in the preparation, fabrication, construction, erection, or completion of the Work, including Owner-furnished or assigned property; (b) spare parts inventory required within the scope of the Contract; and (c) temporary works which are not intended to form part of the permanent constructed Work but which are intended to provide working access to the Site, or to the Work under construction, or which are intended to provide temporary support for the Work under construction, including scaffolding, form work, fences, shoring, falsework, and temporary structures.

4. cover expenses incurred in the repair or replacement of any insured property (including but not limited to fees and charges of engineers and architects).
 5. extend to cover damage or loss to insured property while in temporary storage at the Site or in a storage location outside the Site (but not including property stored at the premises of a manufacturer or Supplier).
 6. extend to cover damage or loss to insured property while in transit.
 7. allow for partial occupation or use of the Work by Owner, such that those portions of the Work that are not yet occupied or used by Owner shall remain covered by the builder's risk insurance.
 8. allow for the waiver of the insurer's subrogation rights, as set forth below.
 9. provide primary coverage for all losses and damages caused by the perils or causes of loss covered.
 10. not include a co-insurance clause.
 11. include an exception for ensuing losses from physical damage or loss with respect to any defective workmanship, design, or materials exclusions.
 12. include performance/hot testing and start-up.
 13. be maintained in effect, subject to the provisions herein regarding Substantial Completion and partial occupancy or use of the Work by Owner, until the Work is complete.
- B. *Notice of Cancellation or Change:* All the policies of insurance (and the certificates or other evidence thereof) required to be purchased and maintained in accordance with this Paragraph 6.05 will contain a provision or endorsement that the coverage afforded will not be canceled or materially changed or renewal refused until at least 10 days prior written notice has been given to the purchasing policyholder. Within three days of receipt of any such written notice, the purchasing policyholder shall provide a copy of the notice to each other insured.
- C. *Deductibles:* The purchaser of any required builder's risk or property insurance shall pay for costs not covered because of the application of a policy deductible.
- D. *Partial Occupancy or Use by Owner:* If Owner will occupy or use a portion or portions of the Work prior to Substantial Completion of all the Work as provided in Paragraph 15.04, then Owner (directly, if it is the purchaser of the builder's risk policy, or through Contractor) will provide notice of such occupancy or use to the builder's risk insurer. The builder's risk insurance shall not be canceled or permitted to lapse on account of any such partial use or occupancy; rather, those portions of the Work that are occupied or used by Owner may come off the builder's risk policy, while those portions of the Work not yet occupied or used by Owner shall remain covered by the builder's risk insurance.
- E. *Additional Insurance:* If Contractor elects to obtain other special insurance to be included in or supplement the builder's risk or property insurance policies provided under this Paragraph 6.05, it may do so at Contractor's expense.
- F. *Insurance of Other Property:* If the express insurance provisions of the Contract do not require or address the insurance of a property item or interest, such as tools, construction equipment, or other personal property owned by Contractor, a Subcontractor, or an employee of Contractor or a Subcontractor, then the entity or individual owning such property item will be responsible for deciding whether to insure it, and if so in what amount.

6.06 *Waiver of Rights*

- A. All policies purchased in accordance with Paragraph 6.05, expressly including the builder's risk policy, 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 insureds thereunder, or against

Engineer or its consultants, or their officers, directors, members, partners, employees, agents, consultants, or subcontractors. Owner and Contractor waive all rights against each other and the respective officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, for all losses and damages caused by, arising out of, or resulting from any of the perils or causes of loss covered by such policies and any other property insurance applicable to the Work; and, in addition, waive all such rights against Engineer, its consultants, all Subcontractors, all individuals or entities identified in the Supplementary Conditions as insureds, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, under such policies for losses and damages so caused. None of the above waivers shall extend to the rights that any party making such waiver may have to the proceeds of insurance held by Owner or Contractor as trustee or fiduciary, or otherwise payable under any policy so issued.

- B. Owner waives all rights against Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, for:
 - 1. loss due to business interruption, loss of use, or other consequential loss extending beyond direct physical loss or damage to Owner's property or the Work caused by, arising out of, or resulting from fire or other perils whether or not insured by Owner; and
 - 2. loss or damage to the completed Project or part thereof caused by, arising out of, or resulting from fire or other insured peril or cause of loss covered by any property insurance maintained on the completed Project or part thereof by Owner during partial occupancy or use pursuant to Paragraph 15.04, after Substantial Completion pursuant to Paragraph 15.03, or after final payment pursuant to Paragraph 15.06.
- C. Any insurance policy maintained by Owner covering any loss, damage or consequential loss referred to in Paragraph 6.06.B shall contain provisions to the effect that in the event of payment of any such loss, damage, or consequential loss, the insurers will have no rights of recovery against Contractor, Subcontractors, or Engineer, or the officers, directors, members, partners, employees, agents, consultants, or subcontractors of each and any of them.
- D. Contractor shall be responsible for assuring that the agreement under which a Subcontractor performs a portion of the Work contains provisions whereby the Subcontractor waives all rights against Owner, Contractor, all individuals or entities identified in the Supplementary Conditions as insureds, the Engineer and its consultants, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, for all losses and damages caused by, arising out of, relating to, or resulting from any of the perils or causes of loss covered by builder's risk insurance and any other property insurance applicable to the Work.

6.07 *Receipt and Application of Property Insurance Proceeds*

- A. Any insured loss under the builder's risk and other policies of insurance required by Paragraph 6.05 will be adjusted and settled with the named insured that purchased the policy. Such named insured shall act as fiduciary for the other insureds, and give notice to such other insureds that adjustment and settlement of a claim is in progress. Any other insured may state its position regarding a claim for insured loss in writing within 15 days after notice of such claim.
- B. Proceeds for such insured losses may be made payable by the insurer either jointly to multiple insureds, or to the named insured that purchased the policy in its own right and as fiduciary for other insureds, subject to the requirements of any applicable mortgage clause. A named insured receiving insurance proceeds under the builder's risk and other policies of insurance required by Paragraph 6.05 shall distribute such proceeds in accordance with such agreement as the parties in interest may reach, or as otherwise required under the dispute resolution provisions of this Contract or applicable Laws and Regulations.

- C. If no other special agreement is reached, the damaged Work shall be repaired or replaced, the money so received applied on account thereof, and the Work and the cost thereof covered by Change Order, if needed.

ARTICLE 7 – CONTRACTOR’S RESPONSIBILITIES

7.01 *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.
- B. At all times during the progress of the Work, Contractor shall assign a competent resident superintendent who shall not be replaced without written notice to Owner and Engineer except under extraordinary circumstances.

7.02 *Labor; Working Hours*

- A. Contractor shall provide competent, suitably qualified personnel to survey and lay out the Work and perform construction as required by the Contract Documents. Contractor shall at all times maintain good discipline and order at the Site.
- B. Except as otherwise required for the safety or protection of persons or the Work or property at the Site or adjacent thereto, and except as otherwise stated in the Contract Documents, all Work at the Site shall be performed during regular working hours, Monday through Friday. Contractor will not perform Work on a Saturday, Sunday, or any legal holiday. Contractor may perform Work outside regular working hours or on Saturdays, Sundays, or legal holidays only with Owner’s written consent, which will not be unreasonably withheld.

7.03 *Services, Materials, and Equipment*

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

7.04 *“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 Contract Price has been based upon Contractor furnishing such item as specified. The specification or description of such an item 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 is permitted, Contractor may request that Engineer authorize the use of other items of material or equipment, or items from other proposed suppliers under the circumstances described below.

1. If Engineer in its sole discretion determines that 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, Engineer shall deem it an “or equal” item. For the purposes of this paragraph, a proposed item of material or equipment will be considered functionally equal to an item so named if:
 - a. in the exercise of reasonable judgment Engineer determines that:
 - 1) it is at least equal in materials of construction, quality, durability, appearance, strength, and design characteristics;
 - 2) it will reliably perform at least equally well the function and achieve the results imposed by the design concept of the completed Project as a functioning whole;
 - 3) it has a proven record of performance and availability of responsive service; and
 - 4) it is not objectionable to Owner.
 - b. Contractor certifies that, if approved and incorporated into the Work:
 - 1) there will be no increase in cost to the Owner or increase in Contract Times; and
 - 2) it will conform substantially to the detailed requirements of the item named in the Contract Documents.
- B. *Contractor’s Expense:* Contractor shall provide all data in support of any proposed “or equal” item at Contractor’s expense.
- C. *Engineer’s Evaluation and Determination:* Engineer will be allowed a reasonable time to evaluate each “or-equal” request. Engineer may require Contractor to furnish additional data about the proposed “or-equal” item. Engineer will be the sole judge of acceptability. No “or-equal” item will be ordered, furnished, installed, or utilized until Engineer’s review is complete and Engineer determines that the proposed item is an “or-equal”, which will be evidenced by an approved Shop Drawing or other written communication. Engineer will advise Contractor in writing of any negative determination.
- D. *Effect of Engineer’s Determination:* Neither approval nor denial of an “or-equal” request shall result in any change in Contract Price. The Engineer’s denial of an “or-equal” request shall be final and binding, and may not be reversed through an appeal under any provision of the Contract Documents.
- E. *Treatment as a Substitution Request:* If Engineer determines that an item of material or equipment proposed by Contractor does not qualify as an “or-equal” item, Contractor may request that Engineer consider the proposed item as a substitute pursuant to Paragraph 7.05.

7.05 Substitutes

- A. Unless the specification or description of an item of material or equipment required to be furnished under the Contract Documents contains or is followed by words reading that no substitution is permitted, Contractor may request that Engineer authorize the use of other items of material or equipment under the circumstances described below. To the extent possible such requests shall be made before commencement of related construction at the Site.
 1. Contractor shall submit sufficient information as provided below to allow Engineer to determine if the item of material or equipment proposed is functionally equivalent to that named and an acceptable substitute therefor. Engineer will not accept requests for review of proposed substitute items of material or equipment from anyone other than Contractor.

2. The requirements for review by Engineer will be as set forth in Paragraph 7.05.B, as supplemented by the Specifications, and as Engineer may decide is appropriate under the circumstances.
3. Contractor shall make written application to Engineer for review of a proposed substitute item of material or equipment that Contractor seeks to furnish or use. The application:
 - a. shall certify that the proposed substitute item will:
 - 1) perform adequately the functions and achieve the results called for by the general design,
 - 2) be similar in substance to that specified, and
 - 3) be suited to the same use as that specified.
 - b. will state:
 - 1) the extent, if any, to which the use of the proposed substitute item will necessitate a change in Contract Times,
 - 2) whether use of the proposed substitute item in the Work will require a change in any of the Contract Documents (or in the provisions of any other direct contract with Owner for other work on the Project) to adapt the design to the proposed substitute item, and
 - 3) whether incorporation or use of the proposed substitute item in connection with the Work is subject to payment of any license fee or royalty.
 - c. will identify:
 - 1) all variations of the proposed substitute item from that specified, and
 - 2) available engineering, sales, maintenance, repair, and replacement services.
 - d. shall contain an itemized estimate of all costs or credits that will result directly or indirectly from use of such substitute item, including but not limited to changes in Contract Price, shared savings, costs of redesign, and claims of other contractors affected by any resulting change.
- B. *Engineer's Evaluation and Determination:* Engineer will be allowed a reasonable time to evaluate each substitute request, and to obtain comments and direction from Owner. Engineer may require Contractor to furnish additional data about the proposed substitute item. Engineer will be the sole judge of acceptability. No substitute will be ordered, furnished, installed, or utilized until Engineer's review is complete and Engineer determines that the proposed item is an acceptable substitute. Engineer's determination will be evidenced by a Field Order or a proposed Change Order accounting for the substitution itself and all related impacts, including changes in Contract Price or Contract Times. Engineer will advise Contractor in writing of any negative determination.
- C. *Special Guarantee:* Owner may require Contractor to furnish at Contractor's expense a special performance guarantee or other surety with respect to any substitute.
- D. *Reimbursement of Engineer's Cost:* Engineer will record Engineer's costs in evaluating a substitute proposed or submitted by Contractor. Whether or not Engineer approves a substitute so proposed or submitted by Contractor, Contractor shall reimburse Owner for the reasonable charges of Engineer for evaluating each such proposed substitute. Contractor shall also reimburse Owner for the reasonable charges of Engineer for making changes in the Contract Documents (or in the provisions of any other direct contract with Owner) resulting from the acceptance of each proposed substitute.

- E. *Contractor's Expense:* Contractor shall provide all data in support of any proposed substitute at Contractor's expense.
- F. *Effect of Engineer's Determination:* If Engineer approves the substitution request, Contractor shall execute the proposed Change Order and proceed with the substitution. The Engineer's denial of a substitution request shall be final and binding, and may not be reversed through an appeal under any provision of the Contract Documents. Contractor may challenge the scope of reimbursement costs imposed under Paragraph 7.05.D, by timely submittal of a Change Proposal.

7.06 *Concerning Subcontractors, Suppliers, and Others*

- A. Contractor may retain Subcontractors and Suppliers for the performance of parts of the Work. Such Subcontractors and Suppliers must be acceptable to Owner.
- B. Contractor shall retain specific Subcontractors, Suppliers, or other individuals or entities for the performance of designated parts of the Work if required by the Contract to do so.
- C. Subsequent to the submittal of Contractor's Bid or final negotiation of the terms of the Contract, Owner may not require Contractor to retain any Subcontractor, Supplier, or other individual or entity to furnish or perform any of the Work against which Contractor has reasonable objection.
- D. Prior to entry into any binding subcontract or purchase order, Contractor shall submit to Owner the identity of the proposed Subcontractor or Supplier (unless Owner has already deemed such proposed Subcontractor or Supplier acceptable, during the bidding process or otherwise). Such proposed Subcontractor or Supplier shall be deemed acceptable to Owner unless Owner raises a substantive, reasonable objection within five days.
- E. Owner may require the replacement of any Subcontractor, Supplier, or other individual or entity retained by Contractor to perform any part of the Work. Owner also may require Contractor to retain specific replacements; provided, however, that Owner may not require a replacement to which Contractor has a reasonable objection. If Contractor has submitted the identity of certain Subcontractors, Suppliers, or other individuals or entities for acceptance by Owner, and Owner has accepted it (either in writing or by failing to make written objection thereto), then Owner may subsequently revoke the acceptance of any such Subcontractor, Supplier, or other individual or entity so identified solely on the basis of substantive, reasonable objection after due investigation. Contractor shall submit an acceptable replacement for the rejected Subcontractor, Supplier, or other individual or entity.
- F. If Owner requires the replacement of any Subcontractor, Supplier, or other individual or entity retained by Contractor to perform any part of the Work, then Contractor shall be entitled to an adjustment in Contract Price or Contract Times, or both, with respect to the replacement; and Contractor shall initiate a Change Proposal for such adjustment within 30 days of Owner's requirement of replacement.
- G. 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 the right of Owner to the completion of the Work in accordance with the Contract Documents.
- H. On a monthly basis Contractor shall submit to Engineer a complete list of all Subcontractors and Suppliers having a direct contract with Contractor, and of all other Subcontractors and Suppliers known to Contractor at the time of submittal.
- I. 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.

- J. Contractor shall be solely responsible for scheduling and coordinating the work of Subcontractors, Suppliers, and all other individuals or entities performing or furnishing any of the Work.
- K. Contractor shall restrict all Subcontractors, Suppliers, and such other individuals or entities performing or furnishing any of the Work from communicating with Engineer or Owner, except through Contractor or in case of an emergency, or as otherwise expressly allowed herein.
- L. 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.
- M. All Work performed for Contractor by a Subcontractor or Supplier shall be pursuant to an appropriate contractual agreement that specifically binds the Subcontractor or Supplier to the applicable terms and conditions of the Contract Documents for the benefit of Owner and Engineer.
- N. Owner may furnish to any Subcontractor or Supplier, to the extent practicable, information about amounts paid to Contractor on account of Work performed for Contractor by the particular Subcontractor or Supplier.
- O. Nothing in the Contract Documents:
 - 1. shall create for the benefit of any such Subcontractor, Supplier, or other individual or entity any contractual relationship between Owner or Engineer and any such Subcontractor, Supplier, or other individual or entity; nor
 - 2. shall create any obligation on the part of Owner or Engineer to pay or to see to the payment of any money due any such Subcontractor, Supplier, or other individual or entity except as may otherwise be required by Laws and Regulations.

7.07 *Patent Fees and Royalties*

- A. Contractor shall pay all license fees and royalties and assume all costs incident to the use in the performance of the Work or the incorporation in the Work of any invention, design, process, product, or device which is the subject of patent rights or copyrights held by others. If a particular invention, design, process, product, or device is specified in the Contract Documents for use in the performance of the Work and if, to the actual knowledge of Owner or Engineer, its use is subject to patent rights or copyrights calling for the payment of any license fee or royalty to others, the existence of such rights shall be disclosed by Owner in the Contract Documents.
- B. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, and its officers, directors, members, partners, employees, agents, consultants, and subcontractors 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 specified in the Contract Documents, but not identified as being subject to payment of any license fee or royalty to others required by patent rights or copyrights.
- C. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute

resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device not specified in the Contract Documents.

7.08 *Permits*

- A. Unless otherwise provided in the Contract Documents, 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 the submission of Contractor's Bid (or when Contractor became bound under a negotiated contract). Owner shall pay all charges of utility owners for connections for providing permanent service to the Work

7.09 *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.

7.10 *Laws and Regulations*

- A. Contractor shall give all notices required by and shall comply with all Laws and Regulations applicable to the performance of the Work. Except where otherwise expressly required by applicable Laws and Regulations, neither Owner nor Engineer shall be responsible for monitoring Contractor's compliance with any Laws or Regulations.
- B. If Contractor performs any Work or takes any other action knowing or having reason to know that it is contrary to Laws or Regulations, Contractor shall bear all resulting costs and losses, and shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such Work or other action. It shall not be Contractor's responsibility to make certain that the Work described in the Contract Documents is in accordance with Laws and Regulations, but this shall not relieve Contractor of Contractor's obligations under Paragraph 3.03.
- C. Owner or Contractor may give notice to the other party of any changes after the submission of Contractor's Bid (or after the date when Contractor became bound under a negotiated contract) in Laws or Regulations having an effect on the cost or time of performance of the Work, including but not limited to changes in Laws or Regulations having an effect on procuring permits and on sales, use, value-added, consumption, and other similar taxes. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times resulting from such changes, then within 30 days of such notice Contractor may submit a Change Proposal, or Owner may initiate a Claim.

7.11 *Record Documents*

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

7.12 *Safety and Protection*

- A. Contractor shall be solely responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the Work. Such responsibility does not relieve Subcontractors of their responsibility for the safety of persons or property in the performance of their work, nor for compliance with applicable safety Laws and Regulations. 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, other work in progress, 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 Owner; the owners of adjacent property, Underground Facilities, and other utilities; and other contractors and utility owners performing work at or adjacent to the Site, when prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation, and replacement of their property or work in progress.
- C. Contractor shall comply with the applicable requirements of Owner's safety programs, if any. The Supplementary Conditions identify any Owner's safety programs that are applicable to the Work.
- D. Contractor shall inform Owner and Engineer of the specific requirements of Contractor's safety program with which Owner's and Engineer's employees and representatives must comply while at the Site.
- E. All damage, injury, or loss to any property referred to in Paragraph 7.12.A.2 or 7.12.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 at its expense (except damage or loss attributable to the fault of Drawings or Specifications or to the acts or omissions of Owner or Engineer 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).
- F. Contractor's duties and responsibilities for safety and protection 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 15.06.B that the Work is acceptable (except as otherwise expressly provided in connection with Substantial Completion).
- G. Contractor's duties and responsibilities for safety and protection shall resume whenever Contractor or any Subcontractor or Supplier returns to the Site to fulfill warranty or correction obligations, or to conduct other tasks arising from the Contract Documents.

7.13 *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.

7.14 *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.

7.15 *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.

7.16 *Shop Drawings, Samples, and Other Submittals*

A. *Shop Drawing and Sample Submittal Requirements:*

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

- B. *Submittal Procedures for Shop Drawings and Samples:* Contractor shall submit Shop Drawings and Samples to Engineer for review and approval in accordance with the accepted Schedule of Submittals. Each submittal will be identified as Engineer may require.

1. *Shop Drawings:*

- a. Contractor shall submit the number of copies required in the Specifications.
- b. Data shown on the Shop Drawings will be complete with respect to quantities, dimensions, specified performance and design criteria, materials, and similar data to show Engineer the services, materials, and equipment Contractor proposes to provide and to enable Engineer to review the information for the limited purposes required by Paragraph 7.16.D.

2. *Samples:*
 - a. Contractor shall submit the number of Samples required in the Specifications.
 - b. Contractor shall clearly identify each Sample as to material, Supplier, pertinent data such as catalog numbers, the use for which intended and other data as Engineer may require to enable Engineer to review the submittal for the limited purposes required by Paragraph 7.16.D.
3. Where a Shop Drawing or Sample is required by the Contract Documents or the Schedule of Submittals, any related Work performed prior to Engineer's review and approval of the pertinent submittal will be at the sole expense and responsibility of Contractor.
- C. *Other Submittals:* Contractor shall submit other submittals to Engineer in accordance with the accepted Schedule of Submittals, and pursuant to the applicable terms of the Specifications.
- D. *Engineer's Review:*
 1. Engineer will provide timely review of Shop Drawings and Samples in accordance with the Schedule of Submittals acceptable to Engineer. Engineer's review and approval will be only to determine if the items covered by the submittals will, after installation or incorporation in the Work, conform to the information given in the Contract Documents and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents.
 2. Engineer's review and approval will not extend to means, methods, techniques, sequences, or procedures of construction or to safety precautions or programs incident thereto.
 3. Engineer's review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.
 4. Engineer's review and approval of a Shop Drawing or Sample shall not relieve Contractor from responsibility for any variation from the requirements of the Contract Documents unless Contractor has complied with the requirements of Paragraph 7.16.A.3 and Engineer has given written approval of each such variation by specific written notation thereof incorporated in or accompanying the Shop Drawing or Sample. Engineer will document any such approved variation from the requirements of the Contract Documents in a Field Order.
 5. Engineer's review and approval of a Shop Drawing or Sample shall not relieve Contractor from responsibility for complying with the requirements of Paragraph 7.16.A and B.
 6. Engineer's review and approval of a Shop Drawing or Sample, or of a variation from the requirements of the Contract Documents, shall not, under any circumstances, change the Contract Times or Contract Price, unless such changes are included in a Change Order.
 7. Neither Engineer's receipt, review, acceptance or approval of a Shop Drawing, Sample, or other submittal shall result in such item becoming a Contract Document.
 8. Contractor shall perform the Work in compliance with the requirements and commitments set forth in approved Shop Drawings and Samples, subject to the provisions of Paragraph 7.16.D.4.
- E. *Resubmittal Procedures:*
 1. Contractor shall make corrections required by Engineer and shall return the required number of corrected copies of Shop Drawings and submit, as required, new Samples for review and approval. Contractor shall direct specific attention in writing to revisions other than the corrections called for by Engineer on previous submittals.

2. Contractor shall furnish required submittals with sufficient information and accuracy to obtain required approval of an item with no more than three submittals. Engineer will record Engineer's time for reviewing a fourth or subsequent submittal of a Shop Drawings, sample, or other item requiring approval, and Contractor shall be responsible for Engineer's charges to Owner for such time. Owner may impose a set-off against payments due to Contractor to secure reimbursement for such charges.
3. If Contractor requests a change of a previously approved submittal item, Contractor shall be responsible for Engineer's charges to Owner for its review time, and Owner may impose a set-off against payments due to Contractor to secure reimbursement for such charges, unless the need for such change is beyond the control of Contractor.

7.17 *Contractor's General Warranty and Guarantee*

- A. Contractor warrants and guarantees to Owner that all Work will be in accordance with the Contract Documents and will not be defective. Engineer and its officers, directors, members, partners, employees, agents, consultants, and subcontractors shall be entitled to rely on Contractor's warranty and guarantee.
- B. Contractor's warranty and guarantee hereunder excludes defects or damage caused by:
 1. abuse, modification, or improper maintenance or operation by persons other than Contractor, Subcontractors, Suppliers, or any other individual or entity for whom Contractor is responsible; or
 2. normal wear and tear under normal usage.
- C. Contractor's obligation to perform and complete the Work in accordance with the Contract Documents shall be absolute. None of the following will constitute an acceptance of Work that is not in accordance with the Contract Documents or a release of Contractor's obligation to perform the Work in accordance with the Contract Documents:
 1. observations by Engineer;
 2. recommendation by Engineer or payment by Owner of any progress or final payment;
 3. the issuance of a certificate of Substantial Completion by Engineer or any payment related thereto by Owner;
 4. use or occupancy of the Work or any part thereof by Owner;
 5. any review and approval of a Shop Drawing or Sample submittal;
 6. 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.
- D. If the Contract requires the Contractor to accept the assignment of a contract entered into by Owner, then the specific warranties, guarantees, and correction obligations contained in the assigned contract shall govern with respect to Contractor's performance obligations to Owner for the Work described in the assigned contract.

7.18 *Indemnification*

- A. To the fullest extent permitted by Laws and Regulations, and in addition to any other obligations of Contractor under the Contract or otherwise, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to the performance of the Work, provided that any

such claim, cost, loss, or damage is attributable to bodily injury, sickness, disease, or death, or to injury to or destruction of tangible property (other than the Work itself), including the loss of use resulting therefrom but only to the extent caused by any negligent act or omission of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work or anyone for whose acts any of them may be liable.

- B. In any and all claims against Owner or Engineer or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors 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 7.18.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 7.18.A shall not extend to the liability of Engineer and Engineer's officers, directors, members, partners, employees, agents, consultants and subcontractors arising out of:
 - 1. the preparation or approval of, or the failure to prepare or approve maps, Drawings, opinions, reports, surveys, Change Orders, designs, or Specifications; or
 - 2. giving directions or instructions, or failing to give them, if that is the primary cause of the injury or damage.

7.19 *Delegation of Professional Design Services*

- A. Contractor will not be required to provide professional design services unless such services are specifically required by the Contract Documents for a portion of the Work or unless such services are required to carry out Contractor's responsibilities for construction means, methods, techniques, sequences and procedures. Contractor shall not be required to provide professional services in violation of applicable Laws and Regulations.
- B. If professional design services or certifications by a design professional related to systems, materials, or equipment are specifically required of Contractor by the Contract Documents, Owner and Engineer will specify all performance and design criteria that such services must satisfy. Contractor shall cause such services or certifications to be provided by a properly licensed professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, and other submittals prepared by such professional. Shop Drawings and other submittals related to the Work designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to Engineer.
- C. Owner and Engineer shall be entitled to rely upon the adequacy, accuracy, and completeness of the services, certifications, or approvals performed by such design professionals, provided Owner and Engineer have specified to Contractor all performance and design criteria that such services must satisfy.
- D. Pursuant to this paragraph, Engineer's review and approval of design calculations and design drawings will be only for the limited purpose of checking for conformance with performance and design criteria given and the design concept expressed in the Contract Documents. Engineer's review and approval of Shop Drawings and other submittals (except design calculations and design drawings) will be only for the purpose stated in Paragraph 7.16.D.1.
- E. Contractor shall not be responsible for the adequacy of the performance or design criteria specified by Owner or Engineer.

ARTICLE 8 – OTHER WORK AT THE SITE

8.01 *Other Work*

- A. In addition to and apart from the Work under the Contract Documents, the Owner may perform other work at or adjacent to the Site. Such other work may be performed by Owner's employees, or through contracts between the Owner and third parties. Owner may also arrange to have third-party utility owners perform work on their utilities and facilities at or adjacent to the Site.
- B. If Owner performs other work at or adjacent to the Site with Owner's employees, or through contracts for such other work, then Owner shall give Contractor written notice thereof prior to starting any such other work. If Owner has advance information regarding the start of any utility work at or adjacent to the Site, Owner shall provide such information to Contractor.
- C. Contractor shall afford each other contractor that performs such other work, each utility owner performing other work, and Owner, if Owner is performing other work with Owner's employees, proper and safe access to the Site, and provide a reasonable opportunity for the introduction and storage of materials and equipment and the execution of such other work. 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 such work; provided, however, that Contractor may cut or alter others' work with the written consent of Engineer and the others whose work will be affected.
- D. If the proper execution or results of any part of Contractor's Work depends upon work performed by others under this Article 8, 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.

8.02 *Coordination*

- A. If Owner intends to contract with others for the performance of other work at or adjacent to the Site, to perform other work at or adjacent to the Site with Owner's employees, or to arrange to have utility owners perform work at or adjacent to the Site, the following will be set forth in the Supplementary Conditions or provided to Contractor prior to the start of any such other work:
 - 1. the identity of the individual or entity that will have authority and responsibility for coordination of the activities among the various contractors;
 - 2. an itemization of the specific matters to be covered by such authority and responsibility; and
 - 3. the extent of such authority and responsibilities.
- B. Unless otherwise provided in the Supplementary Conditions, Owner shall have sole authority and responsibility for such coordination.

8.03 *Legal Relationships*

- A. If, in the course of performing other work at or adjacent to the Site for Owner, the Owner's employees, any other contractor working for Owner, or any utility owner causes damage to the Work or to the property of Contractor or its Subcontractors, or delays, disrupts, interferes with, or increases the scope or cost of the performance of the Work, through actions or inaction, then Contractor shall be entitled to an equitable adjustment in the Contract Price or

the Contract Times, or both. Contractor must submit any Change Proposal seeking an equitable adjustment in the Contract Price or the Contract Times under this paragraph within 30 days of the damaging, delaying, disrupting, or interfering event. The entitlement to, and extent of, any such equitable adjustment shall take into account information (if any) regarding such other work that was provided to Contractor in the Contract Documents prior to the submittal of the Bid or the final negotiation of the terms of the Contract. When applicable, any such equitable adjustment in Contract Price shall be conditioned on Contractor assigning to Owner all Contractor's rights against such other contractor or utility owner with respect to the damage, delay, disruption, or interference that is the subject of the adjustment. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times.

- B. Contractor shall take reasonable and customary measures to avoid damaging, delaying, disrupting, or interfering with the work of Owner, any other contractor, or any utility owner performing other work at or adjacent to the Site. If Contractor fails to take such measures and as a result damages, delays, disrupts, or interferes with the work of any such other contractor or utility owner, then Owner may impose a set-off against payments due to Contractor, and assign to such other contractor or utility owner the Owner's contractual rights against Contractor with respect to the breach of the obligations set forth in this paragraph.
- C. When Owner is performing other work at or adjacent to the Site with Owner's employees, Contractor shall be liable to Owner for damage to such other work, and for the reasonable direct delay, disruption, and interference costs incurred by Owner as a result of Contractor's failure to take reasonable and customary measures with respect to Owner's other work. In response to such damage, delay, disruption, or interference, Owner may impose a set-off against payments due to Contractor.
- D. If Contractor damages, delays, disrupts, or interferes with the work of any other contractor, or any utility owner performing other work at or adjacent to the Site, through Contractor's failure to take reasonable and customary measures to avoid such impacts, or if any claim arising out of Contractor's actions, inactions, or negligence in performance of the Work at or adjacent to the Site is made by any such other contractor or utility owner against Contractor, Owner, or Engineer, then Contractor shall (1) promptly attempt to settle the claim as to all parties through negotiations with such other contractor or utility owner, or otherwise resolve the claim by arbitration or other dispute resolution proceeding or at law, and (2) indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against any such claims, and against all 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 damage, delay, disruption, or interference.

ARTICLE 9 – OWNER'S RESPONSIBILITIES

9.01 *Communications to Contractor*

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

9.02 *Replacement of Engineer*

- A. Owner may at its discretion appoint an engineer to replace Engineer, provided Contractor makes no reasonable objection to the replacement engineer. The replacement engineer's status under the Contract Documents shall be that of the former Engineer.

- 9.03 *Furnish Data*
- A. Owner shall promptly furnish the data required of Owner under the Contract Documents.
- 9.04 *Pay When Due*
- A. Owner shall make payments to Contractor when they are due as provided in the Agreement.
- 9.05 *Lands and Easements; Reports, Tests, and Drawings*
- A. Owner's duties with respect to providing lands and easements are set forth in Paragraph 5.01.
- B. Owner's duties with respect to providing engineering surveys to establish reference points are set forth in Paragraph 4.03.
- C. Article 5 refers to Owner's identifying and making available to Contractor copies of reports of explorations and tests of conditions at the Site, and drawings of physical conditions relating to existing surface or subsurface structures at the Site.
- 9.06 *Insurance*
- A. Owner's responsibilities, if any, with respect to purchasing and maintaining liability and property insurance are set forth in Article 6.
- 9.07 *Change Orders*
- A. Owner's responsibilities with respect to Change Orders are set forth in Article 11.
- 9.08 *Inspections, Tests, and Approvals*
- A. Owner's responsibility with respect to certain inspections, tests, and approvals is set forth in Paragraph 14.02.B.
- 9.09 *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.
- 9.10 *Undisclosed Hazardous Environmental Condition*
- A. Owner's responsibility in respect to an undisclosed Hazardous Environmental Condition is set forth in Paragraph 5.06.
- 9.11 *Evidence of Financial Arrangements*
- A. Upon request of Contractor, Owner shall furnish Contractor reasonable evidence that financial arrangements have been made to satisfy Owner's obligations under the Contract Documents (including obligations under proposed changes in the Work).
- 9.12 *Safety Programs*
- A. While at the Site, Owner's employees and representatives shall comply with the specific applicable requirements of Contractor's safety programs of which Owner has been informed.
- B. Owner shall furnish copies of any applicable Owner safety programs to Contractor.

ARTICLE 10 – ENGINEER’S STATUS DURING CONSTRUCTION

10.01 *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.

10.02 *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 10.08. 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.

10.03 *Project Representative*

- A. If Owner and Engineer have agreed that Engineer will furnish a Resident Project Representative to represent Engineer at the Site and assist Engineer in observing the progress and quality of the Work, then the authority and responsibilities of any such Resident Project Representative will be as provided in the Supplementary Conditions, and limitations on the responsibilities thereof will be as provided in Paragraph 10.08. 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.

10.04 *Rejecting Defective Work*

- A. Engineer has the authority to reject Work in accordance with Article 14.

10.05 *Shop Drawings, Change Orders and Payments*

- A. Engineer’s authority, and limitations thereof, as to Shop Drawings and Samples, are set forth in Paragraph 7.16.
- B. Engineer’s authority, and limitations thereof, as to design calculations and design drawings submitted in response to a delegation of professional design services, if any, are set forth in Paragraph 7.19.
- C. Engineer’s authority as to Change Orders is set forth in Article 11.
- D. Engineer’s authority as to Applications for Payment is set forth in Article 15.

10.06 *Determinations for Unit Price Work*

- A. Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor as set forth in Paragraph 13.03.

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

- A. Engineer will render decisions regarding the requirements of the Contract Documents, and judge the acceptability of the Work, pursuant to the specific procedures set forth herein for initial interpretations, Change Proposals, and acceptance of the Work. In rendering such decisions and judgments, Engineer will not show partiality to Owner or Contractor, and will not be liable to Owner, Contractor, or others in connection with any proceedings, interpretations, decisions, or judgments conducted or rendered in good faith.

10.08 *Limitations on Engineer's Authority and Responsibilities*

- A. Neither Engineer's authority or responsibility under this Article 10 or under any other provision of the Contract, 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 15.06.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 10.08 shall also apply to the Resident Project Representative, if any.

10.09 *Compliance with Safety Program*

- A. While at the Site, Engineer's employees and representatives will comply with the specific applicable requirements of Owner's and Contractor's safety programs (if any) of which Engineer has been informed.

ARTICLE 11 – AMENDING THE CONTRACT DOCUMENTS; CHANGES IN THE WORK

11.01 *Amending and Supplementing Contract Documents*

- A. The Contract Documents may be amended or supplemented by a Change Order, a Work Change Directive, or a Field Order.
 - 1. *Change Orders:*
 - a. If an amendment or supplement to the Contract Documents includes a change in the Contract Price or the Contract Times, such amendment or supplement must be set forth in a Change Order. A Change Order also may be used to establish amendments

and supplements of the Contract Documents that do not affect the Contract Price or Contract Times.

- b. Owner and Contractor may amend those terms and conditions of the Contract Documents that do not involve (1) the performance or acceptability of the Work, (2) the design (as set forth in the Drawings, Specifications, or otherwise), or (3) other engineering or technical matters, without the recommendation of the Engineer. Such an amendment shall be set forth in a Change Order.
2. *Work Change Directives:* A Work Change Directive will not change the Contract Price or the Contract Times but is evidence that the parties expect that the modification ordered or documented by a Work Change Directive will be incorporated in a subsequently issued Change Order, following negotiations by the parties as to the Work Change Directive's effect, if any, on the Contract Price and Contract Times; or, if negotiations are unsuccessful, by a determination under the terms of the Contract Documents governing adjustments, expressly including Paragraph 11.04 regarding change of Contract Price. Contractor must submit any Change Proposal seeking an adjustment of the Contract Price or the Contract Times, or both, no later than 30 days after the completion of the Work set out in the Work Change Directive. Owner must submit any Claim seeking an adjustment of the Contract Price or the Contract Times, or both, no later than 60 days after issuance of the Work Change Directive.
3. *Field Orders:* Engineer may authorize minor changes in the Work if the changes 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. Such changes will be accomplished by a Field Order and will be binding on Owner and also on Contractor, which shall perform the Work involved promptly. If Contractor believes that a Field Order justifies an adjustment in the Contract Price or Contract Times, or both, then before proceeding with the Work at issue, Contractor shall submit a Change Proposal as provided herein.

11.02 *Owner-Authorized Changes in the Work*

- A. Without invalidating the Contract and without notice to any surety, Owner may, at any time or from time to time, order additions, deletions, or revisions in the Work. Such changes shall be supported by Engineer's recommendation, to the extent the change involves the design (as set forth in the Drawings, Specifications, or otherwise), or other engineering or technical matters. Such changes may be accomplished by a Change Order, if Owner and Contractor have agreed as to the effect, if any, of the changes on Contract Times or Contract Price; or by a Work Change Directive. Upon receipt of any such document, Contractor shall promptly proceed with the Work involved; or, in the case of a deletion in the Work, promptly cease construction activities with respect to such deleted Work. Added or revised Work shall be performed under the applicable conditions of the Contract Documents. Nothing in this paragraph shall obligate Contractor to undertake work that Contractor reasonably concludes cannot be performed in a manner consistent with Contractor's safety obligations under the Contract Documents or Laws and Regulations.

11.03 *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, except in the case of an emergency as provided in Paragraph 7.15 or in the case of uncovering Work as provided in Paragraph 14.05.

11.04 *Change of Contract Price*

- A. The Contract Price may only be changed by a Change Order. Any Change Proposal for an adjustment in the Contract Price shall comply with the provisions of Paragraph 11.06. Any Claim for an adjustment of Contract Price shall comply with the provisions of Article 12.
- B. 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, then by application of such unit prices to the quantities of the items involved (subject to the provisions of Paragraph 13.03); or
 - 2. where the Work involved is not covered by unit prices contained in the Contract Documents, then by a mutually agreed lump sum (which may include an allowance for overhead and profit not necessarily in accordance with Paragraph 11.04.C.2); or
 - 3. where the Work involved is not covered by unit prices contained in the Contract Documents and the parties do not reach mutual agreement to a lump sum, then on the basis of the Cost of the Work (determined as provided in Paragraph 13.01) plus a Contractor's fee for overhead and profit (determined as provided in Paragraph 11.04.C).
- C. *Contractor's Fee*: When applicable, 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 13.01.B.1 and 13.01.B.2, the Contractor's fee shall be 15 percent;
 - b. for costs incurred under Paragraph 13.01.B.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 Paragraphs 11.01.C.2.a and 11.01.C.2.b is that the Contractor's fee shall be based on: (1) a fee of 15 percent of the costs incurred under Paragraphs 13.01.A.1 and 13.01.A.2 by the Subcontractor that actually performs the Work, at whatever tier, and (2) with respect to Contractor itself and to any Subcontractors of a tier higher than that of the Subcontractor that actually performs the Work, a fee of five percent of the amount (fee plus underlying costs incurred) attributable to the next lower tier Subcontractor; provided, however, that for any such subcontracted work the maximum total fee to be paid by Owner shall be no greater than 27 percent of the costs incurred by the Subcontractor that actually performs the work;
 - d. no fee shall be payable on the basis of costs itemized under Paragraphs 13.01.B.4, 13.01.B.5, and 13.01.C;
 - 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 11.04.C.2.a through 11.04.C.2.e, inclusive.

11.05 *Change of Contract Times*

- A. The Contract Times may only be changed by a Change Order. Any Change Proposal for an adjustment in the Contract Times shall comply with the provisions of Paragraph 11.06. Any Claim for an adjustment in the Contract Times shall comply with the provisions of Article 12.
- B. An adjustment of the Contract Times shall be subject to the limitations set forth in Paragraph 4.05, concerning delays in Contractor's progress.

11.06 *Change Proposals*

- A. Contractor shall submit a Change Proposal to Engineer to request an adjustment in the Contract Times or Contract Price; appeal an initial decision by Engineer concerning the requirements of the Contract Documents or relating to the acceptability of the Work under the Contract Documents; contest a set-off against payment due; or seek other relief under the Contract. The Change Proposal shall specify any proposed change in Contract Times or Contract Price, or both, or other proposed relief, and explain the reason for the proposed change, with citations to any governing or applicable provisions of the Contract Documents.
 - 1. *Procedures:* Contractor shall submit each Change Proposal to Engineer promptly (but in no event later than 30 days) after the start of the event giving rise thereto, or after such initial decision. The Contractor shall submit supporting data, including the proposed change in Contract Price or Contract Time (if any), to the Engineer and Owner within 15 days after the submittal of the Change Proposal. The supporting data shall be accompanied by a written statement that the supporting data are accurate and complete, and that any requested time or price adjustment is the entire adjustment to which Contractor believes it is entitled as a result of said event. Engineer will advise Owner regarding the Change Proposal, and consider any comments or response from Owner regarding the Change Proposal.
 - 2. *Engineer's Action:* Engineer will review each Change Proposal and, within 30 days after receipt of the Contractor's supporting data, either deny the Change Proposal in whole, approve it in whole, or deny it in part and approve it in part. Such actions shall be in writing, with a copy provided to Owner and Contractor. If Engineer does not take action on the Change Proposal within 30 days, then either Owner or Contractor may at any time thereafter submit a letter to the other party indicating that as a result of Engineer's inaction the Change Proposal is deemed denied, thereby commencing the time for appeal of the denial under Article 12.
 - 3. *Binding Decision:* Engineer's decision will be final and binding upon Owner and Contractor, unless Owner or Contractor appeals the decision by filing a Claim under Article 12.
- B. *Resolution of Certain Change Proposals:* If the Change Proposal does not involve the design (as set forth in the Drawings, Specifications, or otherwise), the acceptability of the Work, or other engineering or technical matters, then Engineer will notify the parties that the Engineer is unable to resolve the Change Proposal. For purposes of further resolution of such a Change Proposal, such notice shall be deemed a denial, and Contractor may choose to seek resolution under the terms of Article 12.

11.07 *Execution of Change Orders*

- A. Owner and Contractor shall execute appropriate Change Orders covering:
 - 1. 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;

2. changes in Contract Price resulting from an Owner set-off, unless Contractor has duly contested such set-off;
 3. changes in the Work which are: (a) ordered by Owner pursuant to Paragraph 11.02, (b) required because of Owner's acceptance of defective Work under Paragraph 14.04 or Owner's correction of defective Work under Paragraph 14.07, or (c) agreed to by the parties, subject to the need for Engineer's recommendation if the change in the Work involves the design (as set forth in the Drawings, Specifications, or otherwise), or other engineering or technical matters; and
 4. changes in the Contract Price or Contract Times, or other changes, which embody the substance of any final and binding results under Paragraph 11.06, or Article 12.
- B. If Owner or Contractor refuses to execute a Change Order that is required to be executed under the terms of this Paragraph 11.07, it shall be deemed to be of full force and effect, as if fully executed.

11.08 *Notification to Surety*

- A. If the provisions of any bond require notice to be given to a surety 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), 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.

ARTICLE 12 – CLAIMS

12.01 *Claims*

- A. *Claims Process:* The following disputes between Owner and Contractor shall be submitted to the Claims process set forth in this Article:
1. Appeals by Owner or Contractor of Engineer's decisions regarding Change Proposals;
 2. Owner demands for adjustments in the Contract Price or Contract Times, or other relief under the Contract Documents; and
 3. Disputes that Engineer has been unable to address because they do not involve the design (as set forth in the Drawings, Specifications, or otherwise), the acceptability of the Work, or other engineering or technical matters.
- B. *Submittal of Claim:* The party submitting a Claim shall deliver it directly to the other party to the Contract promptly (but in no event later than 30 days) after the start of the event giving rise thereto; in the case of appeals regarding Change Proposals within 30 days of the decision under appeal. The party submitting the Claim shall also furnish a copy to the Engineer, for its information only. The responsibility to substantiate a Claim shall rest with the party making the Claim. In the case of a Claim by Contractor seeking an increase in the Contract Times or Contract Price, or both, Contractor shall certify that the Claim is made in good faith, that the supporting data are accurate and complete, and that to the best of Contractor's knowledge and belief the amount of time or money requested accurately reflects the full amount to which Contractor is entitled.
- C. *Review and Resolution:* The party receiving a Claim shall review it thoroughly, giving full consideration to its merits. The two parties shall seek to resolve the Claim through the exchange of information and direct negotiations. The parties may extend the time for resolving the Claim by mutual agreement. All actions taken on a Claim shall be stated in writing and submitted to the other party, with a copy to Engineer.

D. *Mediation:*

1. At any time after initiation of a Claim, Owner and Contractor may mutually agree to mediation of the underlying dispute. The agreement to mediate shall stay the Claim submittal and response process.
 2. If Owner and Contractor agree to mediation, then after 60 days from such agreement, either Owner or Contractor may unilaterally terminate the mediation process, and the Claim submittal and decision process shall resume as of the date of the termination. If the mediation proceeds but is unsuccessful in resolving the dispute, the Claim submittal and decision process shall resume as of the date of the conclusion of the mediation, as determined by the mediator.
 3. Owner and Contractor shall each pay one-half of the mediator's fees and costs.
- E. *Partial Approval:* If the party receiving a Claim approves the Claim in part and denies it in part, such action shall be final and binding unless within 30 days of such action the other party invokes the procedure set forth in Article 17 for final resolution of disputes.
- F. *Denial of Claim:* If efforts to resolve a Claim are not successful, the party receiving the Claim may deny it by giving written notice of denial to the other party. If the receiving party does not take action on the Claim within 90 days, then either Owner or Contractor may at any time thereafter submit a letter to the other party indicating that as a result of the inaction, the Claim is deemed denied, thereby commencing the time for appeal of the denial. A denial of the Claim shall be final and binding unless within 30 days of the denial the other party invokes the procedure set forth in Article 17 for the final resolution of disputes.
- G. *Final and Binding Results:* If the parties reach a mutual agreement regarding a Claim, whether through approval of the Claim, direct negotiations, mediation, or otherwise; or if a Claim is approved in part and denied in part, or denied in full, and such actions become final and binding; then the results of the agreement or action on the Claim shall be incorporated in a Change Order to the extent they affect the Contract, including the Work, the Contract Times, or the Contract Price.

ARTICLE 13 – COST OF THE WORK; ALLOWANCES; UNIT PRICE WORK

13.01 *Cost of the Work*

- A. *Purposes for Determination of Cost of the Work:* The term Cost of the Work means the sum of all costs necessary for the proper performance of the Work at issue, as further defined below. The provisions of this Paragraph 13.01 are used for two distinct purposes:
1. To determine Cost of the Work when Cost of the Work is a component of the Contract Price, under cost-plus-fee, time-and-materials, or other cost-based terms; or
 2. To determine the value of a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price. When the value of any such adjustment is determined on the basis of Cost of the Work, Contractor is entitled only to those additional or incremental costs required because of the change in the Work or because of the event giving rise to the adjustment.
- B. *Costs Included:* Except as otherwise may be agreed to in writing by Owner, costs included in the Cost of the Work shall be in amounts no higher than those prevailing in the locality of the Project, shall not include any of the costs itemized in Paragraph 13.01.C, and shall include only the following items:
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 on the Work. 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, and 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 13.01.
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, as 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 6.05), 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 communication service at the Site, express and courier services, and similar petty cash items in connection with the Work.
- i. The costs of premiums for all bonds and insurance that Contractor is required by the Contract Documents to purchase and maintain.

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

- 1. Payroll costs and other compensation of Contractor's officers, executives, principals (of partnerships and sole proprietorships), general managers, safety managers, engineers, architects, estimators, attorneys, auditors, accountants, purchasing and contracting agents, expeditors, timekeepers, clerks, and other personnel employed by Contractor, whether at the Site or in Contractor's principal or branch office for general administration of the Work and not specifically included in the agreed upon schedule of job classifications referred to in Paragraph 13.01.B.1 or specifically covered by Paragraph 13.01.B.4. The payroll costs and other compensation excluded here 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 Paragraph 13.01.B.

D. *Contractor's Fee:* When the Work as a whole 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, Change Proposal, Claim, set-off, or other 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 11.04.C.

E. *Documentation:* Whenever the Cost of the Work for any purpose is to be determined pursuant to this Article 13, 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.

13.02 Allowances

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

- B. *Cash Allowances*: Contractor agrees that:
 - 1. the cash allowances include the cost to Contractor (less any applicable trade discounts) of materials and equipment required by the allowances to be delivered at the Site, and all applicable taxes; and
 - 2. Contractor's costs for unloading and handling on the Site, labor, installation, overhead, profit, and other expenses contemplated for the cash allowances have been included in the Contract Price and not in the allowances, and no demand for additional payment on account of any of the foregoing will be valid.
- C. *Contingency Allowance*: Contractor agrees that a contingency allowance, if any, is for the sole use of Owner to cover unanticipated costs.
- D. Prior to final payment, an appropriate Change Order will be issued as recommended by Engineer to reflect actual amounts due Contractor on account of Work covered by allowances, and the Contract Price shall be correspondingly adjusted.

13.03 *Unit Price Work*

- A. Where the Contract Documents provide that all or part of the Work is to be Unit Price Work, initially the Contract Price will be deemed to include for all Unit Price Work an amount equal to the sum of the unit price for each separately identified item of Unit Price Work times the estimated quantity of each item as indicated in the Agreement.
- B. The estimated quantities of items of Unit Price Work are not guaranteed and are solely for the purpose of comparison of Bids and determining an initial Contract Price. Payments to Contractor for Unit Price Work will be based on actual quantities.
- C. Each unit price will be deemed to include an amount considered by Contractor to be adequate to cover Contractor's overhead and profit for each separately identified item.
- D. 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 the following paragraph.
- E. Within 30 days of Engineer's written decision under the preceding paragraph, Contractor may submit a Change Proposal, or Owner may file a Claim, seeking an adjustment in the Contract Price 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;
 - 2. there is no corresponding adjustment with respect to any other item of Work; and
 - 3. Contractor believes that it 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 14 – TESTS AND INSPECTIONS; CORRECTION, REMOVAL OR ACCEPTANCE OF DEFECTIVE WORK

14.01 *Access to Work*

- A. Owner, Engineer, their consultants and other representatives and personnel of Owner, independent testing laboratories, and authorities having jurisdiction will have access to the

Site and the Work at reasonable times for their observation, inspection, and testing. Contractor shall provide them proper and safe conditions for such access and advise them of Contractor's safety procedures and programs so that they may comply therewith as applicable.

14.02 *Tests, Inspections, and Approvals*

- A. Contractor shall give Engineer timely notice of readiness of the Work (or specific parts thereof) for all required inspections and tests, and shall cooperate with inspection and testing personnel to facilitate required inspections and tests.
- B. Owner shall retain and pay for the services of an independent inspector, testing laboratory, or other qualified individual or entity to perform all inspections and tests expressly required by the Contract Documents to be furnished and paid for by Owner, except that costs incurred in connection with tests or inspections of covered Work shall be governed by the provisions of Paragraph 14.05.
- 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, obtaining, and paying for all inspections and tests required:
 - 1. by the Contract Documents, unless the Contract Documents expressly allocate responsibility for a specific inspection or test to Owner;
 - 2. to attain Owner's and Engineer's acceptance of materials or equipment to be incorporated in the Work;
 - 3. by manufacturers of equipment furnished under the Contract Documents;
 - 4. for testing, adjusting, and balancing of mechanical, electrical, and other equipment to be incorporated into the Work; and
 - 5. for acceptance of materials, mix designs, or equipment submitted for approval prior to Contractor's purchase thereof for incorporation in the Work.

Such inspections and tests shall be performed by independent inspectors, testing laboratories, or other qualified individuals or entities acceptable to Owner and Engineer.

- E. If the Contract Documents require the Work (or part thereof) to be approved by Owner, Engineer, or another designated individual or entity, then Contractor shall assume full responsibility for arranging and obtaining such approvals.
- F. 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, Contractor shall, if requested by Engineer, uncover such Work for observation. Such uncovering shall be at Contractor's expense unless Contractor had given Engineer timely notice of Contractor's intention to cover the same and Engineer had not acted with reasonable promptness in response to such notice.

14.03 *Defective Work*

- A. *Contractor's Obligation:* It is Contractor's obligation to assure that the Work is not defective.
- B. *Engineer's Authority:* Engineer has the authority to determine whether Work is defective, and to reject defective Work.
- C. *Notice of Defects:* Prompt notice of all defective Work of which Owner or Engineer has actual knowledge will be given to Contractor.

- D. *Correction, or Removal and Replacement*: Promptly after receipt of written notice of defective Work, Contractor shall correct all such defective Work, whether or not fabricated, installed, or completed, or, if Engineer has rejected the defective Work, remove it from the Project and replace it with Work that is not defective.
- E. *Preservation of Warranties*: When correcting defective Work, Contractor shall take no action that would void or otherwise impair Owner's special warranty and guarantee, if any, on said Work.
- F. *Costs and Damages*: In addition to its correction, removal, and replacement obligations with respect to defective Work, Contractor shall pay all claims, costs, losses, and damages arising out of or relating to defective Work, including but not limited to the cost of the inspection, testing, correction, removal, replacement, or reconstruction of such defective Work, fines levied against Owner by governmental authorities because the Work is defective, and the costs of repair or replacement of work of others resulting from defective Work. Prior to final payment, if Owner and Contractor are unable to agree as to the measure of such claims, costs, losses, and damages resulting from defective Work, then Owner may impose a reasonable set-off against payments due under Article 15.

14.04 *Acceptance of Defective Work*

- A. If, instead of requiring correction or removal and replacement of defective Work, Owner prefers to accept it, Owner may do so (subject, if such acceptance occurs prior to final payment, to Engineer's confirmation that such acceptance is in general accord with the design intent and applicable engineering principles, and will not endanger public safety). Contractor shall pay all claims, costs, losses, and damages attributable to Owner's evaluation of and determination to accept such defective Work (such costs to be approved by Engineer as to reasonableness), and for the diminished value of the Work to the extent not otherwise paid by Contractor. If any such acceptance occurs prior to final payment, the necessary revisions in the Contract Documents with respect to the Work shall be incorporated in a Change Order. If the parties are unable to agree as to the decrease in the Contract Price, reflecting the diminished value of Work so accepted, then Owner may impose a reasonable set-off against payments due under Article 15. If the acceptance of defective Work occurs after final payment, Contractor shall pay an appropriate amount to Owner.

14.05 *Uncovering Work*

- A. Engineer has the authority to require special inspection or testing of the Work, whether or not the Work is fabricated, installed, or completed.
- B. If any Work is covered contrary to the written request of Engineer, then Contractor shall, if requested by Engineer, uncover such Work for Engineer's observation, and then replace the covering, all at Contractor's expense.
- C. If Engineer considers it necessary or advisable that covered Work be observed by Engineer or inspected or tested by others, then 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, and provide all necessary labor, material, and equipment.
 - 1. If it is found that the uncovered Work is defective, Contractor shall be responsible for all claims, costs, losses, and damages 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 pending Contractor's full discharge of this responsibility the Owner shall be entitled to impose a reasonable set-off against payments due under Article 15.
 - 2. If the uncovered Work is not found to be defective, Contractor shall be allowed an increase in the Contract Price or an extension of the Contract Times, or both, directly

attributable to such uncovering, exposure, observation, inspection, testing, replacement, and reconstruction. If the parties are unable to agree as to the amount or extent thereof, then Contractor may submit a Change Proposal within 30 days of the determination that the Work is not defective.

14.06 *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, then 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.

14.07 *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, 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, then Owner may, after seven days written notice to Contractor, correct or remedy any such deficiency.
- B. In exercising the rights and remedies under this Paragraph 14.07, Owner shall proceed expeditiously. In connection with such corrective or remedial action, Owner may exclude Contractor from all or part of the Site, take possession of all or part of the Work and suspend Contractor's services related thereto, 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 incurred or sustained by Owner in exercising the rights and remedies under this Paragraph 14.07 will be charged against Contractor as set-offs against payments due under Article 15. Such claims, costs, losses and damages will include but not be limited to all costs of repair, or replacement of work of others destroyed or damaged by correction, removal, or replacement of Contractor's defective Work.
- D. Contractor shall not be allowed an extension of the Contract Times because of any delay in the performance of the Work attributable to the exercise by Owner of Owner's rights and remedies under this Paragraph 14.07.

ARTICLE 15 – PAYMENTS TO CONTRACTOR; SET-OFFS; COMPLETION; CORRECTION PERIOD

15.01 *Progress Payments*

- A. *Basis for Progress Payments:* The Schedule of Values established as provided in Article 2 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 during the pay period, as determined under the provisions of Paragraph 13.03. Progress payments for cost-based Work will be based on Cost of the Work completed by Contractor during the pay period.
- B. *Applications for Payments:*
 - 1. At least 20 days before the date established in the Agreement for each progress payment (but not more often than once a month), Contractor shall submit to Engineer for review

an Application for Payment filled out and signed by Contractor covering the Work completed as of the date of the Application and accompanied by such supporting documentation as is required by the Contract Documents. If payment is requested on the basis of materials and equipment not incorporated in the Work but delivered and suitably stored at the Site or at another location agreed to in writing, the Application for Payment shall also be accompanied by a bill of sale, invoice, or other documentation warranting that Owner has received the materials and equipment free and clear of all Liens, and evidence that the materials and equipment are covered by appropriate property insurance, a warehouse bond, 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.

C. Review of Applications:

1. Engineer will, within 10 days after receipt of each Application for Payment, including each resubmittal, 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 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, the results of any subsequent tests called for in the Contract Documents, a final determination of quantities and classifications for Unit Price Work under Paragraph 13.03, and any other qualifications stated in the recommendation); and
 - c. the conditions precedent to Contractor's being entitled to such payment appear to have been fulfilled in so far as it is Engineer's responsibility to observe the Work.
3. By recommending any such payment Engineer will not thereby be deemed to have represented that:
 - a. inspections made to check the quality or the quantity of the Work as it has been performed have been exhaustive, extended to every aspect of the Work in progress, or involved detailed inspections of the Work beyond the responsibilities specifically assigned to Engineer in the Contract; or
 - b. there may not be other matters or issues between the parties that might entitle Contractor to be paid additionally by Owner or entitle Owner to withhold payment to Contractor.

4. Neither Engineer's review of Contractor's Work for the purposes of recommending payments nor Engineer's recommendation of any payment, including final payment, will impose responsibility on Engineer:
 - a. to supervise, direct, or control the Work, or
 - b. for the means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or
 - c. for Contractor's failure to comply with Laws and Regulations applicable to Contractor's performance of the Work, or
 - d. to make any examination to ascertain how or for what purposes Contractor has used the money paid on account of the Contract Price, or
 - e. to determine that title to any of the Work, materials, or equipment has passed to Owner free and clear of any Liens.
5. Engineer may refuse to recommend the whole or any part of any payment if, in Engineer's opinion, it would be incorrect to make the representations to Owner stated in Paragraph 15.01.C.2.
6. Engineer will recommend reductions in payment (set-offs) necessary in Engineer's opinion to protect Owner from loss because:
 - a. the Work is defective, requiring correction or replacement;
 - b. the Contract Price has been reduced by Change Orders;
 - c. Owner has been required to correct defective Work in accordance with Paragraph 14.07, or has accepted defective Work pursuant to Paragraph 14.04;
 - d. Owner has been required to remove or remediate a Hazardous Environmental Condition for which Contractor is responsible; or
 - e. Engineer has actual knowledge of the occurrence of any of the events that would constitute a default by Contractor and therefore justify termination for cause under the Contract Documents.

D. *Payment Becomes Due:*

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

E. *Reductions in Payment by Owner:*

1. In addition to any reductions in payment (set-offs) recommended by Engineer, Owner is entitled to impose a set-off against payment based on any of the following:
 - a. claims have been made against Owner on account of Contractor's conduct in the performance or furnishing of the Work, or Owner has incurred costs, losses, or damages on account of Contractor's conduct in the performance or furnishing of the Work, including but not limited to claims, costs, losses, or damages from workplace injuries, adjacent property damage, non-compliance with Laws and Regulations, and patent infringement;
 - b. Contractor has failed to take reasonable and customary measures to avoid damage, delay, disruption, and interference with other work at or adjacent to the Site;
 - c. Contractor has failed to provide and maintain required bonds or insurance;
 - d. Owner has been required to remove or remediate a Hazardous Environmental Condition for which Contractor is responsible;

- e. Owner has incurred extra charges or engineering costs related to submittal reviews, evaluations of proposed substitutes, tests and inspections, or return visits to manufacturing or assembly facilities;
 - f. the Work is defective, requiring correction or replacement;
 - g. Owner has been required to correct defective Work in accordance with Paragraph 14.07, or has accepted defective Work pursuant to Paragraph 14.04;
 - h. the Contract Price has been reduced by Change Orders;
 - i. an event that would constitute a default by Contractor and therefore justify a termination for cause has occurred;
 - j. liquidated damages have accrued as a result of Contractor's failure to achieve Milestones, Substantial Completion, or final completion of the Work;
 - k. 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;
 - l. there are other items entitling Owner to a set off against the amount recommended.
2. If Owner imposes any set-off against payment, whether based on its own knowledge or on the written recommendations of Engineer, Owner will give Contractor immediate written notice (with a copy to Engineer) stating the reasons for such action and the specific amount of the reduction, 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, if Contractor remedies the reasons for such action. The reduction imposed shall be binding on Contractor unless it duly submits a Change Proposal contesting the reduction.
 3. Upon a subsequent determination that Owner's refusal of payment was not justified, the amount wrongfully withheld shall be treated as an amount due as determined by Paragraph 15.01.C.1 and subject to interest as provided in the Agreement.

15.02 *Contractor's Warranty of Title*

- A. Contractor warrants and guarantees that title to all Work, materials, and equipment furnished under the Contract will pass to Owner free and clear of (1) all Liens and other title defects, and (2) all patent, licensing, copyright, or royalty obligations, no later than seven days after the time of payment by Owner.

15.03 *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 and request that Engineer issue a certificate of Substantial Completion. Contractor shall at the same time submit to Owner and Engineer an initial draft of punch list items to be completed or corrected before final payment.
- B. Promptly after Contractor's notification, 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.
- C. If Engineer considers the Work substantially complete, Engineer will deliver to Owner a preliminary certificate of Substantial Completion which shall fix the date of Substantial Completion. Engineer shall attach to the certificate a punch list of items to be completed or corrected before final payment. Owner shall have seven days after receipt of the preliminary certificate during which to make written objection to Engineer as to any provisions of the

certificate or attached punch list. If, after considering the objections to the provisions of the preliminary certificate, Engineer concludes that the Work is not substantially complete, Engineer will, within 14 days after submission of the preliminary certificate to Owner, notify Contractor in writing that the Work is not substantially complete, stating the reasons therefor. If Owner does not object to the provisions of the certificate, or if despite consideration of Owner's objections Engineer concludes that the Work is substantially complete, then Engineer will, within said 14 days, execute and deliver to Owner and Contractor a final certificate of Substantial Completion (with a revised punch list of items to be completed or corrected) reflecting such changes from the preliminary certificate as Engineer believes justified after consideration of any objections from Owner.

- D. At the time of receipt of the preliminary certificate of Substantial Completion, Owner and Contractor will confer regarding Owner's use or occupancy of the Work following Substantial Completion, review the builder's risk insurance policy with respect to the end of the builder's risk coverage, and confirm the transition to coverage of the Work under a permanent property insurance policy held by Owner. Unless Owner and Contractor agree otherwise in writing, Owner shall bear responsibility for security, operation, protection of the Work, property insurance, maintenance, heat, and utilities upon Owner's use or occupancy of the Work.
- E. After Substantial Completion the Contractor shall promptly begin work on the punch list of items to be completed or corrected prior to final payment. In appropriate cases Contractor may submit monthly Applications for Payment for completed punch list items, following the progress payment procedures set forth above.
- F. Owner shall have the right to exclude Contractor from the Site after the date of Substantial Completion subject to allowing Contractor reasonable access to remove its property and complete or correct items on the punch list.

15.04 *Partial Use or Occupancy*

- A. Prior to Substantial Completion of all the Work, Owner may use or occupy any substantially completed part of the Work which has specifically been identified in the Contract Documents, or which Owner, Engineer, and Contractor agree constitutes a separately functioning and usable part of the Work that can be used by Owner for its intended purpose without significant interference with Contractor's performance of the remainder of the Work, subject to the following conditions:
 - 1. At any time Owner may request in writing that Contractor permit Owner to use or occupy any such part of the Work that Owner believes to be substantially complete. If and when Contractor agrees that such part of the Work is substantially complete, Contractor, Owner, and Engineer will follow the procedures of Paragraph 15.03.A through E for that part of the Work.
 - 2. At any time Contractor may notify Owner and Engineer in writing that Contractor considers any such part of the Work substantially complete and request Engineer to issue a certificate of Substantial Completion for that part of the Work.
 - 3. Within a reasonable time after either such request, Owner, Contractor, and Engineer shall make an inspection of that part of the Work to determine its status of completion. If Engineer does not consider that part of the Work to be substantially complete, Engineer will notify Owner and Contractor in writing giving the reasons therefor. If Engineer considers that part of the Work to be substantially complete, the provisions of Paragraph 15.03 will apply with respect to certification of Substantial Completion of that part of the Work and the division of responsibility in respect thereof and access thereto.
 - 4. No use or occupancy or separate operation of part of the Work may occur prior to compliance with the requirements of Paragraph 6.05 regarding builder's risk or other property insurance.

15.05 *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, or agreed portion thereof, is incomplete or defective. Contractor shall immediately take such measures as are necessary to complete such Work or remedy such deficiencies.

15.06 *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, annotated record documents (as provided in Paragraph 7.11), and other documents, Contractor may make application for final payment.
2. The final Application for Payment shall be accompanied (except as previously delivered) by:
 - a. all documentation called for in the Contract Documents;
 - b. consent of the surety, if any, to final payment;
 - c. satisfactory evidence that all title issues have been resolved such that title to all Work, materials, and equipment has passed to Owner free and clear of any Liens or other title defects, or will so pass upon final payment.
 - d. a list of all disputes that Contractor believes are unsettled; and
 - e. complete and legally effective releases or waivers (satisfactory to Owner) of all Lien rights arising out of the Work, and of Liens filed in connection with the Work.
3. In lieu of the releases or waivers of Liens specified in Paragraph 15.06.A.2 and as approved by Owner, Contractor may furnish receipts or releases in full and an affidavit of Contractor that: (a) the releases and receipts include all labor, services, material, and equipment for which a Lien could be filed; and (b) all payrolls, material and equipment bills, and other indebtedness connected with the Work for which Owner might in any way be responsible, or which might in any way result in liens or other burdens on Owner's property, 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, or Owner at its option may issue joint checks payable to Contractor and specified Subcontractors and Suppliers.

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

1. If, on the basis of Engineer's observation of the Work during construction and final inspection, and Engineer's review of the final Application for Payment and accompanying documentation as required by the Contract Documents, Engineer is satisfied that the Work has been completed and Contractor's other obligations under the Contract have been fulfilled, Engineer will, within ten days after receipt of the final Application for Payment, indicate in writing Engineer's recommendation of final payment and present the Application for Payment to Owner for payment. Such recommendation shall account for any set-offs against payment that are necessary in Engineer's opinion to protect Owner from loss for the reasons stated above with respect to progress payments. 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 15.07. 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. *Completion of Work:* The Work is complete (subject to surviving obligations) when it is ready for final payment as established by the Engineer's written recommendation of final payment.
- D. *Payment Becomes Due:* Thirty days after the presentation to Owner of the final Application for Payment and accompanying documentation, the amount recommended by Engineer (less any further sum Owner is entitled to set off against Engineer's recommendation, including but not limited to set-offs for liquidated damages and set-offs allowed under the provisions above with respect to progress payments) will become due and shall be paid by Owner to Contractor.

15.07 *Waiver of Claims*

- A. The making of final payment will not constitute a waiver by Owner of claims or rights against Contractor. Owner expressly reserves claims and rights arising from unsettled Liens, from defective Work appearing after final inspection pursuant to Paragraph 15.05, from Contractor's failure to comply with the Contract Documents or the terms of any special guarantees specified therein, from outstanding Claims by Owner, or from Contractor's continuing obligations under the Contract Documents.
- B. The acceptance of final payment by Contractor will constitute a waiver by Contractor of all claims and rights against Owner other than those pending matters that have been duly submitted or appealed under the provisions of Article 17.

15.08 *Correction Period*

- A. If within one year after the date of Substantial Completion (or such longer period of time as may be prescribed by the terms of any applicable special guarantee required by the Contract Documents, or by any specific provision of the Contract Documents), any Work is found to be defective, or if the repair of any damages to the Site, adjacent areas that Contractor has arranged to use through construction easements or otherwise, and other adjacent areas used by Contractor as permitted by Laws and Regulations, is found to be defective, then Contractor shall promptly, without cost to Owner and in accordance with Owner's written instructions:
 - 1. correct the defective repairs to the Site or such other adjacent areas;
 - 2. correct such defective Work;
 - 3. if the defective Work has been rejected by Owner, remove it from the Project and replace it with Work that is not defective, and
 - 4. satisfactorily correct or repair or remove and replace any damage to other Work, to the work of others, or to other land or areas resulting therefrom.
- B. If Contractor does not promptly comply with the terms of Owner's written instructions, or in an emergency where delay would cause serious risk of loss or damage, Owner may have the defective Work corrected or repaired or may have the rejected Work removed and replaced. 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 repair or such removal and replacement (including but not limited to all costs of repair or replacement of work of others).
- C. In special circumstances where a particular item of equipment is placed in continuous service before Substantial Completion of all the Work, the correction period for that item may start to run from an earlier date if so provided in the Specifications.

- D. Where defective Work (and damage to other Work resulting therefrom) has been corrected or removed and replaced under this paragraph, the correction period hereunder with respect to such Work will be extended for an additional period of one year after such correction or removal and replacement has been satisfactorily completed.
- E. Contractor's obligations under this paragraph are in addition to all other obligations and warranties. The provisions of this paragraph shall not be construed as a substitute for, or a waiver of, the provisions of any applicable statute of limitation or repose.

ARTICLE 16 – SUSPENSION OF WORK AND TERMINATION

16.01 *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 written notice to Contractor and Engineer. Such notice will fix the date on which Work will be resumed. Contractor shall resume the Work on the date so fixed. Contractor shall be entitled to an adjustment in the Contract Price or an extension of the Contract Times, or both, directly attributable to any such suspension. Any Change Proposal seeking such adjustments shall be submitted no later than 30 days after the date fixed for resumption of Work.

16.02 *Owner May Terminate for Cause*

- A. The occurrence of any one or more of the following events will constitute a default by Contractor and 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);
 - 2. Failure of Contractor to perform or otherwise to comply with a material term of the Contract Documents;
 - 3. Contractor's disregard of Laws or Regulations of any public body having jurisdiction; or
 - 4. Contractor's repeated disregard of the authority of Owner or Engineer.
- B. If one or more of the events identified in Paragraph 16.02.A occurs, then after giving Contractor (and any surety) ten days written notice that Owner is considering a declaration that Contractor is in default and termination of the contract, Owner may proceed to:
 - 1. declare Contractor to be in default, and give Contractor (and any surety) notice that the Contract is terminated; and
 - 2. enforce the rights available to Owner under any applicable performance bond.
- C. Subject to the terms and operation of any applicable performance bond, if Owner has terminated the Contract for cause, Owner may exclude Contractor from the Site, take possession of the Work, 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 complete the Work as Owner may deem expedient.
- D. Owner may not proceed with termination of the Contract under Paragraph 16.02.B if Contractor within seven days of receipt of notice of intent to terminate begins to correct its failure to perform and proceeds diligently to cure such failure.
- E. If Owner proceeds as provided in Paragraph 16.02.B, Contractor shall not be entitled to receive any further payment until the Work is completed. If the unpaid balance of the Contract Price exceeds the cost to complete the Work, including all related claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals) sustained by Owner, such excess will be paid to Contractor. If the cost to

complete the Work including such related claims, costs, losses, and damages exceeds 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.

- F. 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, or any rights or remedies of Owner against Contractor or any surety under any payment bond or performance bond. Any retention or payment of money due Contractor by Owner will not release Contractor from liability.
- G. If and to the extent that Contractor has provided a performance bond under the provisions of Paragraph 6.01.A, the provisions of that bond shall govern over any inconsistent provisions of Paragraphs 16.02.B and 16.02.D.

16.03 *Owner May Terminate For Convenience*

- A. Upon seven days written notice to Contractor and Engineer, Owner may, without cause and without prejudice to any other right or remedy of Owner, terminate the Contract. In such case, Contractor shall be paid for (without duplication of any items):
 - 1. completed and acceptable Work executed in accordance with the Contract Documents prior to the effective date of termination, including fair and reasonable sums for overhead and profit on such Work;
 - 2. expenses sustained prior to the effective date of termination in performing services and furnishing labor, materials, or equipment as required by the Contract Documents in connection with uncompleted Work, plus fair and reasonable sums for overhead and profit on such expenses; and
 - 3. other reasonable expenses directly attributable to termination, including costs incurred to prepare a termination for convenience cost proposal.
- B. Contractor shall not be paid on account of loss of anticipated overhead, profits, or revenue, or other economic loss arising out of or resulting from such termination.

16.04 *Contractor May Stop Work or Terminate*

- A. If, through no act or fault of Contractor, (1) the Work is suspended for more than 90 consecutive days by Owner or under an order of court or other public authority, or (2) Engineer fails to act on any Application for Payment within 30 days after it is submitted, or (3) 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 16.03.
- B. In lieu of terminating the Contract and without prejudice to any other right or remedy, if Engineer has failed to act on an Application for Payment within 30 days after it is submitted, or Owner has failed for 30 days to pay Contractor any sum finally determined to be due, Contractor may, seven days after written notice to Owner and Engineer, stop the Work until payment is made of all such amounts due Contractor, including interest thereon. The provisions of this paragraph are not intended to preclude Contractor from submitting a Change Proposal 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 17 – FINAL RESOLUTION OF DISPUTES

17.01 *Methods and Procedures*

- A. *Disputes Subject to Final Resolution:* The following disputed matters are subject to final resolution under the provisions of this Article:
 - 1. A timely appeal of an approval in part and denial in part of a Claim, or of a denial in full; and
 - 2. Disputes between Owner and Contractor concerning the Work or obligations under the Contract Documents, and arising after final payment has been made.
- B. *Final Resolution of Disputes:* For any dispute subject to resolution under this Article, Owner or Contractor may:
 - 1. elect in writing to invoke the dispute resolution process provided for in the Supplementary Conditions; or
 - 2. agree with the other party to submit the dispute to another dispute resolution process; or
 - 3. if no dispute resolution process is provided for in the Supplementary Conditions or mutually agreed to, give written notice to the other party of the intent to submit the dispute to a court of competent jurisdiction.

ARTICLE 18 – MISCELLANEOUS

18.01 *Giving Notice*

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

18.02 *Computation of Times*

- A. When any period of time is referred to in the Contract 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.

18.03 *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. 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.

18.04 *Limitation of Damages*

- A. With respect to any and all Change Proposals, Claims, disputes subject to final resolution, and other matters at issue, neither Owner nor Engineer, nor any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, shall be liable to Contractor for any claims, costs, losses, or damages sustained by Contractor on or in connection with any other project or anticipated project.

18.05 *No Waiver*

- A. A party's non-enforcement of any provision shall not constitute a waiver of that provision, nor shall it affect the enforceability of that provision or of the remainder of this Contract.

18.06 *Survival of Obligations*

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

18.07 *Controlling Law*

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

18.08 *Headings*

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

SECTION 00 73 00
SUPPLEMENTARY CONDITIONS

ARTICLE 2 – PRELIMINARY MATTERS

SC-2.01 Delivery of Bonds and Evidence of Insurance

SC-2.01 Delete Paragraphs 2.01 B. and C. in their entirety and insert the following in their place:

- A. Evidence of Contractor's Insurance: When Contractor delivers the executed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner copies of the policies of insurance (including all endorsements, and identification of applicable self-insured retentions and deductibles) required to be provided by Contractor in Article 6. Contractor may block out (redact) any confidential premium or pricing information contained in any policy or endorsement furnished under this provision.
- B. Evidence of Owner's Insurance: After receipt from Contractor of the executed counterparts of the Agreement and all required bonds and insurance documentation, Owner shall promptly deliver to Contractor copies of the policies of insurance to be provided by Owner under Article 6 (if any). Owner may block out (redact) any confidential premium or pricing information contained in any policy or endorsement furnished under this provision.

SC-2.02 Copies of Documents

SC-2.02.A. Amend the first sentence of Paragraph 2.02.A. to read as follows:

Owner shall furnish one copy in electronic portable document format (PDF) to Contractor.

ARTICLE 3 – DOCUMENTS: INTENT, REQUIREMENTS, REUSE

SC-3.01 Add the following paragraph immediately after Paragraph 3.01.E:

- F. In the event there is a discrepancy between components of the project manual, the order of precedence shall be as follows:

Addenda, Supplemental General Conditions, information for bidders, General Conditions, Technical Provisions.

**ARTICLE 5 – AVAILABILITY OF LANDS; SUBSURFACE AND PHYSICAL
CONDITIONS; HAZARDOUS ENVIRONMENTAL CONDITIONS**

SC-5.03 Subsurface and Physical Conditions

SC 5.03 Delete Paragraphs 5.03.A and 5.03.B in their entirety and insert the following:

- A. No reports of explorations or tests of subsurface conditions at or adjacent to the Site, or drawings of physical conditions relating to existing surface or subsurface structures at the Site, are known to Owner.

SC-5.06 Hazardous Environmental Conditions

SC 5.06 Delete Paragraphs 5.06.A and 5.06.B in their entirety and insert the following:

- A. No reports or drawings related to Hazardous Environmental Conditions at the Site are known to Owner.
- B. Not Used.

ARTICLE 6 – BONDS AND INSURANCE

SC-6.03 Contractor's Liability Insurance

SC 6.03 Delete Paragraph 6.03.F in its entirety.

SC 6.03 Add the following new paragraph immediately after Paragraph 6.03.J:

- J. The limits of liability for the insurance required by Paragraph 6.03 of the General Conditions shall provide coverage for not less than the following amounts or greater where required by Laws and Regulations:
 - 1. Workers' Compensation, and related coverages under Paragraphs 6.03.A.1 and A.2 of the General Conditions:

State:	<u>Statutory</u>
Federal, if applicable (e.g., Longshoreman's):	<u>Statutory</u>
Jones Act coverage, if applicable:	
Bodily injury by accident, each accident	\$ <u>1,000,000</u>
Bodily injury by disease, aggregate	\$ <u>1,000,000</u>

Employer's Liability:

Bodily injury, each accident	\$ <u>1,000,000</u>
Bodily injury by disease, each employee	\$ <u>1,000,000</u>
Bodily injury/disease aggregate	\$ <u>1,000,000</u>
Foreign voluntary worker compensation	<u>Statutory</u>
2. Contractor's Commercial General Liability under Paragraphs 6.03.B and 6.03.C of the General Conditions:	
General Aggregate	\$ <u>2,000,000</u>
Products - Completed Operations Aggregate	\$ <u>2,000,000</u>
Personal and Advertising Injury	\$ <u>1,000,000</u>
Each Occurrence (Bodily Injury and Property Damage)	\$ <u>1,000,000</u>
3. Automobile Liability under Paragraph 6.03.D. of the General Conditions:	
Combined Single Limit of	\$ <u>1,000,000 per occurrence</u>
Combined Single Limit of	\$ <u>2,000,000 aggregate</u>
4. Excess or Umbrella Liability:	
Per Occurrence	\$ <u>5,000,000</u>
General Aggregate	\$ <u>5,000,000</u>

ARTICLE 7 – CONTRACTOR'S RESPONSIBILITIES

SC-7.02 Labor; Working Hours

SC-7.02.B. Add the following new subparagraphs immediately after Paragraph 7.02.B:

1. Regular working hours will be 7:00 AM to 6:00 PM

SC-7.02.B. Amend the first and second sentences of Paragraph 7.02.B to state "...all Work at the Site shall be performed during regular working hours, Monday through Friday. Contractor will not perform Work on a Saturday, Sunday, or any legal holiday."

SC-7.02.C. Add the following new paragraph immediately after Paragraph 7.02.B:

Contractor shall be responsible for the cost of any overtime pay or other expense incurred by the Owner for Engineer's services (including those of the

Resident Project Representative, if any), Owner's representative, and construction observation services, occasioned by the performance of Work on Saturday, Sunday, any legal holiday, or as overtime on any regular work day. If Contractor is responsible but does not pay, or if the parties are unable to agree as to the amount owed, then Owner may impose a reasonable set-off against payments due under Article 15.

SC-7.09 Taxes

SC 7.09 Add a new paragraph immediately after Paragraph 7.09.A:

- A. Owner is exempt from payment of sales and compensating use taxes of the State of Kansas and of cities and counties thereof on all materials to be incorporated into the Work.
 - 1. Owner will furnish the required certificates of tax exemption to Contractor for use in the purchase of supplies and materials to be incorporated into the Work.
 - 2. Owner's exemption does not apply to construction tools, machinery, equipment, or other property purchased by or leased by Contractor, or to supplies or materials not incorporated into the Work.

ARTICLE 9 – OWNER'S RESPONSIBILITIES

SC-9.13 Owner's Site Representative

SC-9.13 Add the following new paragraph immediately after Paragraph 9.12 of the General Conditions:

Owner will furnish a "Resident Project Representative" to represent Owner at the Site and assist Owner in observing the progress and quality of the Work.

ARTICLE 10 – ENGINEER’S STATUS DURING CONSTRUCTION

SC-10.03 Project Representative

SC-10.03 Add the following new paragraphs immediately after Paragraph 10.03.A:

- B. The Resident Project Representative (RPR) will act under the supervision of Engineer, and will confer with Engineer regarding RPR's actions.
 - 1. General: RPR's dealings in matters pertaining to the Work in general shall be with Engineer and Contractor. RPR's dealings with Subcontractors shall only be through or with the full knowledge and approval of Contractor. RPR shall generally communicate with Owner only with the knowledge of and under the direction of Engineer.
 - 2. Schedules: Review the progress schedule, schedule of Shop Drawing and Sample submittals, and Schedule of Values prepared by Contractor and consult with Engineer concerning acceptability.
 - 3. Conferences and Meetings: Attend meetings with Contractor, such as preconstruction conferences, progress meetings, job conferences, and other Project-related meetings, and prepare and circulate copies of minutes thereof.
 - 4. Liaison:
 - a. Serve as Engineer’s liaison with Contractor. Working principally through Contractor’s authorized representative or designee, assist in providing information regarding the provisions and intent of the Contract Documents.
 - b. Assist Engineer in serving as Owner’s liaison with Contractor when Contractor’s operations affect Owner’s on-Site operations.
 - c. Assist in obtaining from Owner additional details or information, when required for proper execution of the Work.
 - 5. Interpretation of Contract Documents: Report to Engineer when clarifications and interpretations of the Contract Documents are needed and transmit to Contractor clarifications and interpretations as issued by Engineer.
 - 6. Shop Drawings and Samples:
 - a. Record date of receipt of Samples and Contractor-approved Shop Drawings.
 - b. Receive Samples which are furnished at the Site by Contractor, and notify Engineer of availability of Samples for examination.

- c. Advise Engineer and Contractor of the commencement of any portion of the Work requiring a Shop Drawing or Sample submittal for which RPR believes that the submittal has not been approved by Engineer.
- 7. Modifications: Consider and evaluate Contractor's suggestions for modifications in Drawings or Specifications and report such suggestions, together with RPR's recommendations, if any, to Engineer. Transmit to Contractor in writing decisions as issued by Engineer.
- 8. Review of Work and Rejection of Defective Work:
 - a. Conduct on-Site observations of Contractor's work in progress to assist Engineer in determining if the Work is in general proceeding in accordance with the Contract Documents.
 - b. Report to Engineer whenever RPR believes that any part of Contractor's work in progress is defective, will not produce a completed Project that conforms generally to the Contract Documents, or will imperil the integrity of the design concept of the completed Project as a functioning whole as indicated in the Contract Documents, or has been damaged, or does not meet the requirements of any inspection, test or approval required to be made; and advise Engineer of that part of work in progress that RPR believes should be corrected or rejected or should be uncovered for observation, or requires special testing, inspection or approval.
- 9. Inspections, Tests, and System Start-ups:
 - a. Verify that tests, equipment, and systems start-ups and operating and maintenance training are conducted in the presence of appropriate Owner's personnel, and that Contractor maintains adequate records thereof.
 - b. Observe, record, and report to Engineer appropriate details relative to the test procedures and systems start-ups.
- 10. Records:
 - a. Prepare a daily report or keep a diary or log book, recording Contractor's hours on the Site, Subcontractors present at the Site, weather conditions, data relative to questions of Change Orders, Field Orders, Work Change Directives, or changed conditions, Site visitors, deliveries of equipment or materials, daily activities, decisions, observations in general, and specific observations in more detail as in the case of observing test procedures; and send copies to Engineer.

- b. Record names, addresses, fax numbers, e-mail addresses, web site locations, and telephone numbers of all Contractors, Subcontractors, and major Suppliers of materials and equipment.
- c. Maintain records for use in preparing Project documentation.

11. Reports:

- a. Furnish to Engineer periodic reports as required of progress of the Work and of Contractor's compliance with the Progress Schedule and schedule of Shop Drawing and Sample submittals.
- b. Draft and recommend to Engineer proposed Change Orders, Work Change Directives, and Field Orders. Obtain backup material from Contractor.
- c. Immediately notify Engineer of the occurrence of any Site accidents, emergencies, acts of God endangering the Work, force majeure or delay events, damage to property by fire or other causes, or the discovery of any Constituent of Concern or Hazardous Environmental Condition.

12. Payment Requests: Review applications for payment with Contractor for compliance with the established procedure for their submission and forward with recommendations to Engineer, noting particularly the relationship of the payment requested to the Schedule of Values, Work completed, and materials and equipment delivered at the Site but not incorporated in the Work.

13. Certificates, Operation and Maintenance Manuals: During the course of the Work, verify that materials and equipment certificates, operation and maintenance manuals and other data required by the Contract Documents to be assembled and furnished by Contractor are applicable to the items actually installed and in accordance with the Contract Documents, and have these documents delivered to Engineer for review and forwarding to Owner prior to payment for that part of the Work.

14. Completion:

- a. Participate in Engineer's visits to the Site to determine Substantial Completion, assist in the determination of Substantial Completion and the preparation of a punch list of items to be completed or corrected.
- b. Participate in Engineer's final visit to the Site to determine completion of the Work, in the company of Owner and Contractor, and prepare a final punch list of items to be completed and deficiencies to be remedied.
- c. Observe whether all items on the final list have been completed or corrected and make recommendations to Engineer concerning acceptance and issuance of the notice of acceptability of the work.

C. The RPR shall not:

1. Authorize any deviation from the Contract Documents or substitution of materials or equipment (including “or-equal” items).
2. Exceed limitations of Engineer’s authority as set forth in the Contract Documents.
3. Undertake any of the responsibilities of Contractor, Subcontractors, or Suppliers.
4. Advise on, issue directions relative to, or assume control over any aspect of the means, methods, techniques, sequences or procedures of Contractor’s work.
5. Advise on, issue directions regarding, or assume control over security or safety practices, precautions, and programs in connection with the activities or operations of Owner or Contractor.
6. Participate in specialized field or laboratory tests or inspections conducted off-site by others except as specifically authorized by Engineer.
7. Accept Shop Drawing or Sample submittals from anyone other than Contractor.
8. Authorize Owner to occupy the Project in whole or in part.

**ARTICLE 15 – PAYMENTS TO CONTRACTOR; SET-OFFS; COMPLETION;
CORRECTION PERIOD**

SC-15.03 Substantial Completion

SC 15.03.B Add the following new subparagraph to Paragraph 15.03.B:

1. If some or all of the Work has been determined not to be at a point of Substantial Completion and will require re-inspection or re-testing by Engineer, the cost of such re-inspection or re-testing, including the cost of time, travel and living expenses, shall be paid by Contractor to Owner. If Contractor does not pay, or the parties are unable to agree as to the amount owed, then Owner may impose a reasonable set-off against payments due under Article 15.

SC-15.08 Correction Period

SC 15.08.A Amend paragraph 15.08.A to read as follows:

- A. If within **two** years after the date of Substantial Completion (or such longer period of time as may be prescribed by the terms of any applicable special guarantee required by the Contract Documents, or by any specific provision of the contract Documents), any Work is found to be defective, or if the repair of any damages to the Site, adjacent areas that contractor has arranged to use through construction easements or otherwise, and other adjacent areas used by Contractor as permitted by Laws and Regulations, is found to be defective,

then Contractor shall promptly, without cost to Owner and in accordance with Owner's written instructions:

1. correct the defective repairs to the Site or such other adjacent areas;
2. correct such defective Work;
3. if the defective Work has been rejected by Owner, remove it from the Project and replace it with Work that is not defective, and
4. satisfactorily correct or repair or remove and replace any damage to other Work, to the work of others, or to other land or areas resulting therefrom.

ARTICLE 17 – FINAL RESOLUTION OF DISPUTES

SC-SC-17.02 Add the following new paragraph immediately after Paragraph 17.01.

SC-17.02 Arbitration

- A. All matters subject to final resolution under this Article will be decided by arbitration subject to the conditions and limitations of this paragraph. This agreement to arbitrate and any other agreement or consent to arbitrate entered into will be specifically enforceable under the prevailing law of any court having jurisdiction.
- B. The demand for arbitration will be filed in writing with the other party to the Contract and with the selected arbitrator or arbitration provider, and a copy will be sent to Engineer for information. The demand for arbitration will be made within the specific time required in this Article, or if no specified time is applicable within a reasonable time after the matter in question has arisen, and in no event shall any such demand be made after the date when institution of legal or equitable proceedings based on such matter in question would be barred by the applicable statute of limitations. The demand for arbitration should include specific reference to Paragraph SC-17.02.D below.
- C. No arbitration arising out of or relating to the Contract shall include by consolidation, joinder, or in any other manner any other individual or entity (including Engineer, and Engineer's consultants and the officers, directors, partners, agents, employees or consultants of any of them) who is not a party to this Contract unless:
 1. the inclusion of such other individual or entity is necessary if complete relief is to be afforded among those who are already parties to the arbitration; and
 2. such other individual or entity is substantially involved in a question of law or fact which is common to those who are already parties to the arbitration and which will arise in such proceedings.

- D. The award rendered by the arbitrator(s) shall be consistent with the agreement of the parties, in writing, and include a concise breakdown of the award, and a written explanation of the award specifically citing the Contract provisions deemed applicable and relied on in making the award.
- E. The award will be final. Judgment may be entered upon it in any court having jurisdiction thereof, and it will not be subject to modification or appeal, subject to provisions of the Laws and Regulations relating to vacating or modifying an arbitral award.
- F. The fees and expenses of the arbitrators and any arbitration service shall be shared equally by Owner and Contractor.

END OF SECTION

SECTION 01 22 00
MEASUREMENT AND PAYMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for measurement and payment of all bid items indicated on the bid form.

1.2 PROCEDURES

- A. The total bid for each section of the contract shall cover all work shown on the drawings and required by the specifications and other contract documents. All costs in connection with the work, including furnishing of all materials, equipment, supplies, and appurtenances; providing all construction plant, equipment, tools, and incidentals; and performing of all necessary labor to fully complete the work, shall be included in the unit and lump sum prices named in the Bid Form. No item that is required by the Contract Documents for the proper and successful completion of the work will be paid for outside of or in addition to the prices submitted in the Proposal. All work not specifically set forth as a pay item in the Bid Form shall be considered a subsidiary obligation of the Contractor and all costs in connection therewith shall be included in the prices named in the Bid Form.
- B. All incidental, subsidiary and miscellaneous items of work essential to completion of the project in a satisfactory manner shall be done at no additional cost to the Owner. Some, but not all, of the items that shall be considered incidental or subsidiary are as follows:
 - 1. The support, protection and maintenance of existing utilities such as power and telephone poles, sanitary sewers, manholes, storm drains and other such items that are to be maintained in place, before, during, and after construction of the proposed improvements.
 - 2. Removal of structures or obstructions required to complete the work as indicated on the drawing.
 - 3. Relocation of existing utilities where indicated on the drawings.
 - 4. Traffic control.
 - 5. Acquisition of additional working space and/or easements.
 - 6. Other items as noted in these specifications or on the drawings.

1.3 BID ITEM MEASUREMENT/PAYMENT

A. CONSTRUCTION STAKING

This item shall be paid for at the contract lump sum price bid. The lump sum price bid shall be considered full compensation for all work required to provide the proper horizontal and vertical alignment control for satisfactory completion of the project, submittal of a level/bench run to the Engineer for approval, and for all other materials, equipment, tools, labor, and incidentals necessary to complete the work.

B. CONCRETE PAVEMENT

This item shall be paid for at the contract unit price bid per square yard for the thickness shown and to the limits as shown on the drawings. Other limits will be measured only as directed by the Engineer. The unit price bid shall be considered full compensation for excavating, removing, and disposing of excess and waste materials; forming; furnishing, placing, finishing, and curing concrete; furnishing and placing reinforcement; aggregates; mixing; hauling; spreading; compacting; and for all other materials, equipment, tools, labor, and incidentals necessary to complete the work.

C. ASPHALTIC CONCRETE PAVEMENT

This item shall be paid for at the contract unit price bid per square yard for the thickness shown and to the limits as shown on the drawings. Other limits will be measured only as directed by the Engineer. The unit price bid shall be considered full compensation for all bituminous materials, including tack; admixtures, aggregates; mixing; hauling; spreading; compacting; and for all other materials, equipment, tools, labor, and incidentals necessary to complete the work.

D. ASPHALTIC CONCRETE OVERLAY

This item shall be paid for at the contract unit price bid per square yard for the thickness shown and to the limits as shown on the drawings. Other limits will be measured only as directed by the Engineer. The unit price bid shall be considered full compensation for all bituminous materials, including tack; admixtures, aggregates; mixing; hauling; spreading; compacting; and for all other materials, equipment, tools, labor, and incidentals necessary to complete the work.

E. REINFORCED CONCRETE VALLEY GUTTER

This item shall be paid for at the contract unit price bid per square yard for the thickness shown and to the limits as shown on the drawings. Other limits will be measured only as directed by the Engineer. The unit price bid shall be considered full compensation for excavating, removing, and disposing of excess and waste materials; forming; furnishing, placing, finishing, and curing concrete; furnishing and placing reinforcement; aggregates; mixing; hauling; spreading; compacting; and for all other materials, equipment, tools, labor, and incidentals necessary to complete the work.

F. REINFORCED CONCRETE DRIVE

This item shall be paid for at the contract unit price bid per square yard for the thickness shown and to the limits as shown on the drawings. Other limits will be measured only as directed by the Engineer. The unit price bid shall be considered full compensation for excavating, removing, and disposing of excess and waste materials; forming; furnishing, placing, finishing, and curing concrete; furnishing and placing reinforcement; aggregates; mixing; hauling; spreading; compacting; and for all other materials, equipment, tools, labor, and incidentals necessary to complete the work.

G. REINFORCED CRUSHED ROCK BASE

This item shall be paid for at the contract unit price bid per square yard at the thickness as shown on the drawings. The limits of the area to be paid for are as shown on the drawings. The price bid shall be considered full compensation for furnishing all material, including fabric reinforcement where required; for completing all preparation, hauling, placement, and compaction, and for all other materials, equipment, tools, labor, and incidentals necessary to complete the work.

H. COMBINED CURB & GUTTER

This item shall be paid for at the contract unit price bid per linear foot for the various types shown on the drawings. The limits of areas to be paid for are as shown on the drawings. Plan quantity is calculated along the face of curb; including length across storm drain inlets and drive entrances, flumes, and curb depressions; but excluding length across valley gutters. The unit price bid shall be considered full compensation for all concrete and concrete placement, finishing, jointing and joint sealing, curing, backfilling, and for all other materials, equipment, tools, labor, and incidentals necessary to complete the work.

I. MONOLITHIC EDGE CURB

This item shall be paid for at the contract unit price bid per linear foot for the various types shown on the drawings. The limits of areas to be paid for are as shown on the drawings. Plan quantity is calculated along the face of the curb. The unit price bid shall be considered full compensation for all concrete and concrete placement, finishing, jointing and joint sealing, curing, backfilling, and for all other materials, equipment, tools, labor, and

J. REMOVE AND REPLACE CURB AND GUTTER

This item shall be paid for at the contract unit price bid per linear foot for the various types and for the limits as shown on the drawings. Plan quantity is calculated along the face of the curb. The unit price bid shall be considered full compensation for all saw cuts, removal, disposal of removed materials, backfilling the removal areas with suitable topsoil where necessary, concrete and concrete placement, finishing, jointing and joint sealing, curing, backfilling and for all other materials, equipment, tools, labor and incidentals necessary to complete the work.

K. CONCRETE SIDEWALK

This item shall be paid for at the contract unit price bid per square foot for the thickness shown and to the limits as shown on the drawings. Other limits will be measured only as directed by the Engineer. The unit price bid shall be considered full compensation for excavating, removing, and disposing of excess and waste materials; forming; furnishing, placing, finishing, and curing concrete; furnishing and placing reinforcement; aggregates; mixing; hauling; spreading; compacting; and for all other materials, equipment, tools, labor, and incidentals necessary to complete the work.

L. WHEELCHAIR RAMP

This item will be paid for at the contract unit price bid per each as shown on the drawings. The unit price bid shall be considered full compensation for excavation, furnishing and placing of concrete and warning pavers and for all other materials, equipment, tools, labor, and incidentals necessary to complete the work, including all items necessary to meet local, state, and federal ADA requirements.

M. PAVEMENT REMOVAL

This item shall be paid for at the contract unit price bid per square yard to the limits as shown on the drawings including curb and gutter where indicated. The unit price bid shall be considered full compensation for all saw cuts, removal, disposal of removed material, backfilling the removal areas with suitable topsoil where necessary, and for all other materials, equipment, tools, labor, and incidentals necessary to complete the work.

N. PAVEMENT PATCHING

This item shall be paid for at the contract unit price bid per square yard to the limits as shown on the drawings. Other limits will be measured only as directed by the Engineer. The unit price bid shall be considered full compensation for all saw cuts; milling; removal; disposal or removed material; backfilling the removal area with suitable topsoil where necessary; concrete or bituminous materials, including tack; admixtures; aggregates; base material; fabric reinforcement where required; mixing; hauling; spreading; compacting; and for all other materials, equipment, tools, labor, and incidentals necessary to complete the work.

O. UNCLASSIFIED EXCAVATION

This item shall be paid for at the contract unit price bid per cubic yard as computed between the original ground and finished subgrade or finished ground line as provided in the drawings and as shown in the typical sections and site grading plan. No additional payment will be made for rock and/or water which may be encountered. Additional handling that may be required for topsoiling operations will not be paid for separately. The unit price bid shall be considered full compensation for all excavation, saw cuts, water, hauling of water, the proper formation of embankments, trimming of slopes, disposal of surplus materials, preparation and completion of roadway, subgrade and shoulders, and for all other materials, equipment, tools, labor, and incidentals necessary to complete the work.

P. CONTRACTOR FURNISHED BORROW

This item shall be paid for at the contract unit price bid per cubic yard as indicated on the drawings. Additional handling that may be required for topsoiling operations will not be paid for separately. This unit price bid shall be considered full compensation for all soil, excavation, water, hauling of water, the disposal of surplus materials and for all other materials, equipment, tools, labor, and incidentals necessary to complete the work.

Q. STORM SEWER PIPE

This item shall be paid for at the contract unit price bid per linear foot as shown on the drawings. The unit price bid shall be considered full compensation for pipe, excavation, placing of pipe, backfill, and for and for all other materials, equipment, tools, labor, and incidentals necessary to complete the work.

R. STORM SEWER STRUCTURES

This item shall be paid for at the contract unit price bid per each, for the varying types as shown on the drawings. The unit price bid for each type of structure shall be considered full compensation for all excavation, compaction and backfill; concrete and concrete placement including hook up to adjacent curb and gutter; reinforcing steel; finishing and curing; trash rack (if required); and for all other materials, equipment, tools, labor, and incidentals necessary to complete the work.

S. HEADWALLS AND END SECTIONS

This item shall be paid for at the contract unit price bid per each, including precast sections as shown on the drawings. The unit price bid shall be considered full compensation for headwall and end section construction and for all other materials, equipment, tools, labor, and incidentals necessary to complete the work.

T. CONCRETE DITCH LINING

This item shall be paid for at the contract unit price bid per square yard for the thickness shown and to the limits as shown on the drawings. Other limits will be measured only as directed by the Engineer. The unit price bid shall be considered full compensation for excavating, removing, and disposing of excess and waste materials; forming; furnishing, placing, finishing, and curing concrete; furnishing and placing reinforcement; aggregates; mixing; hauling; spreading; compacting; and for all other materials, equipment, tools, labor, and incidentals necessary to complete the work.

U. RIPRAP

This item shall be paid for at the contract unit price bid per square yard for the various types shown on the drawings. The limits of areas to be paid for are as shown on the drawings or as directed by the Engineer. The unit price bid shall be considered full compensation for furnishing, hauling and placing the material as specified, including filter course and/or filter fabric as shown in the drawings; and for all other materials, equipment, tools, labor, and incidentals necessary to complete the work.

V. EROSION CONTROL BLANKET/TURF REINFORCEMENT MAT

This item shall be paid for at the contract unit price bid per square yard for the various types shown on the drawings. The limits of areas to be paid for are as shown on the drawings or as directed by the Engineer. The unit price bid shall be considered full compensation for furnishing and placing the material as specified, and for all other materials, equipment, tools, labor, and incidentals necessary to complete the work.

W. PAVEMENT MARKING

This item shall be paid for at the contract lump sum price bid for the various types shown on the drawings. The lump sum price bid shall be considered full compensation for all layouts required, surface preparation, furnishing and properly placing all materials, and for all equipment, tools, labor, and incidentals necessary to complete the work.

X. SIGNING

This item shall be paid for at the contract lump sum price bid and shall be full compensation for signs, posts, brackets, bolts, nuts, washers, removal, replacement, and for all other materials, equipment, tools, labor, and incidentals necessary to complete the work.

Y. SANITARY SEWER AND WATERLINE PIPE

These items shall be paid for at the contract unit price bid per linear foot as shown on the drawings, no deductions being made for manholes, valves or fittings. Pipelines at structures shall be measured from center to center of the structure. The unit price bid shall be considered full compensation for all pipe; fittings such as tees, bends, crosses, reducers, couplings, clamps, sleeves, plugs, caps, etc. shown on the drawings or required for satisfactory assembly and installation; trenching; pipe bedding; backfill; testing and disinfection (where required); TV inspections (if required); connecting; and for all other materials, equipment, tools, labor, and incidentals necessary to complete the work.

Z. BORING AND STEEL ENCASEMENT

This item shall be paid for at the contract unit price per linear foot as shown on the drawings. The unit price bid shall be considered full compensations for boring and receiving pits, steel encasement, wood skids, casing spacers, concrete and for all other materials, equipment, tools, labor, and incidentals necessary to complete the work.

AA. MANHOLES

This item shall be paid for at the contract unit prices bid per each for the various types as shown on the drawings. The unit price bid shall be considered full compensation for gasketed frames, bolt down or standard covers, pipe/fittings, coatings, concrete, excavation, compaction, vacuum testing (where required), and for all materials, equipment, tools, labor and incidentals necessary to complete the work.

BB. MANHOLE ADJUSTMENT

This item shall be paid for at the contract unit price bid per each as shown on the drawings. The unit price bid shall be considered full compensation for installation of adjusting rings, removing and replacing field caps, mastic, vacuum testing, gaskets, coatings, concrete, grout, excavation, compaction, and for all other materials, labor, equipment, tools, and incidentals necessary to complete the work.

CC. STUBS AND PLUGS

This item shall be paid for at the contract unit price bid per each as shown on the drawings. The unit price bid shall be considered full compensation for pipe, gasketed caps, sealant, and all other materials, equipment, tools, labor, and incidentals necessary to complete the work.

DD. SEWER SERVICE CONNECTION

This item shall be paid for at the contract unit price bid per each for the various types as shown on the drawings. The unit price bid shall be considered full compensation for pipe, fittings, plugs, caps, marking tape, trenching, backfilling, bedding, testing and all other materials, equipment, tools, labor and incidentals necessary to complete the work.

EE. SEWER SERVICE RECONNECTION

This item shall be paid for at the contract unit price bid per each as shown on the drawings. The unit price bid shall be considered full compensation for the pipe, fittings, plugs, caps, marking tape, trenching, backfilling, bedding, testing and all other materials, equipment, tools, labor and incidentals necessary to complete the work.

FF. LIFT STATION

This item shall be paid for at the contract lump sum bid price. The lump sum price bid shall be considered full compensation for all coordination with the control and pump suppliers for all equipment which is being provided to the Contractor by the Owner or other parties and the construction of the lift station building; site piping; sitework; all equipment; relocation or placement of existing or new valve assemblies; all piping, controls and other miscellaneous items shown on the drawings or specified; electrical coordination; mechanical work; trenching; bedding; backfill; testing; seeding; grading; earthwork; insurance; bonds; utilities; installation; start-up; training; warranty; and for all other materials, equipment, tools, labor and incidentals necessary to complete the work.

GG. WATERLINE PIPE BY DIRECTIONAL DRILL

This item shall be paid for at the contract unit price bid per linear foot as shown on the drawings. The unit price bid shall be considered full compensation for all pipe, drilling, drilling fluid, excavation, backfill, fittings, connecting, and for all other materials, equipment, tools, labor, and incidentals necessary to complete the work.

HH. VALVE ASSEMBLIES AND ANCHORED VALVE ASSEMBLIES

This item shall be paid for at the contract unit price bid per each for the respective sizes as shown on the drawings. The unit price bid shall be considered full compensation for excavation, valve, valve box, pipe, anchor couplings, thrust blocks and for all other materials, equipment, tools, labor and incidentals necessary to complete the work.

II. BLOWOFF ASSEMBLY

This item shall be paid for at the contract unit price bid per each as shown on the drawings. The unit price bid shall be considered full compensation for pipe, cap, plug, coupling, valve, valve box, brass nipple, and for all other materials, equipment, tools, labor and incidentals necessary to complete the work.

JJ. TAPPING SLEEVES AND VALVE

This item shall be paid for at the contract unit price bid per each as shown on the drawings. The unit price bid shall be considered full compensation for sleeve, valve, and for all other materials, equipment, tools, labor and incidentals necessary to complete the work.

KK. FIRE HYDRANT ASSEMBLY

This item shall be paid for at the contract unit price per each as shown on the drawings. The unit price bid shall be considered full compensation for trench and backfill, anchor tee, fittings, pipe, gate valve, valve box, concrete pad (as necessary), fire hydrant, thrust blocking and drain rock, and for all other materials, equipment, tools, labor, and incidentals necessary to complete the work.

LL. WATER SERVICE CONNECTION

This item shall be paid for at the contract unit price bid per each for the various types as shown on the drawings. The unit price bid shall be considered full compensation for the pipe, fittings, plugs, caps, marking tape, excavation, trenching, backfilling, bedding, and for all other materials, equipment, tools, labor and incidentals necessary to complete the work.

MM. WATER SERVICE RECONNECTION

This item shall be paid for at the contract unit price bid per each as shown on the drawings. The unit price bid shall be considered full compensation for the pipe, fittings, excavation, trenching, backfilling, testing and for all other materials, equipment, tools, labor and incidentals necessary to complete the work.

NN. WATER METER VAULT

This item shall be paid for at the contract lump sum price bid per each as shown on the drawings. The unit price bid shall be considered full compensation for the master meter, vault, vault lid, valves, all interior piping, all exterior piping, fittings, trenching, pipe bidding, backfill, grading, site work, testing, fittings, doors or hatches, vents, drains, signs, installation, start-up and for all other materials, equipment, tools, labor and incidentals necessary to complete the work.

OO. BOOSTER PUMP STATION

This item shall be paid for at the contract lump sum bid price. The lump sum price bid shall be considered full compensation for all coordination with the control and pump suppliers for all equipment which is being provided to the Contractor by the Owner or other parties and the construction of the pump station building; site piping; sitework; all equipment; relocation or placement of existing or new valve assemblies; all piping, controls and other miscellaneous items shown on the drawings or specified; electrical coordination; mechanical work; trenching; bedding; backfill; testing; seeding; grading; earthwork; insurance; bonds; utilities; installation; start-up; training; warranty; and for all other materials, equipment, tools, labor and incidentals necessary to complete the work.

PP. FLOWABLE FILL

This item shall be paid for at the contract unit price bid per linear foot of trench filled regardless of trench depth and/or pipe sizes. The limits of areas to be paid for are as shown on the drawings. The unit price bid shall be considered full compensation for all flowable fill, excavation, backfilling, and for all other materials, equipment, tools, labor, and incidentals necessary to complete the work.

QQ. WATERLINE ADJUSTMENT

This item shall be paid for at the contract unit price bid per each as shown on the drawings. The unit price bid shall be considered full compensation for locating the existing waterline, excavation, trenching, pipe, fittings, blocking, backfilling, testing, and for all other materials, equipment, tools, labor, and incidentals necessary to complete the work.

RR. TEMPORARY AND PERMANENT PROJECT SEEDING

These items shall be paid for at the contract unit price bid per acre. The unit price bid shall be considered full compensation for furnishing seed, fertilizer, mulch, and water; ground preparation; application of seed, fertilizer and mulch as required by the drawings and specifications; watering as required in these specifications; and for all other materials, equipment, tools, labor, and incidentals necessary to complete the work.

SS. EROSION CONTROL

This item shall be paid for at the contract lump sum price bid for installation at the locations as shown on the drawings or detailed. The unit price bid shall be considered full compensation for furnishing, installing, and maintaining all erosion control items necessary to meet the requirements of the Sediment and Erosion Control Details as shown on the drawings. Said price shall include inspecting, cleaning, and maintenance of the erosion control items as needed, and all materials, labor, equipment, tools, and incidentals necessary to establish and maintain a working system of erosion control throughout construction. This item shall include, but not be limited to sediment barriers, inlet protection, and temporary construction entrances. Also included in this item is removal of these barriers once a substantial stand of protective cover is established, as approved by the Engineer.

TT. SITE DEMOLITION

This item shall be paid for at the lump sum price bid and shall be full compensation for all demolition activities as shown on the drawings including but not limited to handling and disassembling of structures, complete or partial removal of the structure or elements of the structure, removing all waste material and debris from the site and grading all ground as shown on the drawings.

UU. SITE CLEARING AND RESTORATION

This item shall be paid for at the contract lump sum price bid. The lump sum price bid shall be considered full compensation for mobilization, clearing, grubbing of shrubs, trimming of trees and plants where permitted; removal of trees; removal and replacement of fences, sidewalks, pavements, culverts, and signs; removal of debris, placement of safety fencing, temporary fencing, removal and salvage of conflicting private improvements within the project area, minor shaping and grading of slopes for finished appearance, and clean-up. Removal, repair, and replacement of damaged pavements shall be considered subsidiary to site clearing and restoration. The price bid shall cover all incidental items affected by the work and for all other materials, equipment, tools, labor, and incidentals necessary to complete the work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 29 00
PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements necessary to prepare and process Applications for Payment.

1.2 SCHEDULE OF VALUES

- A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule.
 - 1. Coordinate line items in the schedule of values with other required administrative forms and schedules, including the following:
 - a. Application for Payment forms with continuation sheets.
 - b. Submittal schedule.
 - c. Items required to be indicated as separate activities in Contractor's construction schedule.
 - 2. Submit the schedule of values to Engineer at earliest possible date, but no later than thirty days before the date scheduled for submittal of initial Application for Payment.
- B. Format and Content: Contractor shall establish the schedule of values based on the bid form and Project Manual table of contents.
 - 1. Identification: Include the following Project identification on the schedule of values:
 - a. Project name and location.
 - b. Name of Engineer.
 - c. Engineer's project number.
 - d. Contractor's name and address.
 - e. Date of submittal.
 - 2. Arrange schedule of values consistent with format of EJCDC Document C-620 or as approved by the Engineer.

3. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with Project Manual table of contents. Provide multiple line items for principal subcontract amounts in excess of five percent of the Contract Sum.
4. Provide separate line items in the schedule of values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
5. Each item in the schedule of values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.
 - a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the schedule of values or distributed as general overhead expense, at Contractor's option.
6. Schedule Updating: Update and resubmit the schedule of values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

1.3 APPLICATIONS FOR PAYMENT

- A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments as certified by Engineer and paid for by Owner.
- B. Application for Payment Forms: Use EJCDC Document C-620 or form provided by the Engineer as form for Applications for Payment.
- C. Application Preparation: Complete every entry on form. Execute by a person authorized to sign legal documents on behalf of Contractor. Engineer will return incomplete applications without action.
 1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
 2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
 3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
- D. Stored Materials: Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed. Items shall be stored on-site to be eligible for payment of stored materials.

1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment, for stored materials.
 2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
 3. Provide summary documentation for stored materials indicating the following:
 - a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
 - b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
 - c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.
- E. Transmittal: Submit three signed original copies of each Application for Payment to Engineer.
1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.
 2. Waiver Forms: Submit executed waivers of lien on forms, acceptable to Owner.
- F. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
1. List of subcontractors.
 2. Schedule of values.
 3. Contractor's construction schedule (preliminary if not final).
 4. Products list (preliminary if not final).
 5. Submittal schedule (preliminary if not final).
 6. List of Contractor's staff assignments.
 7. List of Contractor's principal consultants.
 8. Copies of building permits.
 9. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
 10. Initial progress report.
 11. Report of preconstruction conference.
- G. Application for Payment at Substantial Completion: After Engineer issues the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.
1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
 2. This application shall reflect Certificate(s) of Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

- H. Final Payment Application: After completing Project closeout requirements, submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:
1. Evidence of completion of Project closeout requirements.
 2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
 3. Updated final statement, accounting for final changes to the Contract Sum.
 4. Evidence that claims have been settled.
 5. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
 6. Final liquidated damages settlement statement.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 31 00
PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
 - 1. General coordination procedures.
 - 2. Coordination drawings.
 - 3. Requests for Information (RFIs).
 - 4. Project meetings.

1.2 DEFINITIONS

- A. RFI: Request from Contractor seeking information required by or clarifications of the Contract Documents.

1.3 INFORMATIONAL SUBMITTALS

- A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:
 - 1. Name, address, and telephone number of entity performing subcontract or supplying products.
 - 2. Number and title of related Specification Section(s) covered by subcontract.
 - 3. Drawing number and detail references, as appropriate, covered by subcontract.
- B. Key Personnel Names: Prior to beginning construction, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list telephone numbers, and e-mail addresses for each person listed. Provide names and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project. Post at project site. Keep list current at all times.

1.4 REQUESTS FOR INFORMATION (RFIs)

- A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI.

1. Engineer will return RFIs submitted to Engineer by other entities controlled by Contractor with no response.
 2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.
- B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
1. Project name.
 2. Project number.
 3. Date.
 4. Name of Contractor.
 5. Name of Engineer.
 6. RFI number, numbered sequentially.
 7. RFI subject.
 8. Specification Section number and title and related paragraphs, as appropriate.
 9. Drawing number and detail references, as appropriate.
 10. Field dimensions and conditions, as appropriate.
 11. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
 12. Contractor's signature.
 13. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
 - a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.
- C. RFI Forms: RFI shall be submitted on a form acceptable to Engineer.
1. Attachments shall be electronic files in Adobe Acrobat PDF format.
 2. Form shall include space for response by the Engineer.
- D. Engineer's Action: Engineer will review each RFI, determine action required, and respond. Allow seven working days for Engineer's response for each RFI. RFIs received by Engineer after 12:00 p.m. will be considered as received the following working day.
1. The following Contractor-generated RFIs will be returned without action:
 - a. Requests for approval of submittals.
 - b. Requests for approval of substitutions.
 - c. Requests for approval of Contractor's means and methods.
 - d. Requests for coordination information already indicated in the Contract Documents.
 - e. Requests for adjustments in the Contract Time or the Contract Sum.
 - f. Incomplete RFIs or inaccurately prepared RFIs.

2. Engineer's action may include a request for additional information, in which case Engineer's time for response will date from time of receipt of additional information.
3. Engineer's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal.
 - a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Engineer in writing within 3 days of receipt of the RFI response.

1.5 PROJECT MEETINGS

- A. General: Schedule and conduct meetings and conferences at Project site unless otherwise indicated. Contractor is responsible for the preparation of the agenda and meeting minutes associated with each project meeting unless otherwise indicated by the Engineer.
 1. Invitees: Engineer, Owner, the Superintendent, one person representing Contractor's office management and all subcontractors.
 2. Notification: Inform participants and others involved, and individuals whose presence is required, or date and time of each meeting. Notify Owner and Engineer of scheduled meeting dates and times.
 3. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
 4. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner, within three days of the meeting.
- B. Preconstruction Conference: Engineer will schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Engineer, but no later than 15 days prior to the Notice to Proceed and/or start construction.
 1. Invitees: Authorized representatives of Owner, Engineer, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
 2. Agenda: Discuss items of significance that could affect progress, including the following:
 - a. Project Contacts
 - 1) Owner's Representative
 - 2) Contractor's Superintendent
 - 3) Subcontractors
 - 4) Construction Staking
 - 5) Resident Inspector

- 6) Project Engineer
- 7) Permits
- 8) Testing
- 9) Safety
- 10) Security
- 11) Traffic Control

b. Coordination

- 1) Subcontractors and Construction Staking
- 2) Utilities
- 3) List of Emergency Numbers and Contact Persons
- 4) Other Contractors
- 5) Owner's Use of Building(s)/Site
- 6) Permits
- 7) Safety
- 8) Security
- 9) Traffic Control

c. Contract Documents

- 1) Contract Status
- 2) Notice to Proceed
- 3) Additional Sets for Contractor and Others
- 4) Sales Tax Exemption Status
- 5) Other

d. Contract Administration

- 1) Owner – Engineer – Contractor Relationships
 - a) Owner – Engineer – Contractor Relationships
 - b) Lines of Communications
 - c) DBE Participation/Grant Requirements/Documentation
 - d) Issue Resolution
- 2) Construction Progress Schedule
- 3) Substantial Completion - Date
- 4) Final Acceptance – Date
- 5) Liquidated Damages (Substantial Completion)
- 6) Liquidated Damages (Final Completion)
- 7) Request for Information
- 8) Request for Material Substitution
- 9) Extra Work Claims
- 10) Change Orders – Procedure and Form
- 11) Partial Payments

- a) Frequency
 - b) Procedure and Form
 - c) Payment Schedule
 - d) Materials Stored
 - e) Retainage
- e. Quality Control and Submittals
 - 1) Shop Drawings
 - 2) Material Submittals
 - 3) Mix Designs
 - 4) List of Material Suppliers
- f. Special Considerations
 - 1) Staging area and construction office site
 - 2) Waste Sites
 - 3) Discussion of Construction
 - 4) Site Access/Haul Routes
 - 5) Contractor Parking
 - 6) Construction Phase/Sequence
 - 7) Contractor's Working Hours
 - 8) Resident Engineer Field Office
 - 9) Safety
 - 10) Traffic Control
 - 11) Sediment/Erosion Control
 - 12) Miscellaneous
- 3. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 32 00
CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
 - 1. Contractor's construction schedule.
 - 2. Construction schedule updating reports.
 - 3. Daily construction reports.

1.2 INFORMATION ONLY SUBMITTALS

- A. Format for Submittals: Submit required submittals in the following format:
 - 1. Working electronic copy of schedule file, where indicated.
 - 2. PDF electronic file.
- B. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.
- C. Construction Schedule Updating Reports: Submit with Applications for Payment.

1.3 COORDINATION

- A. Coordinate Contractor's construction schedule with the drawings, schedule of values, list of subcontracts, submittal schedule, progress reports, payment requests, and other required schedules and reports.

PART 2 - PRODUCTS

2.1 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

- A. Time Frame: Extend schedule from date established for the Notice of Award to date of final completion.
 - 1. Contract completion date shall not be changed by submission of a schedule that shows an early or late completion date, unless specifically authorized by Change Order.

- B. Activities: Outline a separate numbered activity for each main element of the Work. Comply with the following:
 - 1. Activity Duration: Define duration anticipated for each activity, unless specifically defined in the drawings or Project Manual.
 - 2. Procurement Activities: Include procurement process activities for the long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
 - 3. Submittal Review Time: Include review and resubmittal times as outlined in Division 01. Coordinate submittal review times in Contractor's construction schedule with submittal schedule.
 - 4. Startup and Testing Time: Include days for startup and testing.
 - 5. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Engineer's administrative procedures necessary for certification of Substantial Completion.
 - 6. Punch List and Final Completion: Allow time for completion of punch list items and final completion.
- C. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.
- D. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and Final Completion.
- E. Recovery Schedule: When periodic update indicates the Work is behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule. Indicate changes to working hours, working days, crew sizes, and equipment required to achieve compliance, and date by which recovery will be accomplished. Changes to working hours and working days shall be approved in writing by the Owner and/or Engineer prior to implementation by the Contractor.

2.2 REPORTS

- A. Daily Construction Reports: When indicated on the drawings, the Contractor shall prepare a daily construction report recording the following information concerning events at Project site:
 - 1. List of subcontractors at Project site.
 - 2. List of separate contractors at Project site.
 - 3. Approximate count of personnel at Project site.
 - 4. Equipment at Project site.

5. Material deliveries.
 6. High and low temperatures and general weather conditions, including presence of rain or snow.
 7. Accidents.
 8. Meetings and significant decisions.
 9. Unusual events (see special reports).
 10. Stoppages, delays, shortages, and losses.
 11. Meter readings and similar recordings.
 12. Emergency procedures.
 13. Orders and requests of authorities having jurisdiction.
 14. Change Orders received and implemented.
 15. Work Change Directives received and implemented.
 16. Services connected and disconnected.
 17. Equipment or system tests and startups.
 18. Partial completions and occupancies.
 19. Substantial Completions authorized.
- B. Material Location Reports: Coinciding with the Applications for Payment, prepare and submit a comprehensive list of materials delivered to and stored at Project site. List shall be cumulative, showing materials previously reported plus items recently delivered. Include with list a statement of progress on and delivery dates for materials or items of equipment fabricated or stored away from Project site. Indicate the following categories for stored materials:
1. Material stored prior to previous report and remaining in storage.
 2. Material stored prior to previous report and since removed from storage and installed.
 3. Material stored following previous report and remaining in storage.
- C. Site Condition Reports: Immediately on discovery of a difference between site conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

PART 3 - EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.
1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.

2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
 3. As the Work progresses, indicate final completion percentage for each activity.
- B. Distribution: Distribute copies of approved schedule to Engineer, Owner, separate contractors, testing and inspecting agencies, and other parties identified for coordination with a need-to-know schedule responsibility.
1. Post copies in Project meeting rooms and temporary field offices.
 2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION

SECTION 01 32 33
PHOTOGRAPHIC DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for the following:
 - 1. Preconstruction photographs.
 - 2. Periodic construction photographs.
 - 3. Final completion construction photographs.

1.2 INFORMATION ONLY SUBMITTALS

- A. Key Plan: Submit key plan of Project site and building with notation of vantage points marked for location and direction of each photograph. Indicate elevation or story of construction. Include same information as corresponding photographic documentation.
- B. Digital Photographs: Submit image files within three days of taking photographs. Provide the following information with each image description in file metadata tag:
 - 1. Name of Project.
 - 2. Name and contact information for photographer.
 - 3. Name of Engineer.
 - 4. Name of Contractor.
 - 5. Date photograph was taken.
 - 6. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.
 - 7. Unique sequential identifier keyed to accompanying key plan.

1.3 USAGE RIGHTS

- A. Obtain and transfer copyright usage rights from photographer to Owner for unlimited reproduction of photographic documentation.

PART 2 - PRODUCTS

2.1 PHOTOGRAPHIC MEDIA

- A. Digital Images: Provide images in JPG format, produced by a digital camera with minimum sensor size of 8 megapixels, and at an image resolution of not less than 3200 by 2400 pixels.
- B. Digital Video Recordings: Provide high-resolution, digital video disc in format acceptable to Engineer.

PART 3 - EXECUTION

3.1 CONSTRUCTION PHOTOGRAPHS

- A. Take photographs using the maximum range of depth of field, and that are in focus, to clearly show the Work. Photographs with blurry or out-of-focus areas will not be accepted.
- B. Maintain key plan with each set of construction photographs that identifies each photographic location.
- C. Digital Images: Submit digital images exactly as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.
 - 1. Date and Time: Include date and time in file name for each image.
 - 2. Field Office Images: Maintain one set of images accessible in the field office at Project site, available at all times for reference. Identify images in the same manner as those submitted to Engineer.
- D. Preconstruction Photographs: Before starting construction, take photographs of Project site and surrounding properties, including existing items to remain during construction, from different vantage points, as directed by Engineer.
 - 1. Flag construction limits before taking construction photographs.
 - 2. Take photographs to show existing conditions adjacent to property before starting the Work.
 - 3. Take photographs of existing buildings either on or adjoining property to accurately record physical conditions at start of construction.
 - 4. Take additional photographs as required to record settlement or cracking of adjacent structures, pavements, and improvements.

- E. Periodic Construction Photographs: Take photographs throughout construction as required to show progress of construction. Select vantage points to show status of construction and progress since last photographs were taken.
- F. Final Completion Construction Photographs: Take photographs after date of Substantial Completion for submission as project record documents.

END OF SECTION

SECTION 01 33 00
SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

1.2 DEFINITIONS

- A. Information Only Submittals: Written and graphic information and physical samples that do not require Engineer's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."
- B. File Transfer Protocol (FTP): Communications protocol that enables transfer of files to and from another computer over a network and that serves as the basis for standard Internet protocols. An FTP site is a portion of a network located outside of network firewalls within which internal and external users are able to access files.
- C. Portable Document Format (PDF): An open standard file format licensed by Adobe Systems used for representing documents in a device-independent and display resolution-independent fixed-layout document format.

1.3 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
- B. Processing Time: Allow time for submittal review, including time for resubmittals, as follows:
 - 1. Time for review shall commence on Engineer's receipt of submittal.
 - 2. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
 - 3. Initial Review: Allow 14 calendar days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Engineer will advise Contractor when a submittal being processed must be delayed for coordination.
 - 4. Resubmittal Review: Allow 14 calendar days for review of each resubmittal.

C. Electronic Submittals: Identify and incorporate information in each electronic submittal file as follows:

1. Contractor shall generate a separate email for each submittal. Each email shall contain only 1 pdf document.
2. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
3. Name file with submittal number or other unique identifier, including revision identifier.
4. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Engineer.
5. Transmittal Form for Electronic Submittals shall contain the following information:
 - a. Project name.
 - b. Date.
 - c. Name and address of Engineer.
 - d. Name of Contractor.
 - e. Name of firm or entity that prepared submittal.
 - f. Names of subcontractor, manufacturer, and supplier.
 - g. Category and type of submittal.
 - h. Submittal purpose and description.
 - i. Related physical samples submitted directly.
 - j. Indication of full or partial submittal.

D. Material Submittals:

1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form enabling navigation to each item.
2. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Engineer.
3. Transmittal Form for Material Submittals shall contain the following information:
 - a. Project name.
 - b. Date.
 - c. Name and address of Engineer.
 - d. Name of Contractor.
 - e. Name of firm or entity that prepared submittal.
 - f. Names of subcontractor, manufacturer, and supplier.
 - g. Category and type of submittal.
 - h. Submittal purpose and description.
 - i. Related physical samples submitted directly.
 - j. Indication of full or partial submittal.

- E. Options: Identify options requiring selection by Engineer.
- F. Deviations and Additional Information: Contractor shall provide, in writing, a record of relevant information, requests for data, revisions other than those requested by Engineer on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.
- G. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
 - 1. Note date and content of previous submittal.
 - 2. Note date and content of revision in label or title block and clearly indicate extent of revision.
 - 3. Resubmit submittals until they are marked with approval notation from Engineer's action stamp.
- H. Distribution: Contractor shall furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities.

PART 2 - PRODUCTS

2.1 SUBMITTAL PROCEDURES

- A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
 - 1. Submit electronic submittals via email as PDF electronic files.
 - a. Engineer will return review comments as an electronic Project record document file.
 - b. Product samples shall be delivered directly to the Engineer's mailing address.
- B. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data unless submittal based on Engineer's digital data drawing files is otherwise permitted.

1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
 - a. Identification of products.
 - b. Schedules.
 - c. Compliance with specified standards.
 - d. Notation of coordination requirements.
 - e. Notation of dimensions established by field measurement.
 - f. Relationship and attachment to adjoining construction clearly indicated.
 - g. Seal and signature of professional engineer if specified.
 2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches, but no larger than 22 by 36 inches.
 3. Submit Shop Drawings as a PDF electronic file.
- C. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.
1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
 2. Identification: Attach label on unexposed side of Samples that includes the following:
 - a. Description of Sample.
 - b. Product name and name of manufacturer.
 - c. Sample source.
 - d. Number and title of applicable Specification Section.
 - e. Specification paragraph number and generic name of each item.
 3. For projects where electronic submittals are required, provide corresponding electronic submittal of Sample transmittal, digital image file illustrating Sample characteristics, and identification information for record.
 4. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
 - a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
 - b. Samples not incorporated into the Work shall be designated as Owner's property or the property of the Contractor.

- D. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
- E. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
- F. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
- G. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
- H. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.
- I. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

- A. Action and Information Only Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Engineer.
- B. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

END OF SECTION

SECTION 01 57 13
TEMPORARY EROSION AND SEDIMENT CONTROL

PART 1 - GENERAL

1.1 SUMMARY

- A. This section includes stormwater pollution control measures to significantly reduce erosion and to prevent sediment and other runoff generated pollutants from leaving the site during construction. Section 402 of the Clean Water Act established the National Pollutant Discharge Elimination System (NPDES) to regulate the discharge of pollutants from point sources. The Kansas Department of Health and Environment (KDHE), Bureau of Water, Industrial Programs Section has been given the authority to issue a General NPDES Permit for this project, and the Owner will obtain this permit by submitting a Notice of Intent (NOI) to the KDHE.
- B. One requirement of the General NPDES Permit is that a Storm Water Pollution Prevention Plan (SWPPP) be developed. If the permit is required, the Owner has developed a standard SWPPP for this project that references standard drawings and specifications, inspection and maintenance report forms, requirements for the contractor's Site-Specific Erosion Control Schedule, and other miscellaneous details and information pertaining to erosion and sediment control on the site during construction.

1.2 REFERENCES

- A. EPA Storm Water Management for Construction Activities, Developing Pollution Prevention Plans and Best Management Practices.
- B. "Protecting Water Quality", a field guide to erosion, sediment, and storm water best management practices for development sites in Missouri and Kansas.
- C. KDOT Standard Specifications for State Road and Bridge Construction.
- D. KDOT Temporary Erosion Control Manual: A Guide for the Design, Installation, Inspection, and Maintenance of Temporary Erosion Control Measures in Kansas, January 2007.

1.3 SUBMITTALS

- A. Site-Specific Erosion Control Schedule (prior to construction activity).
- B. All Products and Materials

PART 2 - PRODUCTS

2.1 SILT FENCE

- A. Provide silt fence materials as shown on the standard details, and in compliance with the requirements of AASHTO M 288 for unsupported silt fence, with 4 foot maximum post spacing.

2.2 BIODEGRADABLE FIBER LOGS

- A. Provide commercially available biodegradable fiber logs manufactured from rice straw, excelsior wood fiber, coconut fiber, jute, or other biodegradable material bound with an open mesh fabric of jute or light-weight plastic. The Owner/Engineer will accept the biodegradable logs based on compliance with dimensional and other requirements shown in the Contract Documents, and visual inspection of the installed material.

2.3 GEO-RIDGE PERMEABLE BERM

- A. Provide Geo-Ridge Permeable BermTM manufactured by Nilex Corporation, or approved equal. Berms shall be constructed of a UV stabilized HDPE and designed to allow water to flow through while sediment and debris are collected on the berm. The berm shall be placed perpendicular to the flow of water as a continuous line barrier, attached to the ground using wire staples.

2.4 TRIANGULAR SILT DIKE

- A. Provide Triangular Silt DikeTM manufactured by the Triangular Silt Dike Company of Oklahoma, or approved equal. The triangular silt dikes shall be installed at the tow or slope of the ditch to contain sediment and shall be placed perpendicular to the flow of water as a continuous line barrier. Temporary dikes shall be triangular shape having a height of at least 8 inches in the center with equal sides. The outer cover shall be a woven geotextile fabric placed around the inner urethane foam material and shall be attached to the ground using wire staples.

2.5 EROSION CONTROL BLANKET/TURF REINFORCEMENT MAT

- A. Erosion Control Blanket shall be Curlex® II Erosion Control Blanket (ECB) as manufactured by American Excelsior Company or approved equal. The ECB shall contain a specific cut of seed free Great Lakes Aspen curled wood excelsior with 80% of the fiber \geq 6 inches in length. It shall be of consistent thickness with fibers evenly distributed throughout the entire area of the blanket. The top and bottom of each blanket shall be covered with green polypropylene netting containing oxo-biodegrader additive. ECB shall be provided in rolls in widths of 4, 8, 12 and 16 feet as appropriate for the application. ECB performance capabilities shall be determined by ASTM D 6459 and ASTM D 6460. Turf reinforcement mat shall be as specified on the project drawings.
- B. Staples shall be a minimum 4" biodegradable E-Staple® or 6" wire for cohesive soils and 6" biodegradable E-Staple® or 8" wire for non-cohesive soils or an approved equal product. Staples for turf reinforcement mat shall be in accordance with manufacturer's specifications and installation guidelines.

2.6 INLET BARRIER

- A. Provide inlet barrier materials as shown on the drawings.

2.7 TEMPORARY FERTILIZER, SEED, AND MULCH

- A. Provide temporary fertilizer, seed mix, and mulch in accordance with local authority having jurisdiction requirements. If no local requirements exist, provide temporary fertilizer, seed mix, and mulch according to the latest KDOT recommendations.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

- A. Comply with storm water pollution control requirements in accordance with the KDHE general NPDES permit, the SWPPP, and any other applicable city or county permits, and any other governing agency regulations.
- B. Limit the soil exposed during construction as much as practically possible. Restrict activities which expose soil to stormwater flow in ditches, gullies, and/or steep hillsides that carry higher waters during rainfalls.

3.2 STORM WATER POLLUTION PREVENTION PLAN

- A. The SWPPP references Standard Specifications and Drawings pertaining to temporary erosion and pollution control, inspection and maintenance reports (completed by the Resident Project Representative), and the Contractor's Erosion Control Schedule (see below).
- B. Before any construction activities begin on the project, the Contractor, and subcontractor who will implement any measures identified in the SWPPP, is required to certify that he understands the terms and conditions of the general NPDES permit. Submittal of bid shall be considered certification by the Contractor.
- C. Submit to the Owner/Engineer a schedule for the implementation and maintenance of erosion and pollution control work during the various phases of construction. Submit the schedule before the preconstruction conference, before any work on the project is done. No work on the project is allowed until the Owner/Engineer has accepted the schedule. Submit a schedule that contains, as a minimum, the following information:
 - 1. A site description, including:
 - a. the nature of the activity,
 - b. intended sequence of major construction activities,
 - c. the total area of the site,
 - d. the area of the site that is expected to undergo excavation,
 - e. a site map, with:
 - 1) area of soil disturbance,
 - 2) outline of areas which will not be disturbed,
 - 3) location of major structural and non-structural controls,
 - 4) areas where stabilization practices are expected to occur.
 - 2. A description of controls:
 - a. erosion and sediment controls, including:
 - 1) stabilization practices for all areas disturbed by construction,
 - 2) structural practices for all drainage/discharge locations,
 - b. other controls, including:
 - 1) waste disposal practices which prevent discharge of solid materials into waters of the U.S.,
 - 2) measures to ensure compliance with state or local waste disposal, sanitary sewer, or septic system regulations,

- 3) description of the timing, during the construction, of when the measures will be implemented, including permanent erosion control items when required in the Contract.
 3. Acknowledgment that State and Local requirements have been included in the plan.
 4. A description of maintenance procedures for control measures identified in the plan.
- D. Use temporary erosion and pollution control measures to control erosion resulting from the construction of the project. Use temporary erosion and pollution control measures to prevent contamination of adjacent streams or other watercourses, lakes, ponds, or other areas of water impoundment from storm water runoff from the construction site. Coordinate temporary erosion and pollution control measures with the construction of permanent erosion control features to provide continuous erosion control. Schedule construction of drainage structures and permanent erosion control features as soon as practical.
- Initiate temporary erosion and pollution control measures as soon as practical, within 14 calendar days after construction activities have temporarily or permanently ceased on a portion of the project site. Exceptions to this requirement are as follows:
1. If implementations of erosion and pollution control measures are precluded by snow cover, undertake such measures as soon as practical.
 2. If construction activities will resume on the portion of the project site within 14 calendar days, temporary erosion and pollution control measures do not have to be initiated.
- E. If on-site or Owner furnished off-site borrow areas are to be excavated below the ground water elevation, construct a permanent berm around the borrow area to prevent storm water runoff from entering the excavated area.
- F. Restrict construction operations in rivers, streams, and other water impoundments to those areas that must be entered for the construction of temporary or permanent structures. When no longer required, promptly remove all falsework, piling, temporary crossings, and other obstructions caused by the construction. Do not ford live streams with construction equipment.
- G. Accomplish temporary erosion and pollution control with berms, slope drains, ditch checks, slope barriers, sediment basins, inlet sediment barriers, seeding and mulching, and erosion control blankets. Implement these measures as necessary, at any time of the year.

- H. Install and maintain temporary erosion and pollution control devices as shown in the Contract Documents, or as dictated by weather conditions, actual site conditions, construction procedures, and as directed by the Owner/Engineer. If temporary erosion and pollution control is not implemented and maintained according to the approved schedule, all work on the project will cease until conditions are brought back into compliance.

3.3 TEMPORARY BERMS

- A. Use temporary berms to divert storm runoff to stabilized slopes or temporary slope drains. Construct temporary berms to the approximate dimensions shown in the Contract Documents. Compact the berms, until no further consolidation is observed, using a dozer track, grader wheel, or other equipment.

3.4 TEMPORARY SLOPE DRAINS

- A. Use temporary slope drains to carry storm runoff down fill slopes and cut backslopes. Construct the temporary slope drains according to the details shown in the Contract Documents.

3.5 TEMPORARY DITCH CHECKS

- A. The Contractor has the option to use any of the materials for temporary ditch checks that are listed on the Standard Plan Sheets. Construct the temporary ditch checks according to the details shown in the Contract Documents. When deposits reach approximately $\frac{1}{2}$ the height of the temporary ditch check, remove and dispose of the accumulated sediment.

3.6 TEMPORARY SLOPE BARRIER

- A. The Contractor has the option to use any of the materials for temporary slope barriers that are listed on the Standard Plan Sheets. Construct the temporary slope drains according to the details shown in the Contract Documents. If temporary biodegradable logs or straw or hay bales are used, when deposits reach approximately $\frac{1}{2}$ the height of the log or bale, remove and dispose of the sediment. If temporary silt fence is used, supplement the silt fence with a support fence, if the hydraulic and sediment loading dictate. Reduce the post spacing and drive the posts deeper in the ground in low areas and soft, swampy ground. Remove and dispose of sediment deposits when the deposit approaches $\frac{1}{3}$ the height of the silt fence.

3.7 TEMPORARY SEDIMENT BASINS

- A. Before constructing the temporary sediment basin, clear the area of all vegetation. Construct the temporary sediment basin with a wide cross-section and a minimum grade. Construct the temporary sediment basin as shown in the Contract Documents. Dispose of excess excavated material. When deposits reach approximately 1/3 the depth of the structure, remove and dispose of the accumulated sediment.

3.8 TEMPORARY INLET SEDIMENT BARRIER

- A. The Contractor has the option to use any of the materials for temporary inlet sediment barriers that are listed on the Standard Plan Sheets. Construct the temporary inlet sediment barriers according to the details shown in the Contract Documents. If temporary silt fence is used, reduce post spacing and drive the posts deeper into the ground in low areas and soft, swampy ground. When deposits reach approximately 1/3 the height of the silt fence, remove and dispose of the sediment. If temporary triangular silt dike and straw or hay bales are used, when deposits reach approximately 1/2 the height of the silt dike or bales, remove and dispose of the sediment.

3.9 TEMPORARY STREAM CROSSING

- A. The Contractor has the option to use any of the materials for temporary stream crossings that are listed on the Standard Plan Sheets. Construct the temporary stream crossings according to the details shown in the Contract Documents. If the Contractor's operations require a temporary stream crossing, and one is not shown as a bid item in the Contract Documents, the Contractor may install a temporary stream crossing according to the details in the Contract Documents, at his expense. Comply with all applicable rules, regulations and state laws, and obtain all required permits.

3.10 TEMPORARY FERTILIZER, SEED, AND MULCH

- A. Prepare the seedbed, fertilize, seed, and mulch in accordance with local authority having jurisdiction requirements. If no local requirements exist, provide temporary fertilizer, seed mix, and mulch according to the latest KDOT recommendations.

3.11 EROSION CONTROL

- A. Place erosion control according to the requirements of Division 900 of the KDOT Standard Specifications, the SWPPP, and the approved site specific Erosion Control Plans and Notes.

3.12 EROSION CONTROL BLANKET/TURF REINFORCEMENT MAT

- A. Installation: Erosion control blanket or Turf Reinforcement Mat shall be installed in accordance with manufacturer's Installation Guidelines, Staple Pattern Guides, and CAD details. The extent of erosion control blanket shall be as shown indicated on the project drawings.

3.13 INLET BARRIER

- A. Inlet Barrier shall be installed per the manufacturer's guidelines, specifications, and details. Inlet barriers shall be installed at locations as shown on project drawings at a minimum, and as required during construction.

3.14 MAINTENANCE AND REMOVAL OF TEMPORARY EROSION AND
POLLUTION CONTROL DEVICES

- A. Maintain the integrity of the temporary erosion and pollution control devices as long as they are necessary to contain sediment runoff. Inspect the temporary erosion and pollution control devices immediately after each rainfall. Inspect the temporary erosion and pollution control devices at least daily during prolonged rainfall. Correct any deficiencies immediately. Contractor shall remove the temporary devices erosion control as directed by the Engineer. After removal of the temporary erosion and pollution control devices, remove and dispose of the silt accumulation. Grade, fertilize, seed, and mulch any bare areas.

END OF SECTION

SECTION 01 71 23
FIELD ENGINEERING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:
 - 1. Construction layout.
 - 2. Field engineering and surveying.
 - 3. Installation of the Work.

1.2 QUALITY ASSURANCE

- A. Surveying/Engineering Firm Qualifications: A surveying or engineering firm that is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing construction staking/layout services.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, mechanical and electrical systems, and other construction affecting the Work.
 - 1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; underground electrical services, and other utilities.
 - 2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

3.2 PREPARATION

- A. Existing Utility Information: Furnish information to local utility and/or Owner that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.
- B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents submit a Request for Information to Engineer according to requirements in Division 01.

3.3 CONSTRUCTION LAYOUT

- A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey, horizontal control points and existing benchmarks. If discrepancies are discovered, notify Engineer promptly.
- B. General: Engage a qualified engineering or surveying firm to lay out the Work using accepted surveying practices.
 - 1. Establish benchmarks and horizontal control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
 - 2. Establish limits on use of Project site.
 - 3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
 - 4. Set alignment offset stakes, as required.
 - 5. Set intermediate elevation hubs, as required.
 - 6. Set offset hubs for structures/foundations, as required.
 - 7. Set batter boards for trench installation, as required.
 - 8. Set stringlines as required.
 - 9. Check the location, level and plumb, of every major element as the Work progresses.
 - 10. Notify Engineer when deviations from required lines and levels exceed allowable tolerances.
 - 11. Collect location and elevation data for underground features prior to backfill for record drawing documentation.

- C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.
- D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.
- E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Engineer.
- F. Provide field notes of construction survey to Engineer.

3.4 FIELD ENGINEERING

- A. Identification: Benchmarks, control points and property corners are as indicated on the drawings.
- B. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.
 - 1. Do not change or relocate existing benchmarks or control points without prior written approval of Engineer. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Engineer before proceeding.
 - 2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.
- C. Benchmarks: Establish and maintain a minimum of two permanent benchmarks on Project site, referenced to data established by survey control points.
 - 1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
 - 2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
 - 3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.

END OF SECTION

SECTION 01 78 23
OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
 - 1. Emergency manuals.
 - 2. Operation manuals for systems, subsystems, and equipment.
 - 3. Product maintenance manuals.
 - 4. Systems and equipment maintenance manuals.

1.2 DEFINITIONS

- A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.
- B. Subsystem: A portion of a system with characteristics similar to a system.

1.3 CLOSEOUT SUBMITTALS

- A. Manual Content: Operations and maintenance manual content is specified in individual Specification Sections to be reviewed at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
 - 1. Engineer will comment on whether content of operations and maintenance submittals are acceptable.
 - 2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.
- B. Format: Submit operations and maintenance manuals in the following format:
 - 1. PDF electronic file. Assemble each manual into a composite electronically indexed file. Submit three CD/DVD copies to Engineer.
 - a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.
 - b. Enable inserted reviewer comments on draft submittals.

2. Three paper copies. Include a complete operation and maintenance directory. Enclose title pages and directories in clear plastic sleeves. Engineer will return one copy.
- C. Initial Manual Submittal: Submit draft copy of each manual at least 30 days before commencing demonstration and training. Engineer will comment on whether general scope and content of manual are acceptable.
- D. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 7 days before commencing demonstration and training. Engineer will return copy with comments.
 1. Correct or revise each manual to comply with Engineer's comments. Submit copies of each corrected manual within 10 days of receipt of Engineer's comments and prior to commencing demonstration and training.

PART 2 - PRODUCTS

2.1 OPERATION AND MAINTENANCE DOCUMENTATION TABLE OF CONTENTS

- A. Contents: Prepare a single, comprehensive directory of emergency, operation, and maintenance data and materials, listing items and their location to facilitate ready access to desired information. Include a section in the directory for each of the following:
 1. List of documents.
 2. List of systems.
 3. List of equipment.
- B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.
- C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.
- D. Identification: Identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents.

2.2 REQUIREMENTS FOR OPERATION AND MAINTENANCE MANUALS

- A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
 - 1. Title page.
 - 2. Table of contents.
 - 3. Manual contents.
- B. Title Page: Include the following information:
 - 1. Subject matter included in manual.
 - 2. Name and address of Project.
 - 3. Name and address of Owner.
 - 4. Date of submittal.
 - 5. Name and contact information for Contractor.
 - 6. Name and contact information for Engineer.
- C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
 - 1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.
 - 2. Names and contact information for major consultants to the Engineer that designed the systems contained in the manuals.
 - 3. Cross-reference to related systems in other operation and maintenance manuals.
- D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.
 - 1. Operation Manuals:
 - a. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
 - 1) System, subsystem, and equipment descriptions.
 - a) Describe the sequence of operation, and diagram controls as installed.
 - b) Diagram piping as installed, and identify color-coding where required for identification.

- 2) Performance and design criteria if Contractor has delegated design responsibility.
- 3) Operating standards.
- 4) Operating procedures.
- 5) Operating logs.
- 6) Wiring diagrams.
- 7) Control diagrams.
- 8) Piped system diagrams.
- 9) Precautions against improper use.
- 10) License requirements including inspection and renewal dates.

b. Descriptions shall include the following:

- 1) Product name and model number.
- 2) Manufacturer's name.
- 3) Equipment identification with serial number of each component.
- 4) Equipment function.
- 5) Operating characteristics.
- 6) Limiting conditions.
- 7) Performance curves.
- 8) Engineering data and tests.
- 9) Complete nomenclature and number of replacement parts.

c. Operating Procedures:

- 1) Startup procedures.
- 2) Equipment or system break-in procedures.
- 3) Routine and normal operating instructions.
- 4) Regulation and control procedures.
- 5) Instructions on stopping.
- 6) Normal shutdown instructions.
- 7) Seasonal and weekend operating instructions.
- 8) Required sequences for electric or electronic systems.
- 9) Special operating instructions and procedures.

2. Maintenance Manuals:

- a. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.
 - 1) List each product included in manual, identified by product name and arranged to match manual's table of contents.

- 2) For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

b. Product Information:

- 1) Product name and model number.
- 2) Manufacturer's name.
- 3) Color, pattern, and texture.
- 4) Material and chemical composition.
- 5) Reordering information for specially manufactured products.
- 6) Standard maintenance instructions and bulletins.
- 7) Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
- 8) Identification and nomenclature of parts and components.
- 9) List of items recommended to be stocked as spare parts.

c. Maintenance Procedures:

- 1) Inspection procedures.
- 2) Types of cleaning agents to be used and methods of cleaning.
- 3) List of cleaning agents and methods of cleaning detrimental to product.
- 4) Schedule for routine cleaning and maintenance.
- 5) Repair instructions.
- 6) Include lists of materials and local sources of materials and related services.
- 7) Test and inspection instructions.
- 8) Troubleshooting guide.
- 9) Precautions against improper maintenance.
- 10) Disassembly; component removal, repair, and replacement; and reassembly instructions.
- 11) Aligning, adjusting, and checking instructions.
- 12) Demonstration and training video recording, if available.
- 13) Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
 - a) Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
 - b) Maintenance and Service Record: Include manufacturers' forms for recording maintenance.

- 14) Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to

- manufacturers' maintenance documentation and local sources of maintenance materials and related services.
- 15) Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.
3. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
- E. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.
1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
 2. File Names and Bookmarks: Enable bookmarking of individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.
- F. Manuals, Paper Copy: Submit manuals in the form of hard copy, bound and labeled volumes.
1. Binders: Heavy-duty, three-ring, vinyl-covered, binders, in thickness necessary to accommodate contents, with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
 - a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
 - b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents. Indicate volume number for multiple-volume sets.
 2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
 3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment.

4. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
 - a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
 - b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

2.3 REQUIREMENTS FOR EMERGENCY MANUALS

- A. Content: Organize manual into a separate section for each of the following:
 1. Type of emergency.
 2. Emergency instructions.
 3. Emergency procedures.
- B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:
 1. Fire.
 2. Flood.
 3. Fuel Leak.
 4. Water leak or Water Outage.
 5. Power failure.
 6. System, subsystem, or equipment failure.
 7. Chemical release or spill.
- C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.
- D. Emergency Procedures: Include the following, as applicable:
 1. Instructions on stopping.
 2. Shutdown instructions for each type of emergency.
 3. Operating instructions for conditions outside normal operating limits.
 4. Required sequences for electric or electronic systems.
 5. Special operating instructions and procedures.

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

- A. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.
- B. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.
 - 1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
 - 2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.
- C. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
 - 1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.
- D. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation. Do not use original project record documents as part of operation and maintenance manuals.

END OF SECTION

SECTION 01 79 00
DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:
 - 1. Demonstration of operation of systems, subsystems, and equipment.
 - 2. Training in operation and maintenance of systems, subsystems, and equipment.
 - 3. Demonstration and training video recordings.

1.2 INFORMATIONAL SUBMITTALS

- A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.
 - 1. Indicate proposed training modules using manufacturer-produced demonstration and training video recordings for systems, equipment, and products in lieu of video recording of live instructional module.
- B. Qualification Data: For instructor.
- C. Attendance Record: For each training module, submit list of participants and length of instruction time.
- D. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.

1.3 CLOSEOUT SUBMITTALS

- A. Demonstration and Training Video Recordings: Submit two copies within seven days of end of each training module.

1. Identification: On each copy, provide an applied label with the following information:
 - a. Name of Project.
 - b. Name of Engineer.
 - c. Name of Contractor.
 - d. Name of training module
 - e. Date of training.
2. At completion of training, submit complete training manual(s) for Owner's use prepared and bound in format matching operation and maintenance manuals and in PDF electronic file format on CD/DVD.

1.4 QUALITY ASSURANCE

- A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.
- B. Instructor Qualifications: A factory-authorized service representative, experienced in operation and maintenance procedures and training.

1.5 COORDINATION

- A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.
- B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.
- C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Engineer.

PART 2 - PRODUCTS

2.1 INSTRUCTION PROGRAM

- A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.

B. Training Modules: Include instruction for the following as applicable to the system, equipment, or component:

1. Basis of System Design, Operational Requirements, and Criteria: Include the following:

- a. System, subsystem, and equipment descriptions.
- b. Performance and design criteria if Contractor is delegated design responsibility.
- c. Operating standards.
- d. Regulatory requirements.
- e. Equipment function.
- f. Operating characteristics.
- g. Limiting conditions.
- h. Performance curves.

2. Documentation: Review the following items in detail:

- a. Emergency manuals.
- b. Operations manuals.
- c. Maintenance manuals.
- d. Project record documents.
- e. Identification systems.
- f. Warranties and bonds.
- g. Maintenance service agreements and similar continuing commitments.

3. Emergencies: Include the following, as applicable:

- a. Instructions on meaning of warnings, trouble indications, and error messages.
- b. Instructions on stopping.
- c. Shutdown instructions for each type of emergency.
- d. Operating instructions for conditions outside of normal operating limits.
- e. Sequences for electric or electronic systems.
- f. Special operating instructions and procedures.

4. Operations: Include the following, as applicable:
 - a. Startup procedures.
 - b. Equipment or system break-in procedures.
 - c. Routine and normal operating instructions.
 - d. Regulation and control procedures.
 - e. Control sequences.
 - f. Safety procedures.
 - g. Instructions on stopping.
 - h. Normal shutdown instructions.
 - i. Operating procedures for emergencies.
 - j. Operating procedures for system, subsystem, or equipment failure.
 - k. Seasonal and weekend operating instructions.
 - l. Required sequences for electric or electronic systems.
 - m. Special operating instructions and procedures.
5. Adjustments: Include the following:
 - a. Alignments.
 - b. Checking adjustments.
 - c. Noise and vibration adjustments.
 - d. Economy and efficiency adjustments.
6. Troubleshooting: Include the following:
 - a. Diagnostic instructions.
 - b. Test and inspection procedures.
7. Maintenance: Include the following:
 - a. Inspection procedures.
 - b. Types of cleaning agents to be used and methods of cleaning.
 - c. List of cleaning agents and methods of cleaning detrimental to product.
 - d. Procedures for routine cleaning
 - e. Procedures for preventive maintenance.
 - f. Procedures for routine maintenance.
 - g. Instruction on use of special tools.
8. Repairs: Include the following:
 - a. Diagnosis instructions.
 - b. Repair instructions.
 - c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
 - d. Instructions for identifying parts and components.
 - e. Review of spare parts needed for operation and maintenance.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Division 01
- B. Set up instructional equipment at instruction location.

3.2 INSTRUCTION

- A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.
- B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
- C. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
 - 1. Schedule training with Owner at mutually agreed upon times with at least seven days' advance notice.
- D. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.
- E. Cleanup: Collect used and leftover educational materials and give to Owner. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

END OF SECTION

SECTION 03 30 00
CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

- A. Work performed under this section consists of cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for structures and pavements in locations or, over the areas as shown on the Drawings in conformance with the dimensions, lines, grades, thicknesses, and typical sections shown on the Drawings or established by the Engineer.

1.2 DEFINITIONS

- A. The following are industry abbreviations.
 - 1. ASTM: ASTM International
 - 2. AASHTO: American Association of State Highway and Transportation Officials
 - 3. ACI: American Concrete Institute
 - 4. CRSI: Concrete Reinforcing Steel Institute
 - 5. RPR: Resident Project Representative

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
- C. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.

1.4 INFORMATION SUBMITTALS

- A. Material certificates, test reports or manufacturer data sheets showing that the materials or products being supplied comply with these specifications. At a minimum these shall include:

1. Portland Cement and other cementitious materials
2. Flyash
3. Aggregate
4. Metal reinforcement and accessories
5. Fiber reinforcement
6. Waterstops
7. Admixtures
8. Concrete embedments
9. Anchor bolts

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94 requirements for production facilities and equipment and certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
- B. Testing Agency Qualifications: An independent agency qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.
- C. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.
- B. Waterstop: Store waterstop under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

PART 2 - PRODUCTS

2.1 CEMENTITIOUS MATERIALS:

- A. Portland Cement: ASTM C 150, Type I or Type II.
- B. Fly Ash : ASTM C 618, Class F or C
- C. Silica Fume: ASTM C 1240, amorphous silica

2.2 AGGREGATES

- A. Normal-Weight Aggregates: ASTM C 33, coarse aggregate or better, well graded.
Provide aggregates from a single source.

1. Coarse Aggregate: ASTM C 33, Size #67 gradation or approved alternate (See Table 1). The nominal maximum size of the coarse aggregates shall not be larger than one-fifth of the narrowest dimension between sides of forms, one-third the depth of slabs, nor three-fourths of the minimum clear distance between reinforcing bars or between bars and forms, whichever is least.

TABLE 1					
Sieve Size	1	$\frac{3}{4}$	$\frac{3}{8}$	4	8
% Retained	0	0-10	45-80	90-100	95-100

2. Fine Aggregate: Fine aggregate shall consist of clean, hard, durable, uncoated siliceous or calcareous particles and free of materials with deleterious reactivity to alkali in cement within the limits shown in Table 2. The Fineness Modulus (F.M.) of the fine aggregate furnished shall be not less than 2.5 nor more than 3.4 when determined by using a sieve series consisting of the No. 4, 8, 16, 30, 50 and 100 sizes. After acceptance of a gradation for use in the work the F.M. shall not vary more than + 0.2.

TABLE 2							
Sieve Size	$\frac{3}{8}$	4	8	16	30	50	100
% Retained	0	0-5	0-20	15-50	40-75	70-90	90-99

3. Deleterious substances in aggregates shall not exceed the following percentages by weight when tested under the designated ASTM method.

TABLE 3			
	Coarse	Fine	Test
Material Passing No. 200 Sieve	1.0	3.0	C117
Shale	0.5	0.5	C123
Soft Friable Pieces	0.5	0.5	C142
Sticks (wet)	0.1	0.1	
Coal	0.3	0.3	C123
Clay Lumps (wet, on No. 4 Sieve)	1.5	0.3	C142

4. The Fineness Modulus (F.M.) of the fine aggregate furnished shall not be less than 2.5 nor more than 3.4 when determined by using a sieve series consisting of the No. 4, 8, 15, 30, 50 and 100 sizes. After acceptance of a gradation for use in the work the F.M. shall not vary more than +0.2.

5. Stockpiles – Aggregates shall be stockpiled by building up free-draining horizontal layers not greater than 4 feet in thickness. Aggregates that have become mixed with earth or foreign material shall not be used. If the water content in coarse aggregate is below that which the aggregate will absorb, such aggregate shall be wet down at least 12 hours in advance of the time the mix is to be batched.
6. Aggregate Tests
 - a. General – All aggregates proposed by the Contractor for use in the work shall be certified by an approved Testing Laboratory as complying with the above requirements covering deleterious materials and gradation. In addition, unless waived by the Engineer, certified tests also shall be provided in accordance with Paragraphs (b) thru (e) below. All costs of testing shall be borne by the Contractor.
 - b. Soundness – Coarse aggregate for concrete when tested for soundness with magnesium sulfate in accordance with ASTM Standard C88 shall have a total loss not greater than 18% by weight.
 - c. Abrasion – The percentage of wear of the coarse aggregates by the Los Angeles Abrasion Test, ASTM C131, shall be less than 40%.
 - d. Absorption – Coarse aggregate for concrete shall have an absorption limit of 4% or less, as determined by ASTM C127.
 - e. Mortar Strength – Fine aggregates shall be of such quality that when made into a mortar and tested in accordance with ASTM C87 the mortar shall develop compressive strengths at 7 and 28 days of not less than 100 percent of that developed by the control mortar specified in C87.

2.3 ADMIXTURES

- A. Admixtures are defined by these specifications as a material, other than Portland Cement, aggregate or water, added to concrete to modify its properties. The following admixtures shall be used when required and may be used when permitted.
 1. Air-Entraining Admixture: ASTM C 260.
 2. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
 - a. Water-Reducing Admixture: ASTM C 494, Type A, F & G.
 - b. Retarding Admixture: ASTM C 494, Type B & D.
 - c. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.
 - d. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.

- e. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494, Type G.
- f. Plasticizing and Retarding Admixture: ASTM C 1017, Type II.

2.4 WATER: ASTM C 94, Potable.

2.5 METAL REINFORCEMENT:

- A. Reinforcing Bars: ASTM A 615, Grade 60, deformed.
- B. Welded Steel Wire Fabric: ASTM A185. Fabric shall conform to the size and dimensions shown on the Drawings.
- C. Epoxy-Coated Reinforcing Bars: ASTM A 615, Grade 60, deformed bars epoxy-coated. Epoxy coated reinforcement shall be used where shown on the Drawings.
- D. Joint Dowel Bars: ASTM A615, Grade 40, of the diameter, length and style as shown on the Drawings.
- E. Tie Bars: ASTM A 615, Grade 60, deformed, of the diameter, length and spacing as shown on the Drawings.

2.6 FIBER REINFORCEMENT:

- A. Synthetic Micro-Fiber: Fibrillated polypropylene micro-fibers engineered and designed for use in concrete, complying with ASTM C 1116, Type III. Fibers shall be ¾" in length.

2.7 MISCELLANEOUS ITEMS:

- A. Waterstop: Extruded PVC material complying with all current requirements of Corps of Engineers Specification CRD-C-572. Waterstop profile, size and other requirements to be selected based upon intended use. All waterstops to be submitted for approval per these specifications.
- B. Joint Sealing Compound shall be where shown on the Drawings. Refer to Section 32 13 13 for specific requirements.

2.8 FORMING MATERIALS

- A. Smooth-Formed Finished Concrete: Form-facing panels constructed of plywood, metal, or other approved panel materials that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.

- B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.
- C. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that will produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.
- D. Pan-Type Forms: Glass-fiber-reinforced plastic or formed steel, stiffened to resist plastic concrete loads without detrimental deformation.
- E. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.
- F. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
- G. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal. Furnish units that will leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.

PART 3 - EXECUTION

3.1 PROPORTIONING

- A. Concrete mixes are to meet the requirements of Table 4 with mix proportions complying with ACI 211.

TABLE 4					
Concrete Class ⁽¹⁾	Concrete Strength		Maximum Water/Cement Ratio	Air Entrainment (%)	Slump (in.)
	Compressive f'c (psi)	Flexural MR (psi)			
Class I					
Slabs & Walks	4000	500		5 +/- 1	2 to 5
Pavement	4000	650	.45	5 +/- 1	1 to 3
Curbs & Gutters	4000	650	.45	5 +/- 1	1 to 3
Structures & Walls	4000	n.a.	.45	5 +/- 1	2 to 5
Foundations	4000	n.a.	.45	5 +/- 1	2 to 5
Class II	3000	n.a.	n.a.	6 +/- 1	1 to 3

- 1) The Class of concrete to be used in the various parts of the work shall be as specified herein or as noted on the drawings. Where no specific class has been designated, Class I concrete shall be used.

- B. Fly ash conforming to ASTM C 618, Class F or C may be used to replace a maximum of 20% of the cement.
- C. Coarse Aggregate and Fine Aggregate shall be combined in such proportions that the limits of the total aggregate retained on the No. 4 mesh sieve will be a minimum of 30% and a maximum of 50%.
- D. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94, ASTM C 1116 and ACI 304R, and furnish batch ticket information to the RPR or Contractors Site Superintendent.
- E. Site batched and mixed concrete is not allowed by the provisions of this specification. Should the Contractor seek to utilize site prepared concrete, separate application for approval shall be submitted to the Engineer including, but not limited to, plans for batching facility, quality control, material handling, etc.

3.2 FORMS

- A. Forms shall conform to the shape, lines and dimensions of the concrete as shown on the Drawings. Forms shall be provided for all vertical surfaces. The materials, design, and construction of formwork shall conform to the applicable portions of the American Concrete Institute Standard "Recommended Practice for Concrete Formwork" (ACI 347) and to these specifications.
- B. The design of the formwork shall be the responsibility of the Contractor.

- C. Forms shall be built true to line and shall be mortar-tight and sufficiently rigid to prevent displacement or bulging between supports. Bends, chamfers and other offsets shall be provided when the forms are built. Joints shall be kept to a minimum and framing shall solidly back all joints.
- D. Before forms are placed, material to form exposed surfaces shall be oiled thoroughly. Forms for unexposed concrete may be oiled at the Contractor's option. All forms not oiled shall be wetted immediately before placing concrete and points at which water has gathered within the forms shall be drained.
- E. The removal of forms shall not be started until the concrete has attained the necessary strength to support its own weight and any construction loads. Forms shall not be removed before the expiration of 30 hours from any construction. Forms supported by false work shall not be removed until the concrete has attained its design strength.

3.3 REINFORCEMENT

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."
- B. Prior to positioning, reinforcing steel shall be cleaned of all loose mill scale and rust or coatings which might prevent or reduce bond. Reinforcement shall be positioned accurately and secured against any displacement by using annealed iron wire ties or suitable clips and be supported by suitable metal supports, spacers or hangers. All reinforcing shall be in place and securely fastened before placing any concrete.

3.4 EPOXY-COATED REINFORCEMENT

- A. In order to protect the coated reinforcement from damage, the Contractor shall use padded or nonmetallic slings and padded straps. Bundled bars shall be handled in a manner which will prevent excessive sagging of bars which will damage the coating. The bundled bars shall not be dropped or dragged and must be stored on wooden cribbing. If, in the opinion of the Engineer, the coated bars have been extensively damaged, the material will be rejected. The Contractor may propose for the approval of the Engineer, alternate precautionary measures.

- B. The bars shall be fabricated and placed as shown on the Drawings and as specified. All bending should be done around nylon coated pins or wooden mandrels. The rate of bending may have to be reduced for some bar sizes to minimize cracking or disbonding of the coating. Any visible evidence of cracking or disbonding of the coating in the bent area of bars bent in accordance with the plan requirements may be patched with approval of the Engineer, except that a hairline crack, 0.003 inch or less, at the base of the deformation will not be cause for rejection nor will patching of these cracks be required. All patching shall be done promptly after bending. Bars shall not be shipped until patching material has lost all tackiness.
- C. Plastic-coated tie wires approved by the Engineer shall be used in the assembly of the coated bars in the structure to protect them from physical damage.
- D. Patching material shall be applied to all sheared ends and contact areas for hangers or couplers. Patching materials shall be applied to all damaged areas at the points of occurrence, such as the initial application, fabrication, destination or installation points with the following exception. Damaged areas of coating not more than 0.2 inch across at the widest point of exposed area of bare steel and occurring no more than six in any lineal foot of coated bar need not be repaired.
- E. Areas to be patched shall be clean and free of surface contaminants. They shall be promptly treated in accordance with the resin manufacturer's recommendations and before detrimental oxidation occurs.

3.5 PLACING CONCRETE

- A. Concrete placement to be in accordance with ACI 301, 304, 318 and 302.
- B. In the case of special site conditions and/or when requested by the Engineer, the method selected by the Contractor to place the concrete shall be submitted for approval along with sufficient details and data to review the procedure.
- C. Cold-Weather Placement: Comply with ACI 306 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
 - 1. When average high and low temperature is expected to fall below 40°F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
 - 2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
 - 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

D. Hot-Weather Placement: Comply with ACI 305 and as follows:

1. Maintain concrete temperature below 90°F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3.6 CURING OF CONCRETE

- A. All concrete surfaces shall be protected to insure that loss of moisture from the surface is held to a minimum for a period of at least seven (7) days following initial set. Concrete damaged by improper curing shall be subject to removal and replacement as directed. The method of curing, regardless of type, will not relieve the Contractor of his responsibility to provide concrete having required strength and surface finish. Unless otherwise specified for a specific item of work, the prevention of the loss of moisture from the concrete surface shall be accomplished by one of the following methods:
1. Surface maintained continuously wet by sprinkling or inundation.
 2. Covering with burlap mats kept continuously wet.
 3. Covering surfaces with 4 mil polyethylene sheeting. Splices shall be made with a minimum lap of 4 inches and sealed with tape. Materials to be approved by the Engineer.
 4. Application of a membrane curing compound approved by the Engineer
- B. Forms left in place during the specified curing period shall be sprinkled and maintained moist as required to prevent rapid drying of the concrete;
- C. Other methods of curing as may be approved by the Engineer.

3.7 CONTROL TESTS

- A. All concrete and concrete materials used in the work shall be tested as directed by the Engineer. The Contractor shall provide material for all samples and test specimens required.

- B. So long as the Contractor's work progresses in an orderly and reasonable manner the costs of field sample preparation and testing of all specimens will be borne by the Owner. Should the Contractor use methods or procedures that require unreasonable or excessive field testing to determine whether specification requirements are being met, or if field testing is performed with continued negative results that indicate the Contractor's methods or procedures are not adequate to provide the specified results, the Engineer shall notify the Contractor in writing that the costs of all additional testing beyond specific limits, which shall be set out in the written notice for the particular area or material in question, shall be the responsibility of the Contractor.
- C. Control tests which will be conducted on a continuing basis include:
 - 1. Slump Test: (ASTM-C143) as directed during concrete placement.
 - 2. Yield Test: (ASTM-C138) as directed during concrete placement, generally once each day during concrete placement.
 - 3. Compressive Strength: (ASTM-C39) two (2) test specimens plus (1) spare for each 50 cubic yards or less of each class of concrete placed during one day's operation to be tested at 7 and 28 days. Test specimens to be prepared in accordance with ASTM-C31.
 - 4. Flexural Strength: (ASTM-C78) as directed during concrete placement, two (2) test specimens plus (1) spare for each day's placement of more than 50 CY. Test specimens to be prepared in accordance with ASTM-C31.
 - 5. Air Entrainment: (ASTM-C231) as directed during concrete placement, generally at least once each day during concrete placement.

3.8 DEFECTIVE CONCRETE

- A. Deficient Strength: Where the results of strength tests indicate concrete which fails to conform to these specifications, additional test specimens shall be taken, in accordance with ASTM C42, from the questioned areas, as directed by the Engineer. If the strength indicated by these core samples meets the specification requirements the concrete will be accepted. In the event that the core tests fail to meet the specifications, all concrete represented by the deficient test specimen shall be removed and replaced by the Contractor at no additional cost to the Owner. The cost of all coring and testing, including satisfactory patching of core holes, shall be borne by the Contractor.
- B. Defective Area: Areas of concrete which are defective for reasons other than strength (i.e. Honeycombs, finish irregularities, misalignment of forms, etc.) shall be repaired by methods approved by the Engineer. When in the opinion of the Engineer satisfactory repairs cannot be made the defective concrete shall be removed and replaced by the Contractor at no additional cost to the Owner.

3.9 CONSTRUCTION

- A. The Contractor shall ensure all pipe, pipe sleeves, reinforcing and other embedment's are properly set and placed prior to any concrete pours. Concrete items shall be constructed to the detailed thickness and to the lines and grade as shown on the Drawings.
- B. After the specified curing period, the faces of all joints to be sealed shall be thoroughly cleaned, using compressed air, sweeping, brooming or other methods approved by the Engineer. The faces of the joint shall be dry after being thoroughly cleaned, and filled with joint sealing compound using a nozzle designed to completely fill the joint.
- C. Joints shall be filled to within the top surface, but in no case shall they be overfilled. Upon completion of the joint sealing operations, all excess material and foreign material shall be removed from the concrete surface.
- D. Finishing of Related Unformed Surface: Equipment or structure foundations, floor slabs and steps shall receive a troweled finish. Slabs to receive a coating shall have a finish as recommended by coating manufacturer.
- E. All surfaces exposed to view which have been in contact with the forms shall receive a smooth rubbed finish in accordance with ACI 30. All air bubbles shall be filled flush with a bonding grout before final rubbing as specified above.

END OF SECTION

SECTION 31 10 00
SITE CLEARING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Protecting existing vegetation to remain.
2. Removing existing vegetation.
3. Clearing and grubbing.
4. Stripping and stockpiling topsoil.
5. Removing above- and below-grade site improvements.
6. Disconnecting, capping or sealing, removing; and in place abandoning of site utilities.

1.2 DEFINITIONS

- A. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.
- B. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil; but in disturbed areas such as urban environments, the surface soil can be subsoil.
- C. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil and is the zone where plant roots grow. Its appearance is generally friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2 inches in diameter; and free of subsoil and weeds, roots, toxic materials, or other nonsoil materials.
- D. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction, to dripline or as indicated on Drawings.
- E. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.3 MATERIAL OWNERSHIP

- A. Except for stripped topsoil and other materials indicated to remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.4 INFORMATIONAL SUBMITTALS

- A. Existing Conditions: Documentation of existing trees and plantings, adjoining construction, and site improvements that establishes preconstruction conditions that might be misconstrued as damage caused by site clearing.
 - 1. Use sufficiently detailed photographs, videotape, or digital media.

1.5 PROJECT CONDITIONS

- A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.
 - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
 - 2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.
- B. Improvements on Adjoining Property: Authority for performing site clearing indicated on property adjoining Owner's property will be obtained by Owner before award of Contract.
 - 1. Do not proceed with work on adjoining property unless directed in writing by Owner or appropriate rights-of-way/easements are in place. Unless otherwise indicated, Contractor is responsible for staking the limits of rights-of-way or easements.
- C. Salvable Improvements: Carefully remove items indicated to be salvaged and store within the Right-of-way or where indicated on the plans.
- D. Utility Locator Service: Notify Kansas One Call, phone 1-800-DIG-SAFE before site clearing.
- E. Do not commence site clearing operations until temporary erosion- and sedimentation-control and plant protection measures are in place.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Section 31 20 00 - Earth Moving.
 - 1. Obtain approved borrow soil material off-site when satisfactory soil material is not available on-site.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect and maintain benchmarks and survey control points from disturbance during construction.
- B. Locate and clearly identify trees, shrubs, and other vegetation to remain. Flag each tree trunk at 48 inches above the ground. Erect temporary construction fence at dripline of trees/shrubs/vegetation to be protected.
- C. Protect existing site improvements to remain from damage during construction.
 - 1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.2 TREE AND PLANT PROTECTION

- A. General: Protect trees and plants not specifically designated for removal on the drawings.
- B. Unauthorized Tree/Plant Removal on Public Property: If trees/plants not designated for removal are removed from public property or right-of-way, the contractor shall be charged damages equal to \$200.00 for each inch in diameter of the tree removed, measured at 3 feet above the ground. Said damages shall be deducted from the project payment that is to be made to the contractor.
- C. Unauthorized Tree/Plant Removal on Private Property: If tree/plants not designated for removal are removed from easements on private property, the contractor shall pay the landowner within whose property said easement is located an amount equal to \$200.00 for each inch in diameter of the tree removed, measured at 3 feet above the ground. In addition to the aforementioned payment of \$200.00 per caliper inch, the contractor shall also replace all non-designated trees that are removed. The replaced deciduous trees shall be a minimum of 10 feet in height and be of the same species as the removed tree or a substitute approved by the landowner. Replaced conifers shall be a minimum of 6 feet in height and be of a species approved by the landowner.

3.3 PROTECTION OF EXISTING IMPROVEMENTS

- A. Work around and protect all structures, fences, pavement or other improvements not in direct conflict with construction. Contractor shall bear all costs for the removal, resetting, replacement, adjustment and/or repair of improvements not in conflict with construction that are impacted by Contractor's operations.

3.4 EXISTING UTILITIES

- A. Locate, identify, disconnect, and seal or cap utilities indicated to be removed or abandoned in place.
 - 1. Arrange with utility companies to shut off indicated utilities.
- B. Locate, identify, and disconnect utilities indicated to be abandoned in place.
- C. Interrupting Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
 - 1. Notify Owner not less than ten days in advance of proposed utility interruptions.
 - 2. Do not proceed with utility interruptions without Owner's written permission.
- D. Excavate for and remove underground utilities indicated to be removed.

3.5 CLEARING AND GRUBBING

- A. Remove obstructions, trees, shrubs, and other vegetation to permit installation of new construction.
 - 1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
 - 2. Grind down stumps and remove roots, obstructions, and debris to a depth of 12 inches below exposed subgrade.
 - 3. Use only hand methods for grubbing within protection zones.
 - 4. Chip removed tree branches and dispose of off-site.
- B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.
 - 1. In areas outside of engineered fill, place fill material in horizontal layers not exceeding a loose depth of 6 inches, and compact each layer to a density equal to adjacent original ground.

3.6 TOPSOIL STRIPPING

- A. Remove sod and grass before stripping topsoil.
- B. Strip topsoil to depth of 6 inches unless otherwise indicated in a manner to prevent intermingling with underlying subsoil or other waste materials.
 - 1. Remove subsoil and non-soil materials from topsoil, including clay lumps, gravel, and other objects more than 2 inches in diameter; trash, debris, weeds, roots, and other waste materials.

- C. Stockpile topsoil away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion by water.
 - 1. Limit height of topsoil stockpiles to 72 inches.
 - 2. Do not stockpile topsoil within protection zones.
 - 3. Dispose of surplus topsoil. Surplus topsoil is that which exceeds the quantity used to construct the project or indicated to be stockpiled.

3.7 SITE IMPROVEMENTS

- A. Remove existing above- and below-grade improvements as indicated and necessary to facilitate new construction.
- B. Remove slabs, sidewalks, paving, curbs, gutters, and aggregate base as indicated.
 - 1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut a long line of existing pavement to remain before removing adjacent existing pavement. Saw-cut faces vertically.
- C. Remove other site improvements as indicated, including, but not limited to, fences, signs, footings/foundations, mailboxes, and outbuildings.

3.8 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.

END OF SECTION

SECTION 31 20 00
EARTH MOVING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Preparing subgrades for slabs-on-grade, walks, pavements, turf and grasses, and plants.
2. Excavating and backfilling for buildings and structures.
3. Granular Drainage Fill for concrete slabs-on-grade and pavement.
4. Subbase course for concrete walks, pavements, or asphalt paving.
5. Subsurface drainage backfill for walls, trenches, and subbases.
6. Excavating and backfilling trenches for utilities and pits for buried utility structures.

1.2 DEFINITIONS

- A. Backfill: Soil material or controlled low-strength material used to fill an excavation.
1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
 2. Final Backfill: Backfill placed over initial backfill to fill a trench.
- B. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe. Bedding shall be an approved material and shall be placed based on the pipe and soil conditions.
- C. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.
- D. Granular Drainage Fill: Durable aggregate layer providing drainage under pavement and structures.
- E. Filter Materials: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand.
- F. Controlled Low Strength Materials (Excavatable Flowable Fill): Blend of Portland Cement, fly ash, fine aggregate, and water admixtures used to fill an excavation as an alternate to backfill.
- G. Impervious Material: Used to provide a relatively impermeable barrier to reduce seepage. Generally consists of low to medium plasticity clay as classified by the Unified Soil Classification System (USCS).

- H. Engineered Fill: Material designated and placed in a compacted manner in accordance with Geotechnical Engineering report.
- I. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.
 - 1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Engineer/Owner. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
 - 2. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Engineer/Owner. Unauthorized excavation, as well as remedial work directed by Engineer/Owner, shall be without additional compensation.
- J. Fill: Soil materials used to raise existing grades.
- K. StormWater Pollution Prevention Plan (SWPPP): Document prepared to comply with the National/Pollution Discharge Elimination System (NPDES) Stormwater Program which regulates Stormwater discharge.
- L. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, manholes, utility vaults, utility tunnels, handholes or other man-made stationary features constructed on or below the ground surface.
- M. Subbase Course: Aggregate layer placed between the subgrade and base course for hot-mix asphalt pavement, or aggregate layer placed between the subgrade and a Portland Cement concrete pavement or a Portland Cement concrete or hot-mix asphalt walk.
- N. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase course, granular drainage fill, structures, or pavement materials.
- O. Utilities: On-site pipes, conduits, ducts, and cables, as well as services within buildings.
- P. Pipe Zone: Cross sectional area of trench that includes the pipe, bedding material below the pipe, and the initial backfill beside and over the pipe.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of the following manufactured products required:
 - 1. Geogrid Reinforcement
 - 2. Geotextiles

3. Controlled low-strength material, including design mixture.
4. Aggregates

B. Samples for Verification: For the following products, in sizes indicated below:

1. Geogrid Reinforcement: 12 by 12 inches.
2. Geotextile: 12 by 12 inches.
3. Aggregates, as per Engineer, Material Classification and Moisture Density Relationship

1.4 INFORMATIONAL SUBMITTALS

A. Material Test Reports: For each on-site and borrow soil material proposed for fill and backfill as follows:

1. Classification according to ASTM D 2487.
2. Laboratory compaction curve according to ASTM D 698.

1.5 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth moving operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.
3. Traffic control devices shall be in accordance with the Manual on Uniform Traffic Control Devices (MUTCD).

B. Improvements on Adjoining Property: Authority for performing earth moving indicated on property adjoining Owner's property will be obtained by Owner before award of Contract.

1. Do not proceed with work on adjoining property until directed by Engineer/Owner.

C. Utility Locator Service: Kansas One-Call for area where Project is located before beginning earth moving operations.

D. Do not commence earth moving operations until temporary erosion- and sedimentation-control measures.

E. Do not commence earth moving operations until plant-protection measures specified in Division 01 or indicated on the drawings are in place.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

- A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.
- B. Satisfactory Soils: Soil Classification Groups CL, ML, SC, GW, GP, GM, SW, SP, and SM according to ASTM D 2487, or a combination of these groups; free of rock or gravel larger than 2 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.
1. Liquid Limit: less than or equal to 45.
 2. Plasticity Index: less than or equal to 30.
 3. Moisture Content: between optimum and 3 % above optimum.
- C. Unsatisfactory Soils: Soil Classification Groups GC, OL, CH, MH, OH, and PT according to ASTM D 2487, or a combination of these groups.
1. Unsatisfactory soils also include satisfactory soils not maintained within three percent (3%) of optimum moisture content at time of compaction.
- D. Subbase Material (Crushed Rock): Shall comply with the quality requirements of aggregates for aggregate base construction as specified in Section 1104 of the "Standard Specifications for State Road & Bridge Construction", Kansas Dept. of Transportation, Latest Edition. Absorption shall not exceed 4%. Gradation of crushed rock shall be as follows:

TABLE 1					
Sieve Sizes	2-1/2"	3/4"	#4	#40	#200
% Retained	0	20-60	50-80	80-94	90-98

- E. Subbase Material (Crushed Concrete): At the CONTRACTOR'S option, crushed concrete may be used in lieu of crushed rock. The absorption requirement does not apply. All other quality requirements and gradation shall be the same as that specified for crushed rock.
- F. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.
- G. Bedding Course: Granular bedding material consisting of durable crushed rock conforming to the requirements of the latest revision of ASTM C-33 Size No. 67 (3/4-inch to No. 4). Sand-gravel mix meeting Type UD-1 of the KDOT's Standard Specifications for State Road and Bridge Construction, Latest Edition. Soundness, abrasion, and absorption limits to be as required for coarse aggregates in Division 03.

- H. Compacted Embedment Materials Bedding Course: Approved sand material free from debris, organic materials, and stones with 100% passing a $\frac{3}{4}$ inch sieve to be placed in uniform layers not more than 6 inches thick and compacted to 95% maximum density as determined by ASTM D698. Granular bedding material may be substituted for all or part of Compacted Embedment Materials.
- I. Granular Drainage Fill: Narrowly graded mixture of washed crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.
- J. Compacted Granular Backfill: Approved sand material free from debris, organic materials, and stones with 100% passing a $\frac{3}{4}$ inch sieve and not more than 15% passing a No. 200 sieve; to be jetted and mechanically vibrated into place and compacted to 95% maximum density as determined by ASTM D698.
- K. Sand: ASTM C33, fine aggregate

2.2 GEOGRID REINFORCEMENT

- A. Geogrid Reinforcement: Shall be BX 1100 by Tensar Corporation or approved equal. The geogrid reinforcement shall be a regular grid structure formed by biaxially drawing a continuous sheet of select polypropylene material and shall have aperture geometry and rib and junction cross-sections sufficient to permit significant mechanical interlock with the material being reinforced. The geogrid shall have high flexural rigidity and high tensile modulus in relation to the material being reinforced and shall also have high continuity of tensile strength through all ribs and junctions of the grid structure. The geogrid shall maintain its reinforcement and interlock capabilities under repeated dynamic loads while in service and shall also be resistant to ultraviolet degradation, to damage under normal construction practices and to all forms of biological or chemical degradation normally encountered in the material being reinforced.

The geogrid shall also conform in all respects to the property requirements listed on Table 2.

TABLE 2			
PROPERTY	TEST METHOD	UNITS	VALUE
INTERLOCK			
Aperture Size ¹	I.D. Caliper ²		
-MD		in	1.0 (nom)
-CMD		in	1.3 (nom)
Open Area	COE Method ³	%	70 (min)
Thickness	ASTM D 1777-64		
-ribs		in	0.03 (nom)
-junctions		in	0.11 (nom)
REINFORCEMENT			
Flexural Rigidity	ASTM D 1388-64 ⁴	mg-cm	250,000 (min)
Tensile			
-modulus	GRI GG1-87 ⁵	lb/ft	13,500 (min)
-@2% strain	GRI GG1-87 ⁵	lb/ft	270 (min)
-@5% strain	GRI GG1-87 ⁵	lb/ft	540 (min)
-ultimate strength	GRI GG1-87 ⁵	lb/ft	850 (min)
Junctions	GRI GG2-87 ⁶		
-strength		lb/ft	750 (min)
-efficiency		%	90 (min)
MATERIAL			
polypropylene	ASTM D 4101	%	98 (min)
	Group 1/Class 1/		
	Grade 2		
carbon black	ASTM 4218	%	0.5 (min)

¹ MD dimension is along roll length. CMD dimension is across roll width.

² Maximum inside dimension in each principal direction measured by calipers.

³ Percent open area measured without magnification by Corps of Engineers method as specified in CW 02215 Civil Works Construction Guide, November 1977.

⁴ ASTM D 1388-64 modified to account for wide specimen testing as described in Tensar test method TTM-5.0 "Stiffness of Geosynthetics".

⁵ Secant modulus at 2% elongation measured by Geosynthetic Research Institute test method GG1-87 "Geogrid Tensile Strength". No offset allowances are made in calculating secant modulus.

⁶ Geogrid junction strength and junction efficiency measured by Geosynthetic Research Institute test method GG2-87 "Geogrid Junction Strength".

2.3 GEOTEXTILES

- A. Subsurface Drainage Geotextile: Nonwoven needle-punched geotextile, manufactured for subsurface drainage applications, made from polyolefins or polyesters; with elongation greater than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:

1. Grab Tensile Strength: 157 lbf; ASTM D 4632.
2. Sewn Seam Strength: 142 lbf; ASTM D 4632.
3. Tear Strength: 56 lbf ASTM D 4533.
4. Puncture Strength: 56 lbf; ASTM D 4833.
5. Apparent Opening Size: No. 70 sieve, maximum; ASTM D 4751.
6. Permittivity: 0.1 per second, minimum; ASTM D 4491.
7. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.

- B. Separation Geotextile: Woven geotextile fabric, manufactured for separation applications, made from polyolefins or polyesters; with elongation less than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:

1. Grab Tensile Strength: 247 lbf; ASTM D 4632.
2. Sewn Seam Strength: 222 lbf; ASTM D 4632.
3. Tear Strength: 90 lbf; ASTM D 4533.
4. Puncture Strength: 90 lbf; ASTM D 4833.
5. Apparent Opening Size: No. 60 sieve, maximum; ASTM D 4751.
6. Permittivity: 0.02 per second, minimum; ASTM D 4491.
7. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.

2.4 CONTROLLED LOW-STRENGTH MATERIAL

- A. Controlled Low-Strength Material (Flowable Fill): Flowable concrete material produced from the following:

1. Portland Cement: ASTM C 150, Type 1.
2. Fly Ash: ASTM C 618, Class C or F.
3. Normal-Weight Aggregate: ASTM C 33, 3/8-inch nominal maximum aggregate size.
4. Water: ASTM C 94/C 94M.
5. Air-Entraining Admixture: ASTM C 260.
6. Fine Aggregate: Fine aggregate for flowable fill shall be natural sand with gradation meeting the limits of % retained on the following sieve sizes:

TABLE 3							
Sieve Sizes	3/8 inch	#4	#8	#16	#30	#50	#100
% Retained	0	0 - 5	0 - 20	15 - 50	40 - 75	70 - 90	90 - 99

- B. Produce conventional-weight, controlled low-strength material with 100 psi compressive strength when tested according to ASTM C 495.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth moving operations.
- B. Protect and maintain erosion and sedimentation controls during earth moving operations.
- C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

3.2 DEWATERING

- A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.
- B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.
 - 1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.

3.3 EXPLOSIVES

- A. Explosives: Do not use explosives.

3.4 EXCAVATION, GENERAL

- A. Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Material to be excavated will be classified as unclassified. No additional payment will be made for rock and/or water which may be encountered.
 - 1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.
 - 2. Remove material to lines and grades indicated to permit installation of permanent construction without exceeding the following dimensions:

- a. 24 inches outside of concrete forms other than at footings.
- b. 12 inches outside of concrete forms at footings.
- c. 6 inches outside of minimum required dimensions of concrete cast against grade.
- d. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
- e. 6 inches beneath bottom of concrete slabs-on-grade.
- f. The greater of 18 inches wider than pipe or 42 inches wide.
- g. 4 inches (6 inches if in rock) beneath pipe for pipe diameters 27" and below, 5 inches (9 inches if in rock) beneath pipe for pipe diameters 30 inches to 60 inches and 6 inches (12 inches if in rock) beneath pipe for pipe diameters greater than 60 inches. Hand-excavate deeper for bells of pipe.

3.5 EXCAVATION FOR STRUCTURES

- A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.
 - 1. Excavations for Footings and Foundations: Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.

3.6 EXCAVATION FOR WALKS AND PAVEMENTS

- A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.7 EXCAVATION FOR UTILITY TRENCHES

- A. Excavate trenches to indicated gradients, lines, depths, and elevations.

3.8 SUBGRADE INSPECTION

- A. Notify Engineer/Owner when excavations have reached required subgrade.
- B. If Engineer/Owner determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.
- C. Proof-roll subgrade below the building slabs and pavements with a pneumatic-tired and loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph.
 2. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Engineer/Owner, and replace with compacted backfill or fill as directed.
- D. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
- E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Engineer/Owner, without additional compensation.

3.9 UNAUTHORIZED EXCAVATION

- A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi, may be used when approved by Engineer/Owner.
1. Fill unauthorized excavations under other construction, pipe, or conduit as directed by Engineer/Owner.

3.10 STORAGE OF SOIL MATERIALS

- A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.
- B. Materials stockpiled in a floodplain will require permits from Kansas State Board of Agriculture, KDHE, and U.S. Corps of Engineers. Contractor is responsible for obtaining all necessary permits for materials stockpiled in the floodplain at no cost to the Owner or Engineer.
- C. Materials stockpiled outside of the approved construction limits may require archeological investigations or other permitting which shall be obtained by the Contractor at no cost to the Owner or Engineer.

3.11 BACKFILL

- A. Place and compact backfill in excavations promptly, but not before completing the following:

1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
 2. Surveying locations of underground utilities for Record Documents.
 3. Testing and inspecting underground utilities.
 4. Removing concrete formwork.
 5. Removing trash and debris.
 6. Removing temporary shoring and bracing, and sheeting.
 7. Installing permanent or temporary horizontal bracing on horizontally supported walls.
- B. Place backfill on subgrades free of mud, frost, snow, or ice.
- C. Utility Trench Pipe Zone
1. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.
 2. Place and compact initial backfill of compacted embedment material or granular bedding material, to a height of 12 inches (18 inches if in rock) over the pipe or conduit. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.
- D. Utility Trench Final Backfill
1. Trenches under Footings: Backfill trenches excavated under footings to within 18 inches of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings. Concrete is specified in Division 03.
 2. Trenches under Roadways: Provide the following to a point two feet beyond the back of curb or edge of roadway.
 - a. As specified on the plans, provide conventional weight, controlled low-strength material or compacted granular backfill as backfill to a height 24 inches below the bottom of pavement. Secure pipeline or install controlled low-strength material in lifts to prevent flotation of the pipeline.
 - b. The remainder of the trench shall be backfilled with the material specified on the drawings or the subbase material.

3. All Other Trenches:

- a. Place and compact final backfill of satisfactory soil to final subgrade elevation.

3.12 SOIL FILL

- A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.
- B. Place and compact fill material in layers to required elevations as follows:
 1. Under grass and planted areas, use satisfactory soil material.
 2. Under walks and pavements, use satisfactory soil material.
 3. Under steps and ramps, use engineered fill.
 4. Under building slabs, use engineered fill.
 5. Under footings and foundations, use engineered fill.
- C. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.13 SOIL MOISTURE CONTROL

- A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 3 percent of optimum moisture content.
 1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
 2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 3 percent and is too wet to compact to specified dry unit weight.

3.14 COMPACTION OF SOIL BACKFILLS AND FILLS

- A. Place backfill and fill soil materials in layers not more than 6 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.
- B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.
- C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 698:

1. Under structures, building slabs, steps, and pavements, scarify and recompact top 6 inches of existing subgrade and each layer of backfill or fill soil material at 95 percent.
2. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at a minimum of 95 percent.
3. Under turf or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at a minimum of 90 percent.
4. For utility trenches, compact each layer of initial and final backfill soil material at 95 percent.

3.15 GRADING

- A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
 1. Provide a smooth transition between adjacent existing grades and new grades.
 2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.
- B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
 1. Turf or Unpaved Areas: Plus or minus 1 inch.
 2. Walks: Plus or minus 1 inch.
 3. Pavements: Plus or minus 1/2 inch.
- C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

3.16 SUBBASE MATERIAL UNDER PAVEMENTS AND WALKS

- A. Place subbase course on subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade, place subbase material under pavements and walks as follows:
 1. Install separation geotextile or geogrid reinforcement on prepared subgrade according to manufacturer's written instructions.
 2. Place base course material over subbase course under hot-mix asphalt pavement.
 3. Shape subbase material to required crown elevations and cross-slope grades.
 4. Place subbase material 6 inches or less in compacted thickness in a single layer.
 5. Place subbase material that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.

6. Compact subbase material at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

3.17 GRANULAR DRAINAGE FILL UNDER CONCRETE OR ASPHALT

- A. Place granular drainage fill on subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade, place and compact granular drainage fill under cast-in-place concrete slabs-on-grade as follows:
 1. Install subdrainage geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
 2. Place granular drainage fill 6 inches or less in compacted thickness in a single layer.
 3. Place granular drainage fill that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
 4. Compact each layer of granular drainage fill to required cross sections and thicknesses to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

3.18 FIELD QUALITY CONTROL

- A. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.
- B. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:
 1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 2000 sq. ft. or less of paved area or building slab, but in no case fewer than three tests.
 2. Foundation Wall Backfill: At each compacted backfill layer, at least one test for every 100 feet or less of wall length, but no fewer than two tests.
 3. Trench Backfill: At each compacted initial and final backfill layer, at least one test for every 150 feet or less of trench length, but no fewer than two tests.
- C. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

3.19 PROTECTION

- A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
- B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
 - 1. Scarify or remove and replace soil material to depth as directed by Engineer; reshape and recompact.
- C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
 - 1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.20 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION

SECTION 31 37 00
RIPRAP

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Riprap placed loose.
 - 2. Riprap placed with grout.
 - 3. Aggregate ditch lining.

1.2 ACTION SUBMITTALS

- A. General: Submittals shall be made by the Contractor in accordance with the procedures set forth in Division 01.
- B. Manufacturer's Certificate: Certify that the products meet or exceed the specified requirements

1.3 QUALITY ASSURANCE

- A. Furnish each aggregate material from single source throughout the Work.
- B. Perform Work in accordance with KDOT standards.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Delivery:
 - 1. Deliver materials to the Site to ensure uninterrupted progress of the Work.
 - 2. Contractor shall provide all storage areas, unless designated otherwise on the drawings.
- B. Storage:
 - 1. Store materials to allow convenient access for inspection and identification.
 - 2. Store material using pallets, platforms, or other supports.

1.5 PROJECT CONDITIONS

- A. Comply with the requirements including proof of insurance, and other permit requirements for construction across or along railroads, highways, local or county roads, or drainage ways.
- B. Comply with the requirements for NPDES permitting, including best management practices for storm water discharges from the construction site.
- C. Comply with state and/or federal regulations for work performed in waterways or wetlands.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Rock riprap shall be furnished and installed to the lines, grades, and dimensions as indicated on the plans for the slopes and berms of the embankments.
- B. Material is to consist of individual fragments, dense, sound, resistant to abrasion and free of cracks, seam or other defects which would tend to increase unduly their destruction by water and frost actions. Material is to meet the requirements as outlined in this specification section.

2.2 MATERIALS

- A. Riprap:
 - 1. Minimum weight per cubic foot, not less than one hundred forty (140) pounds when tested in accordance with A.S.T.M. Standard C-127.
 - 2. Loss after ten (10) cycles of freezing and thawing to be less than fifteen percent (15%) when tested in accordance with AASHO Designation T-103.
 - 3. The material shall have the following gradation:

SIZE REQUIREMENTS FOR ROCK RIPRAP

TABLE 1 PERCENT HEAVIER THAN							
	1/4 Ton	250 lbs.	200 lbs.	180lbs.	60 lbs.	10 lbs.	5 lbs.
Heavy	0%		50%				90%
Light		0%		5-15%	50-70%	85-100%	

B. Stone for Filter Course:

1. Provide crushed or uncrushed gravel or quarried stone for filter course that meets the installation type specified.
2. Quality:
 - a. Soundness, Minimum: 0.85
 - b. Wear, Maximum: 45%
3. Provide stone for filter course that complies with the table below:

TABLE 2									
Material	% Retained on Sieve Size								
	6"	5"	4"	3"	2"	1"	½"	3/8"	No.4
Type 1		0	0-5		10-40	25-60		55-85	70-95
Type 2			0	0-5			50-90		
Type 3	0	5-25			40-60			75-95	

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify of existing conditions before starting work.
- B. Grade the locations where the riprap is to be placed as shown on the Drawings.
- C. Prepare for the riprap by undercutting to the depth required for the riprap. After the riprap is completed, backfill and compact around the structure.
- D. Do not place riprap over frozen or unstable subgrade surfaces.

3.2 PLACEMENT

- A. Rock riprap may be placed below water providing it is placed by an approved method which will prevent segregation.
- B. Rock riprap and filter course, where shown, shall be placed on a prepared 6" subgrade, unless otherwise noted on the plans, so as to produce a reasonably well-graded mass with a minimum practicable percentage of void. Rock riprap shall be placed to its full course thickness in one operation without displacing the bedding.

- C. Placing rock riprap by dumping into chutes or any other method likely to cause segregation will not be permitted.
- D. Placement of rock on the slope and in the trenches shall be accomplished by controlled dumping directly in place.
- E. Bulldozing of rock from the upper banks will not be permitted.
- F. Use of a drag line or similar equipment operated from the top of the bank to pull rock into position on the upper slope will be permitted.
- G. Larger rocks should be well distributed and the entire mass of rocks in their final position should be stable and free of pockets of small rocks and clusters of larger ones; rearrangement of individual pieces by hand may be required to obtain the results described above.
- H. A tolerance of plus six (6) inches from the lines and grades shown on the drawings will be allowed in the finished rock riprap surface, except that the extreme tolerance should not be continuous over an area greater than 200 square feet.
- I. Where indicated on the Drawings, place geotextile fabric over substrate, lap edges and ends.
- J. Place riprap where indicated on Drawings.
- K. Installed Thickness: As indicated on Drawings.
- L. Grouted rock riprap material shall be the same as rock riprap. This riprap shall be grouted with Type III concrete to the limits shown on the plans or as directed by the engineer. Some hand placing of riprap stones shall be necessary to produce reasonably true surfaces and a close fit of stones. The spaces between the stones shall be filled with concrete with sufficient water to form a plastic mix. The grout shall be poured and broomed into the spaces until they are completely filled.

END OF SECTION

SECTION 32 12 16
ASPHALT PAVING

PART 1 - GENERAL

1.1 SUMMARY

- A. Work performed under this section consists of bituminous material to be placed over the areas as shown on the drawings in conformance with the lines, grades, thicknesses, and typical sections shown on the Drawings or established by the Engineer.

1.2 DEFINITIONS

- A. The following are industry abbreviations not defined elsewhere in this Project Manual:
 - 1. ASTM: ASTM International
 - 2. AASHTO: American Association of State Highway and Transportation Officials
 - 3. HMA: Hot Mix Asphalt
 - 4. RPR: Resident Project Representative

1.3 ACTION SUBMITTALS

- A. Product Data for the following:
 - 1. Asphalt Mix Design
 - 2. Material Sources
 - 3. Certified test reports of bituminous material in current production or stored in tanks under the ownership of the Contractor.

PART 2 - PRODUCTS

2.1 BITUMINOUS MATERIAL

- A. Bituminous materials for Plant Mix Asphalt Mixture -Commercial Grade shall be a PG 64-22 asphalt produced by a supplier holding an Approved Supplier Certification (ASC) in accordance with AASHTO Standard PP26-96.2.
- B. Bituminous materials for tack and priming of contact surfaces of gutters, etc. shall be emulsified asphalt meeting one of the criteria below:

TABLE 1		
SPECIFICATIONS FOR ANIONIC EMULSIFIED ASPHALT		
	Min.	Max.
Viscosity, Saybolt Furol at 77°F, sec.	10	100
Residue by Distillation (% by Mass)	57	-----
Storage Stability, % *	-----	1
Sieve Test, % Retained	-----	0.50
Tests on Distillation		
Penetration, 77°F, 100g, 5 sec	75	125
Solubility, %.	97.5	-----
Ductility, 77°F, mm	800	-----
Elastic Recovery @ 50°F, 20 cm elongation, %	-----	-----

* If the Contractor's storage tanks are equipped with a mechanical propeller type agitation device, and the entire contents of the tank are thoroughly mixed before each day's use, the requirement for satisfactory compliance with the storage stability test will be waived

TABLE 2		
SPECIFICATIONS FOR CATIONIC EMULSIFIED ASPHALT		
	Min.	Max.
Viscosity, Saybolt Furol At 77°F, sec.	10	60
Residue by Distillation (% by Mass)	57	-----
Storage Stability, % *	-----	1
Sieve Test, % Retained	-----	0.50
Particle Charge	Positive**	
Tests on Distillation		
Penetration, 77°F, 100g, 5 sec	50	100
Solubility, %.	97.5	-----
Ductility, 77°F, mm	800	-----

*Current of the particle charge may need to be more than 8 mA.

TABLE 3 - SPECIFICATIONS FOR EMULSION BONDING LIQUID

	EBL	
	Min.	Max.
Viscosity, Saybolt Furol At 122°F, sec.	25	125
Storage Stability, % *	-----	1
Sieve Test**, % Retained	-----	0.30
Residue by Distillation, %	63	-----
Oil Distillate by Distillation, %	-----	2
Demulsibility, % (35 ml, 0.02 N CaCl ₂) (Anionic Version)	60	-----
Demulsibility, % (35 ml, 0.8% Dioctyl Sulfosuccinate) (Cationic Version) 60		
Tests on Distillation Residue		
Penetration, 77°F, 100g, 5 sec	90	150
Elastic Recovery***, %	97.5	-----

* After sitting undisturbed for 24 hours, the sample shall show no more than 5 ml of the white latex residue.

**The sieve test is waived if successful application of the material has been achieved in the field.

***Elastic recovery, AASHTO T 301, 50°F, 20 cm elongation, 5 minute hold, % min., run on Distillation Residue.

2.2 AGGREGATES

A. Aggregates shall be of the following composition, quality and gradation requirements:

1. Crushed Aggregates: Limit crushed aggregates to the following materials:

- a. Produce Crushed Stone (CS-1) and Crushed Screenings (CS-2) by crushing limestone, sandstone, porphyry (rhyolite, basalt, granite and Iron Mountain Trap Rock are examples of porphyry) or other types of stone.
- b. Produce Crushed Gravel (CG) by crushing siliceous gravel containing not more than 15% non-siliceous material.
- c. Provide Chat (CH-1) obtained during the mining of lead and zinc ores in the tri-state mining district.
- d. Consider materials complying with Mineral Filler Supplements (MFS-1, MFS-2, MFS-4 and MFS-7 as crushed aggregates.
- e. Produce Crushed Steel Slag (CSSL) by crushing electric furnace steel slag. Some sources of steel slag are angular when produced and may be treated the same as crushed gravel and manufactured sand. Use steel slag with an Uncompacted Void Content of the Fine Aggregate "U" Value of more than 42.00 and the Course Aggregate Angularity greater than the minimum specified value. The maximum allowable quantity of crushed steel slag is 50% of the total aggregate weight.
- f. Produce Manufactured Sand or Buckshot by crushing siliceous sand and gravel, or washing crushed stone screenings.

2. Uncrushed Aggregates: Limit uncrushed aggregates to the following materials:
 - a. Produce Sand-Gravel (SSG) by mixing natural sand and gravel formed by the disintegration of siliceous and/or calcareous materials.
 - b. Provide Natural Sand consisting of particles formed by the natural disintegration of siliceous and/or calcareous materials. Use natural sand with an Uncompacted Void Content "U" value of less than 42.00.
 - c. Provide Grizzly (Grizzly Waste) consisting of the matrix or bedding material occurring in conjunction with calcitic or dolomitic cemented sandstone "Quartzite", generally separated from the sandstone prior to crushing.
3. Mineral Filler Supplement
 - a. Provide a mineral filler supplement that is easily pulverized and free of cemented lumps, mudballs, and organic materials that complies with the following. Do not blend 2 or more materials to produce mineral filler supplement. Provide only 1 mineral filler supplement in each HMA design.
 - b. Mineral Filler Supplement designation MFS-1 is Portland cement, blended hydraulic cements, or crushed stone.
 - c. Mineral Filler Supplement designation MFS-2 is crushed limestone.
 - d. Mineral Filler Supplement designation MFS-3 is water or wind deposited silty soil material.
 - e. Mineral Filler Supplement designation MFS-4 is Hydrated lime. The minimum allowable quantity of MFS-4 or Hydrated Lime is 1% of the total aggregate weight when required as a supplement on the Contract Documents.
 - f. Mineral Filler Supplement designation MFS-5 is volcanic ash containing a minimum of 70% glass shard. The maximum allowable quantity of MFS-5 is 5% of the total aggregate weight when specified as acceptable mineral filler supplement.
 - g. Mineral Filler Supplement designation MFS-6 is fly ash. Fly ash is the finely divided residue resulting from the combustion of ground or powdered coal and is transported from the boiler by flue gasses. The maximum allowable quantity of MFS-6 is 3% of the total aggregate weight when specified as acceptable mineral filler supplement.
 - h. Mineral Filler Supplement designation MFS-7 is processed chat sludge that has been dewatered at the source of supply, and does not exceed 15% moisture content by weight at the time of shipping.

4. Reclaimed Asphalt Pavement (RAP)

- a. If RAP is used, inform the Engineer of the source and type of RAP. Provide RAP that is reasonably free of contamination, uniform in composition (similar to RAP gradation shown on mix design) and passes through a 2-1/4" screen or grizzly. The Engineer will accept the RAP on a visual inspection.
- b. Plant Mix Asphalt Mixture-Commercial Grade may contain up to 25% RAP in base courses and 10% RAP in surface courses, provided the Engineer approves the RAP source.

B. Quality of Individual Aggregates.

1. Soundness, minimum0.90%
 - a. Soundness requirements do not apply to aggregates having less than 10% material retained on the No. 4 mesh sieve.
2. Wear, maximum40%
 - a. Wear requirements do not apply to aggregates having less than 10% retained on the No. 8 sieve.
3. Absorption, maximum4.0%
 - a. Apply the specified maximum absorption to both the fraction retained on the No. 4 sieve and the fraction passing the No. 4. Screenings produced concurrently with CS-1 will be accepted without tests for absorption.
 - b. Crushed aggregates with less than 10% materials retained on the No. 4 sieve (excluding mineral filler supplements) must be produced from a source complying with the official quality requirements of this Section prior to crushing.
4. Plasticity Index, the maximum P.I. for MFS-1, MFS-2, MFS-3, MFS-5, and MFS-7 is 6.

C. Product Control of Individual Aggregates

1. Deleterious Substances. Provide combined aggregates free from alkali, acids, organic matter, or injurious quantities of other foreign substances that does not exceed the following maximum percentages by weight.
 - a. Shale or Shale-like1.0%
 - b. Clay lumps and friable particles1.0%
 - c. Sticks (wet)0.1%
 - d. Coal (AASHTO T-113)0.5%

D. Combined Gradation

1. Provide combined aggregates for the mixes required in the Contract Documents as shown in Table 4.

TABLE 4 - COMBINED AGGREGATE REQUIREMENTS											
Mix Designation	Percent Retained-Square Mesh Sieves										
	1"	3/4"	1/2"	3/8"	No. 4	No. 8	No. 16	No. 30	No. 50	No. 100	No. 200
BM-1			0	0-8	18-39	35-53	50-68	60-80	72-90	82-95	92-98
BM-1A		0	6-13	14-23	32-47	49-65	62-76	72-85	81-91	86-96	92-98
BM-1B		0	0-10	7-22	41-59	61-79	75-89	82-94	86-97	89-99	93-99
BM-1T			0	0-14	39-59	57-72	70-85	78-91	87-99	90-99	92-98
BM-2		0		8-30		42-72		64-88			92-98
BM-2A		0		6-21	23-40	38-56		61-82		88-99	92-99
BM-2B	0	0-5		10-30		42-72		64-88			92-98
BM-2C	0	0-10	12-22	19-39	51-69	65-83	75-91	82-95	87-99	90-99	93-99

Notes:

1. BM-2 used in base construction will be restricted to BM-2, BM-2B or BM-2C gradation.
2. The maximum percent moisture in the final mixture shall not exceed 0.5%

2.3 ASPHALT-AGGREGATE MIXTURE

- A. Marshall Mix Design: A minimum of 10 working days before the start of HMA production, submit in writing to the Engineer for review and approval, each combination of aggregates proposed for use in the Project. For each asphalt-aggregate mixture submitted, include Marshall Test data to demonstrate that mixtures comply with properties specified in TABLE 4 and Marshall Test data below. Testing shall be done in accordance with ASTM procedures and using 50 compaction blows.

1. Bituminous Base or Sub-Base shall meet the following requirements:

Stability (min.)	1000
Flow	.05 to .12
% Voids	3 to 7
% Voids Filled	70 to 80

Minimum asphalt content shall be 4.25 percent of the dry weight of the aggregates.

2. Bituminous Surface shall meet the following requirements:

Stability (min.)	1600
Flow	.05 to .12
% Voids	3 to 5
% Voids Filled	70 to 85

Minimum asphalt content shall be 4.75 percent of the dry weight of the aggregates.

PART 3 - EXECUTION

3.1 SURFACE PREPARATIONS

- A. Subgrade Surface: The subgrade surface shall be maintained by the Contractor and shall not be excessively dry or wet prior to placing of bituminous mixture. No asphalt priming of the subgrade surface will be required, but moistening of the surface will be required when directed by the Engineer.
- B. Bituminous Base Surfaces: Fresh Bituminous Base Surfaces shall be free of any foreign matter or moisture prior to placing of any additional courses of bituminous material. Each lift of bituminous mat base course which will be covered by another lift of bituminous mat, shall receive a bituminous tack coat. The entire bituminous surface shall be tacked at the rate of 0.1 gallon per square yard prior to placing of the next course of bituminous material.
- C. Existing Pavement Surfaces: Existing pavement surfaces of any type shall be free of any foreign matter or moisture prior to placing of any course of bituminous material. The entire pavement surface shall be tacked at the rate of 0.1 gallon per square yard prior to placing of the covering course of bituminous material.

3.2 TRANSPORTATION AND DELIVERY OF HOT BITUMINOUS MIXTURE

- A. Mixture shall be transported from plant to point of use in pneumatic-tired vehicles having tight bodies previously cleaned of all foreign materials. Inside surface of each vehicle may be lubricated lightly with oil or soap solution prior to loading, but excessive use of lubricant or use of gasoline, kerosene, or similar products will not be permitted.
- B. Material shall be weighed then delivered and dumped into hopper of a self-propelled power machine for placing and spreading material as hereinafter specified.
- C. During transportation of hot bituminous mixtures from remote central mixing plant to point of usage and placement on the prepared subgrade or base course, trucks shall be provided with tarpaulin covers or other adequate protection to prevent undue loss of heat. In any case, temperature of mixture at time of placement shall be within the range of 275° to 325° F.

3.3 PLACING HOT BITUMINOUS MIXTURE

- A. Bituminous mixture shall be placed in layers of not more than 2- inch compacted thickness for Surface Courses nor more than 4-inch compacted thickness for Base Courses.

- B. Equipment for spreading, shaping and finishing bituminous paving mixture shall consist of an approved self-contained power machine utilizing an integral electronic automatic control system. The machine shall be suitably equipped and operated to obtain a finished course of proper depth, grade and surface.
- C. The speed of machine shall be regulated so that the surface of the pavement is smooth.
- D. The Contractor shall develop a laydown plan that ensures that his equipment operates within its tolerances and also ensures that longitudinal joints of upper lifts do not align with those of lower lifts.
- E. All joints shall present the same texture, density and smoothness as other sections of the course. Placing of any course shall be as nearly continuous as possible.
- F. Rollers shall pass over unprotected end of freshly laid mixture only when laying of the course is to be discontinued. In such cases, provisions shall be made for proper bond by cutting back the joint to expose an even, vertical surface for full thickness of the course. Exposed edges shall be given a light fog coat of tack material. Fresh mixture shall be raked against joints, thoroughly tamped and rolled.
- G. Do not place asphalt mixture on any wet or frozen surface or when weather conditions otherwise prevent the proper handling and finishing of the mixture.
- H. Only place asphalt mixture when either the minimum ambient air temperature or the road surface shown in Table 3 is met. The RPR may waive the temperature and weather condition requirements if warranted.

TABLE 5 - MINIMUM HMA PLACEMENT TEMPERATURES			
Paving Course	Thickness (inches)	Air Temperature (°F)	Road Surface Temperature (°F)
Surface	All	50	55
Subsurface	<1.5	50	55
Subsurface	≥1.5 and <3	40	45
Subsurface	≥3	30	35

3.4 COMPACTION OF BITUMINOUS MIXTURES

- A. All bituminous base and bituminous surface lifts shall be compacted in a workman like manner and in accordance with accepted construction practices.
- B. Rollers or other compactive devices shall be operated by competent and experienced roller operators and shall be kept in operation continuously, if necessary, so that all parts of the pavement will receive substantially equal compaction at the time desired. The Engineer shall order the mixing plant to cease operations at any time proper compaction is not being performed.
- C. A rolling procedure should be established to insure that the maximum feasible density is being obtained with care being taken not to damage the pavement from over rolling.

The required percentage of the Field Mold Density will be the absolute minimum density permitted and shall not be considered as a goal or an average. Unless otherwise specified, the completed asphaltic concrete pavement shall have a density greater than or equal to 92% of theoretical maximum specific gravity (G_{mm}).

- D. Rollers shall be self-propelled and shall be in good condition, capable of reversing without backlash, and shall be operated at speeds slow enough to avoid displacement of the bituminous mixture. The number and weight of rollers shall be sufficient to compact the mixture to the required density while it is still in a workable condition. The use of equipment and/or rolling procedures which results in excessive crushing of the aggregate will not be permitted. A minimum of two rollers will be required for compaction of the bituminous mixture. One shall be a steel wheel type and the other a pneumatic-tired type, unless otherwise required by the RPR. A vibratory roller will be considered as a steel wheel type.
- E. The final rolling of the top or surface course shall be accomplished with a steel roller unless otherwise designated. Vibratory rollers used for finish rolling shall be operated with the vibratory unit in the off position. Final rolling shall be completed when the temperature is approximately 175° F or above.

3.5 CONTROL TESTS

- A. All asphaltic concrete and asphaltic concrete materials used in the work shall be tested as directed by the RPR. The Contractor shall provide material for all samples and test specimens required.
- B. So long as the Contractor's work progresses in an orderly and reasonable manner the costs of field sample preparation and testing of all specimens will be borne by the Owner. Should the Contractor use methods or procedures that require unreasonable or excessive field testing to determine whether specification requirements are being met, or if field testing is performed with continued negative results that indicate the Contractor's methods or procedures are not adequate to provide the specified results, the Engineer shall notify the Contractor in writing that the costs of all additional testing beyond specific limits, which shall be set out in the written notice for the particular area or material in question, shall be the responsibility of the Contractor.
- C. Smoothness Tests: Finished surface of bituminous pavement shall not vary more than 1/4 inch when measured by a 10-foot straightedge applied parallel to the centerline. Tests for conformity with specified crown and grade shall be made immediately after initial compression and any variation shall be corrected by removing or adding materials and continuing rolling. After completion of final rolling, smoothness shall again be checked, and irregularities that exceed specified tolerances or that retain water on the surface shall be corrected by removing defective work and replacing with new material or by adding additional material, as determined by the RPR.
- D. Asphaltic Cement Content: Minimum one test per day, one test per 500 tons of asphalt or as directed by RPR; according to ASTM D6307.

- E. Marshall Properties (Stability and Flow): Minimum one test per day, one test per 500 tons of asphalt or as directed by RPR; according to ASTM D6926 and ASTM D6927.
- F. Sieve Analysis of Cold-Feed Aggregate: Minimum one test per day, one test per 500 tons of asphalt or as directed by RPR; according to ASTM C136 and ASTM C117.
- G. Percent (%) Voids and Percent (%) VMA: Minimum one test per day, one test per 500 tons of asphalt or as directed by RPR; according to ASTM D2041.
- H. Compaction: At the option of the RPR, either of the following methods may be used to determine road density:
 - 1. Furnish 3 cores, 4 inches in diameter, suitable for determining road density, from each location designated by the RPR.
 - 2. A nuclear meter may be used to determine the road density at locations as determined by the RPR.

3.6 PROTECTION OF PAVEMENT

- A. The contractor shall protect all sections of newly compacted base and surface courses from traffic until hardened, or as determined by the RPR.

3.7 UNSUITABLE MATERIAL

- A. Any mixture that becomes loose, broken, mixed with foreign material, or which is in any way defective in finish or density, or which does not comply in all other respects with the requirements of the specifications shall be removed, replaced with suitable material, and finished in accordance with this project manual.

END OF SECTION

SECTION 32 13 13
CONCRETE PAVING

PART 1 - GENERAL

1.1 SUMMARY

- A. Work performed under this section consists of construction of concrete pavements, over the areas as shown on the Drawings in conformance with the dimensions, lines, grades, thicknesses, and typical sections shown on the Drawings or established by the RPR. The term “concrete pavements” shall include street and parking lot paving, curb and gutter, sidewalks, driveways, valley gutters and other similar exposed, slab on grade construction.

1.2 DEFINITIONS

- A. The following are industry abbreviations not defined elsewhere in this Specification.
 - 1. ASTM: ASTM International
 - 2. AASHTO: American Association of State Highway and Transportation Officials
 - 3. RPR: Resident Project Representative

1.3 ACTION SUBMITTALS

- A. Product Data:
 - 1. As Per Division 03 Concrete.
 - 2. Joint Sealing Material.
 - 3. Expansion Joint Filler.
 - 4. Concrete Curing Materials.
- B. Construction methods:
 - 1. Method of concrete placement.
 - 2. Materials and Equipment for concrete placement.

PART 2 - PRODUCTS

- A. Portland Cement Concrete as per Division 03 Concrete and the information provided on the Drawings. Concrete minimum 28-day compressive strength shall be 4000 psi, unless indicated otherwise on the Drawings.

- B. Steel Reinforcement as Per Division 03 Concrete and the information provided on the Drawings.
- C. Hot Joint Sealing Compound.
 - 1. Provide a joint sealant that is a homogeneous blend of elastomers and other plasticizers and agents blended to result in a product that seals cracks in pavements from water intrusion.
 - 2. The sealant must retain adhesion and flexibility during extremes of expansion and contraction of the crack through a temperature range of 0°F to 140°F. Heat and apply the material according to manufacturer's recommendations.
 - a. Bond: When tested at -20°F to 200% extension of 1/2 inch to 1-1/2 inch for 3 cycles, the material exhibits no cracking, separation, or other opening that at any point is greater than 1/4 inch deep in the sealer or between the sealer and the mortar block. A minimum of 2 test specimens in a set of 3 representing a given sample must comply with this requirement.
 - b. Flow: 5 mm maximum.
 - c. Resilience: 50 - 80% recovery.
 - d. Penetration: 0°F, 150 grams, 5 seconds: 18 - 80
 - 3. Provide material capable of a minimum 12-hour pot life at application temperature and of being re-heatable at least once (in a normal field application) without experiencing changes in application characteristics, polymer and oil separation, balling or other signs of gelling.
 - 4. Package the material in pails or boxes clearly marked with recommended pouring temperature, maximum heating temperature, shelf life if appropriate, and batch number. The size of a batch, which is any well-defined quantity produced by essentially the same process during a designated amount or time (such as an 8-hour shift), must be a minimum of 10,000 lbs.
 - 5. Lots from the same manufacturer may be commingled during application. Do not commingle materials from different manufacturers.
- D. Cold Applied Chemically Cured Joint Sealant
 - 1. Joint Sealant. Use either Type NS (Non Self-Leveling) or Type SL (Self-Leveling). Provide joint sealants that consist of a cold applied formulation that is self-priming and compatible with Portland Cement concrete. The sealants must comply with the applicable test requirements in ASTM D 5893. Acetic acid cure sealants will not be accepted.
 - 2. Backer Rod. Furnish material that is resilient closed or open cell polyethylene foam rod as recommended by the manufacturer of the sealant. Provide a backer rod compatible with the sealant, with no bond or reaction occurring between the rod and the sealant.

E. Preformed Expansion Joint Filler

1. Provide material that complies with AASHTO M 213.
2. Asphalt Expansion Joints shall be composed of asphalt, vegetable fibers, and mineral fillers, formed under heat and pressure between two asphalt-saturated felt liners. Asphalt Expansion Joints shall conform to AASHTO M33 or ASTM D994, shall be 1/2" thick and weigh approximately 3 pounds per square foot, unless shown otherwise on the Drawings.

F. Liquid Membrane Curing Compound

1. Provide liquid membrane forming compound that complies with AASHTO M 148 for Type 1-D, clear or translucent with fugitive dye, or Type 2, white pigmented compound.
2. Type 2 white pigmented compound will be further classified into Type 2 (Wax Based) and Type 2 (Other). This is to allow specifying of wax based compound for certain applications where a bond breaker is desired. Either formulation base may be supplied except when wax based is specified.
3. Do not allow water-emulsion based material to freeze. Material that has been subjected to freezing temperatures will be rejected.

G. Fly Ash as Per Division 03 Concrete, class C or F the maximum substitution of Portland Cement with fly ash shall not exceed 15% by weight.

PART 3 - EXECUTION

3.1 GENERAL

- A. Concrete pavement shall be constructed to the detailed thicknesses and to the lines and grades shown on the Drawings. Concrete shall be placed over moistened and unfrozen subgrade. The ambient temperature shall be at least 40 deg. F. and rising. If the ambient temperature exceeds 90 deg. F, the RPR has the authority to suspend operations until weather conditions improve. The subgrade shall be free of excessive moisture prior to concrete placement.

3.2 PREPARATION OF THE SUBGRADE

- A. Before placing any surfacing material on any section, complete the ditches and drains along that section to effectively drain the surface to be paved.
- B. Trim the base or subgrade to the line, grade and typical cross-section as shown in the Drawings. Maintain the subgrade or base to the as-constructed condition, repairing any encountered defects to the specifications.

- C. Maintain the subgrade surface to readily drain at all times. Protect the subgrade from damage when handling materials, tools and equipment. Do not store or stockpile materials on the subgrade.
- D. Do not place material or lay pavement on a frozen or muddy subgrade, or when it is raining or snowing.
- E. Lightly spray the subgrade or base with water to obtain a thoroughly moistened condition when the concrete is deposited on it. Do not puddle water on the grade.
- F. Do not deposit any material until the subgrade or base has been checked and approved by the RPR.
- G. Subgrade Preparation shall be of the types and thicknesses as shown on the Drawings.

3.3 PLACING REINFORCEMENT.

- A. Place pavement reinforcement at the locations shown in the Drawings. Use a sufficient number of approved metal bar supports or pins to hold all dowel bars and tie bars in proper position as required by the Drawings.
- B. Longitudinal joint tie bars and dowel bars may be installed mechanically if approved by the RPR. The satisfactory placement of the bars depends on the ability of the Contractor's operation to place and maintain the bars in their true position. When satisfactory placement is not obtained by mechanical means, the RPR may require the tie bars and dowel bars be installed ahead of placing the concrete, and that they be securely held in their exact position by staking and tying.
- C. Thoroughly coat each dowel with hard grease or other approved bond breaker as shown in the Contract Documents. The bond breaker coating shall not exceed 15 mils \pm 5 mils in thickness when averaged over 3 points measured at the $\frac{1}{4}$ points on the bar at 90° intervals around the bar.
- D. When reinforced concrete pavement is placed in 2 layers, strike off the entire width of the bottom layer to such length and depth that the sheet of fabric or bar mat may be laid full length on the concrete in its final position without further manipulation. Place the reinforcement directly on the concrete, then place the top layer of concrete, strike it off and screed it. Remove any portion of the bottom layer of concrete that has been placed more than 30 minutes, and replace it with fresh mixed concrete at the Contractor's expense. When reinforced concrete is placed in 1 layer, the reinforcement may be positioned in advance of the concrete placement or it may be placed in the plastic concrete after initial spreading, by mechanical or vibratory means.

- E. Place the wire mesh reinforcement in the pavement at the locations shown in the Drawings.
 - 1. When two layers of wire mesh reinforcement are required, support the bottom layer in the required position with bar chairs. Use separators for the top layer if the strike-off cannot be used properly for the operation.
 - 2. Lap the reinforcement as shown in the Drawings. Laps parallel to the centerline of the pavement are prohibited except for unusual width of pavement lanes or for irregular areas.
 - 3. If the Drawings do not show dimensions for laps, the minimum lap either perpendicular or parallel to the centerline of the pavement is 6 inches.
 - 4. Fasten or tie adjacent wire mesh sheets together to hold all parts of the wire mesh sheets in the same plane.
- F. If a “wire pattern” appears on the surface of the fresh pavement, immediately modify placement procedures to eliminate the problem.
- G. Use reinforcing steel free from detrimental materials that could impair the bond between the steel and concrete.

3.4 FIXED FORM PAVING

- A. Forms.
 - 1. Use straight, metal forms having adequate strength to support the proposed operations. Each section shall be a minimum of 10 feet in length. Use forms with a depth equal to the prescribed edge thickness of the concrete, a base width at least equal to the depth of the forms and without a horizontal joint.
 - 2. Forms to be used as track for subgrade planers and finishing machines shall have a base width at least eight inches wide.
 - 3. Use flexible or curved forms of proper radius for curves of 150 foot radius or less, except approved straight forms of 5 foot lengths may be used for curves of a radius from 75 to 150 foot. Flexible or curved forms must be approved by the RPR.
 - 4. The RPR may approve the use of wood forms in areas requiring hand finishing.
 - 5. Secure the forms in place to withstand the impact and vibration of the consolidating and finishing equipment without visible spring or settlement. Extend flange braces outward on the base a minimum of $\frac{2}{3}$ the height of the form.
 - 6. Remove forms with battered top surfaces or bent, twisted or broken forms. Do not use repaired forms until they have been inspected and approved by the RPR.
 - 7. Do not use buildup forms, except where the total area of pavement of any specified thickness on the project is less than 2,000 square yards.
 - 8. Do not vary the top face of the form from a true plane more than $\frac{1}{8}$ inch in 10 feet, and do not vary the vertical face of the form by more than $\frac{1}{4}$ inch.
 - 9. The forms shall contain provisions for locking the ends of abutting form sections together tightly, and for secure setting.

10. Provide a foundation under the forms that is compact and true to the specified grade so that the whole length of the form will be set firmly in contact with the grade.

B. Form Setting.

1. Set forms sufficiently in advance of the point where concrete is being placed so that line and grade may be checked.
2. After the forms have been correctly set, thoroughly tamp the grade mechanically at both the inside and outside edges of the base of the forms.
3. Stake forms into place with a minimum of 3 pins for each 10 feet section. Place a pin at each side of every joint.
4. Tightly lock form sections, free from play or movement in any direction.
5. Do not deviate the form from true line by more than ¼ inch at any point.
6. No excessive settlement or springing of forms under the finishing machine is permitted.
7. Clean and oil forms before the placing of concrete.

C. Grade and Alignment.

1. Check the alignment and grade elevations of the forms immediately before placing the concrete and make any necessary corrections. When any form has been disturbed or any grade has become unstable, reset and recheck the form.

D. Removing Forms.

1. Unless otherwise provided, do not remove forms from freshly placed concrete until it has set for a minimum of 12 hours, except auxiliary forms used temporarily in widened areas.
2. Remove forms carefully to avoid damage to the pavement.

3.5 SLIP FORM PAVING

A. Equipment

1. Use standard manufacture, slip form paving equipment capable of spreading, consolidating, screeding and float finishing freshly placed concrete in one pass. Use slip form equipment capable of producing a homogeneous pavement to the specified cross-section, profile and density.
2. Use slip form paving equipment that is automatically controlled (from a reference system) in regard to line and grade.
3. Use slip form paving equipment equipped with traveling side forms. The traveling side forms shall trail behind the paver a sufficient distance to prevent edge slump of the concrete pavement.
4. Use all the component parts recommended by the manufacturer of the slip form paving equipment.

5. If any unit of the paving train shall operate on adjacent pavement, protect the adjacent pavement.

B. Operations

1. Once the paving operation has started, provide adequate equipment and supply of materials to maintain continuous placement for any given working period. Keep all concrete conveying equipment clean.
2. Do not apply any tractive forces to the slip form paver, except that which is controlled from the machine.
3. Trim to grade the subgrade or surface of the base over which the tracks of the paver will travel. Do not disturb this surface with other equipment. If the equipment or method of operation requires the subbase to be wider than shown in the Drawings, place additional material to provide an adequate surface for the tracks of the paver.
4. Upon completion of the paving operations, remove or repair any base material damaged by the slip form paver's tracks. All necessary construction and removal of this additional base material is subsidiary to other items of the contract.
5. Operate the paver continuously, stopping only when absolutely necessary. If the forward motion of the paver is stopped, immediately stop the vibrator and tamping elements.
6. Deposit the concrete on the grade in successive batches to minimize re-handling. Place concrete over and against any joint assemblies so the joint assembly is retained in its correct position. Spread the concrete using approved mechanical spreaders to prevent segregation and separation of the materials.
7. After striking the concrete off with the spreader, leave sufficient concrete in place to allow the final shaping by the use of screeds, templates and pans, depending on make, model and type of machines approved for use in the paving train. Adjust the paving units to meet the required final cross-section, minimizing the need to carry back concrete to fill voids or depressions. Adjust each screed or template so a uniform roll of concrete extends the full length of the screed or template and allows just enough concrete to pass under the unit to properly feed the next machine. Do not shove large volumes of concrete with the screed or template. Adjust the screed or template to maintain a uniform cross-section.
8. Use multiple spreaders for single and multiple lift operations. Place concrete ahead of the initial spreader strikeoff no more than 30 minutes ahead of the final spreader strikeoff.

9. The use of any paving machine in the paving train is contingent on its ability to finish the pavement satisfactorily to the required grade, section and specified degree of consolidation. The RPR may at any time require the adjustment, repair or replacement of the machine for unsatisfactory performance.
10. Correct any edge slump of the pavement in excess of ¼ inch, exclusive of edge rounding, before the concrete hardens. Excessive edge slumping will be sufficient reason to discontinue paving until machinery (or mix) is properly adjusted or removed from the project.
11. When the machine finishing has been completed, check the surface with a straightedge a minimum of 10 feet in length before texturing. Operate the straightedge parallel to the pavement centerline, starting at the center and progressing outward. Advance in successive stages of less than ½ the length of the straightedge. At the Contractor's option, this requirement may be eliminated when smoothness is to be determined by the profilograph.
12. If any unit of the paving train shall operate on adjacent pavement, protect the adjacent pavement.

3.6 CONSOLIDATION AND FINISHING

- A. Perform hand spreading with shovels, not rakes. Do not allow workers to walk in the fresh concrete with boots or shoes coated with earth or foreign substance.
- B. Do not apply moisture to the surface of the concrete pavement unless the RPR approves the use of additional water on the fresh concrete surface to lubricate the float of the longitudinal finisher. If unusual weather conditions require the addition of superficial water to the concrete surface, apply it only in the form of a fine, fog mist.
- C. Consolidate and finish the concrete to the cross-section and elevation shown in the Drawings.
- D. Use vibrators or other approved equipment to consolidate each layer of concrete, when placed in more than 1 lift, or full depth if placed in 1 lift. Uniformly vibrate the concrete across the full width and depth of the pavement so that the density of pavement concrete is a minimum of 98% of the vibrated unit weight. The 98% density requirement may be eliminated on miscellaneous areas such as entrance pavement, median pavement and gore areas.
- E. Vibrators, either of the surface type (pan or screed) or the immersion type (tube or spud) may be attached to the spreader, paver or finishing machine, or may be mounted on a separate carriage. Only operate the vibrators when the machine they are mounted on is moving forward. Do not operate hand vibrators more than 15 seconds, or less than 5 seconds in any one location unless approved otherwise by the RPR. Place vibrators in and withdraw from concrete vertically in a slow deliberate manner.

F. Additional requirements for vibrators for concrete pavement:

1. The frequency of vibration of surface, pan or screed vibrators shall be a minimum of 3,500 cycles per minute,
2. The frequency of vibration of immersion tube vibrators attached to the paving machine shall be a minimum of 5,000 cycles per minute; and
3. The frequency of vibration of immersion spud vibrators (both hand operated and gang mounted) shall be a minimum of 8,000 cycles per minute.
4. In addition, when epoxy coated reinforcing steel is involved use vibrators with heads of rubber or other resilient material. Rubber covers securely fastened over steel heads shall be acceptable. The requirement does not apply to dowel bars and tie bars for pavement.

G. Maintain a uniform, continuous roll of concrete over the vibrators ahead of the strike-off. The height of the roll shall be approximately the same height as the thickness of the pavement being vibrated.

H. In order to obtain concrete consolidation in the vicinity of joint assemblies, the RPR may require that these areas be hand vibrated with an immersion spud vibrator.

I. On projects or areas within projects where the use of conventional equipment is impracticable, other consolidation and finishing equipment may be used with approval of the RPR.

3.7 TEXTURING

A. Provide a transverse or longitudinal tined finish where shown in the Drawings.

1. Use a burlap drag as soon as all excess moisture has disappeared and while the concrete is still plastic enough to make a granular surface possible.
2. Following the dragging operation, make a final finish or texture of the surface of the plastic pavement with grooving equipment with a metal comb that is capable of producing a uniform pattern of longitudinal grooves approximately 3/16 inch wide, spaced at 3/4 inch centers and 1/8 to 1/4 inch deep. Perform the operation at such time to minimize displacement of larger aggregate particles and before the surface permanently sets.

B. Unless otherwise noted in the Drawings, parking lot pavement, curb and gutters, sidewalks, driveways, valley gutters and other similar exposed, slab on grade construction shall receive a light broom finish.

C. Before final texturing, finish the exposed edge of the pavement to a radius of 1/4 inch with an edger. Edge the interior longitudinal joints on multiple-lane pavement to a radius of 1/8 inch. Eliminate any tool marks appearing on the slab adjacent to the joints or edge of the slab. Do not disturb the rounding of the corner of the slab.

3.8 JOINTS

A. General:

1. Construct joints according to the Drawings. Failure to construct the joints in the best possible manner will be cause for suspension of work until the cause of the defective work is remedied.
2. If existing pavement of any type is required to abut with the new pavement, and the termination of the removal is not at an existing joint, make the new joint by sawing the existing pavement full depth with a diamond saw before removal.
3. The objective is to create or form a plane of weakness in the fresh concrete before uncontrolled or erratic cracking occurs. The following methods are acceptable:
 - a. Use concrete saws to saw all contraction joints no wider than the initial saw cut and to a depth of $D/3 \pm 1/4$ inch. Extreme conditions could exist which make it impracticable to prevent erratic cracking by sawing the joints early. At the onset of the project, devise methods, with the approval of the RPR, to control this cracking.
 - b. Make a “plastic concrete cut” straight and well defined so it can be sawed out by the saw crew. The “plastic concrete cut” would replace the specified initial saw cut. Suggested procedures could be the use of a stiff metal parting strip, with or without handles that would be gently inserted in the fresh concrete and removed, thereby parting the interlocking coarse aggregate and providing a plane of weakness.
 - c. Cut the fresh concrete with a mason’s trowel and straightedge from a worker’s bridge. It is imperative that the “plastic concrete cut” joint and the second stage saw cut are in the same exact location.
 - d. At the Contractor’s option, “early entry” saws may be used based on satisfactory performance and depth of cut recommended by the equipment manufacturer.
 - e. Procedures to control erratic cracking are not limited to these examples.
4. Edge any transverse joint requiring hand finishing and edging with a tool having a radius of $1/8$ inch. Do not indent the surface of the pavement with the horizontal face of the edger.

B. Contraction Joints.

1. Install contraction joints of the type, dimensions and spacing shown in the Drawings.
2. Dowel Joints.
 - a. Stretch a stringline along the centerline of the joint, or otherwise adequately mark it to assure dowel bar joint assembly alignment.

- b. Install the dowel bar joint assembly so the centerline of the assembly is perpendicular to the centerline of the slab, and the dowels lie parallel to the slab surface and slab centerline. Place concrete so it will not displace or disarrange the joint assembly. Mark the location of contraction joints to assure the joints are sawed in the proper location.

C. Longitudinal Joints.

1. Construct longitudinal joints according to the Drawings. When sawed joints are specified or used, provide approved guide lines or devices to cut the longitudinal joint on the true line as shown in the Drawings. Perform the sawing of longitudinal joints at a time that will prevent erratic or uncontrolled cracking. When “plastic concrete cut” methods are used, no sawing or widening of the joint will be required to make a sealant reservoir.

D. Construction Joints.

1. Make a butt construction joint perpendicular to the centerline of the pavement at the close of each day’s work, or when the process of depositing concrete is stopped for a length of time sufficient for the concrete to take its initial set. Form this joint by using a clean header having a nominal thickness of 2 inches, and minimum cross-sectional area equal to pavement thickness by pavement width. Cut the header true to the crown of the finished pavement. Accurately set and hold it in place in a plane at right angles to centerline and perpendicular to the surface of the pavement.
2. Protect the top surface of the header with steel. Securely fasten a trapezoidal piece of metal or wood approximately 2 inches wide and a minimum of 1 inch in depth on the face of the header, along the center of the header to form a grooved or keyed joint.
3. With approval of the RPR, the Contractor may pave beyond the joint location a distance to maintain the line and grade. Saw the construction joint when the concrete has hardened. Drill holes for reinforcing tie bars and epoxy the bars in-place. Place fresh concrete against the previously placed concrete taking care to avoid injury to the edge. Vibrate the concrete to obtain an interlocking joint and prevent a honeycombed face of the joint. The additional concrete, removal of debris and other work created by this alternative is at the Contractor’s expense.
4. Unless shown otherwise in the Drawings, do not place any construction joint within 5 feet of an expansion, contraction or other construction joint.

E. Isolation (Expansion) Joint Construction

1. Isolation joints shall be formed around fixed objects, structures, walks and where indicated in the Drawings.

F. Special Joint Construction.

1. Construct special joints as shown in the Drawings or as ordered by the RPR around drainage, utility and other structures located within the concrete pavement boundaries. Hold temporary forms securely in place during the concrete placement operation.

G. Joint Construction.

1. Construct all joints as shown in the Drawings. Repair or replace any curing medium damaged during joint construction. Construct joints as follows:
 - a. Induced Plane of Weakness. The first saw cut is a relief cut at the proper joint location, approximately $\frac{1}{8}$ inch wide and to the full joint depth as shown in the Drawings ($D/3 \pm \frac{1}{4}$ inch). Make the relief cut as soon as the concrete has hardened enough so that no excess raveling or spalling occurs, but before any random cracks develop. The sequence of the relief sawing is at the Contractor's option, provided all relief sawing is completed before random cracking develops. Use suitable guide lines or devices to cut the joint straight and in the correct location. Repair curing membrane damaged during sawing as directed by the RPR. Alternate methods to the first stage sawing as specified in this Section may also be used.
 - b. Reservoir Construction. Do not perform widening of the relief joints to full width until the concrete is a minimum of 48 hours old. Delay it longer if the sawing causes raveling of the concrete. If second stage sawing is performed before completion of the curing period, maintain the cure by use of curing tapes, plastic devices or other materials approved by the RPR. Center the joint groove over the relief cut, and saw it to the dimensions shown in the Drawings. Should any spalling of the sawed edges occur that would detrimentally affect the joint seal, patch it with an approved epoxy patching compound and allow it to harden before installing the joint material. Make each patch true to the intended neat lines of the finished cut joint.

H. Cleaning Joints.

1. Immediately clean freshly cut sawed joints by flushing with a jet of water under pressure and other necessary tools to remove the resulting slurry from the joint and immediate area.
2. To clean the joints, use air compressors equipped with suitable traps capable of removing all surplus water and oil from the compressed air. When contaminated air is found to exist, work will be stopped until suitable adjustments are made, and the air stream is found to be free of contaminants.
3. Just before applying the hot or cold joint sealant, complete a final cleaning by air blasting to clean incompressibles from the joint.

I. Sealing Joints.

1. The joint location, size and configuration is shown in the Drawings. Use applicable materials to obtain the required joint sealant configuration. Seal longitudinal pavement joints full depth with either a cold applied chemically cured joint sealant or a hot joint sealing compound. Use only 1 type of longitudinal joint sealant on a project, unless otherwise approved by the RPR. Seal joints before opening to traffic.
2. Cold Applied Chemically Cured Joint Sealants.
 - a. Do not seal joints until they are clean and dry, and the pavement has attained the age recommended by the manufacturer of the sealant. Do not apply sealant to damp concrete, or install it during inclement weather. Place the sealer full depth in close conformity with dimensions shown in the Drawings. Any deviation will be cause for rejection of the joint until satisfactory corrective measures are taken. Do not apply joint sealant when the ambient air temperature is below 40°F, or as specified by the manufacturer.
 - b. Apply the joint sealant by an approved mechanical device. Any failure of the joint material in either adhesion or cohesion will be cause for rejection. Repair the joint to the RPR's satisfaction.
 - c. Some cold applied, chemically cured sealants are not self-leveling and will not position properly in the joint under its own weight. Tool the sealant surface as shown in the Drawings. Accomplish tooling before a skin forms on the surface. The use of soap or oil as a tooling aid is prohibited.
 - d. After a joint has been sealed, promptly remove all surplus joint sealer from the pavement or structure surfaces.
 - e. Do not permit traffic over sealed joints until the sealer is tack free, or until debris from traffic cannot imbed into the sealant.
3. Hot Applied Joint Sealing Compound.
 - a. Do not seal joints until they are clean and dry, and the pavement has attained the age recommended by the manufacturer of the joint sealing compound. Install joint sealing compound according to the manufacture's recommendations.
 - b. Completely clean out the application unit when changing brands of materials, or if the material exhibits any sign of changes in application characteristics, polymer or oil separation, balling or any signs of jelling. If the application unit contains compatible material from a previous project at start-up, provide the RPR a certification covering the material in the application unit, including the manufacturer, type, etc. Material that cannot be identified and certified shall be completely cleaned out before start-up.
 - c. After a joint has been sealed, promptly remove all surplus joint sealer from the pavement or structure surfaces.

- d. Do not permit traffic over sealed joints until the sealer is tack free, or until debris from traffic cannot imbed into the sealant.

3.9 PROTECTION AND CURING OF CONCRETE

- A. Cure the pavement by using burlap, liquid membrane-forming compounds, white polyethylene sheeting, concrete curing blankets or reinforced white polyethylene sheeting. Failure to provide proper curing is cause for immediate suspension of the concreting operations.
- B. Burlap, Concrete Curing Blankets, White Polyethylene Sheeting and Reinforced White Polyethylene Sheeting.
 1. Place the curing material on the pavement immediately after the pavement has been finished, and the concrete has hardened sufficiently to avoid harmful marring of the surface, yet early enough to prevent undue loss of moisture from the concrete. If the pavement becomes dry before the curing material is placed, moisten the concrete with a fine spray of water. Place burlap-polyethylene blankets with the dampened burlap side down. Dampen burlap and place on the surface. Keep burlap damp throughout the entire curing period.
 2. Lap adjacent units of curing materials approximately 18 inches. Upon removal of the forms, extend the material to completely cover the full depth of the exposed pavement.
 3. Weight the curing material down using continuous windrows of earth placed along the sides and edges of the pavement and transversely across the pavement on the laps to cause the material to remain in contact with the covered surface throughout the curing period. Other methods may be used with approval of the RPR.
 4. Walking on the pavement surface to place the curing material is prohibited. Walking on the curing material is prohibited until the pavement has cured sufficiently to prevent damage to the surface.
 5. Leave the curing material in place for a minimum of 4 days, unless otherwise directed by the RPR. Immediately repair any tears or holes appearing in the material during the curing period, or replace it with material in good condition.
 6. The material may be reused, provided it is kept serviceable by proper repairs, and if in the judgment of RPR it will provide water retention during the curing period.
- C. Liquid Membrane-Forming Compounds.
 1. After finishing operations have been completed and immediately after the free water has left the surface, completely coat and seal the surface of the slab with a uniform layer of white membrane curing compound. Apply the compound in 1 application at a minimum rate of 1 gallon per 150 square feet of surface. Thoroughly mix the curing compound at all times during usage. Do not dilute the white membrane curing compound.

2. Protect the treated surface from injury a minimum of 4 days, unless otherwise directed by the RPR. If the newly coated film is damaged in any way, apply a new coat of material to the affected areas equal in coverage to that specified for the original coat. A minimum of foot traffic will be permitted on the dried film as necessary to properly carry on the work, provided any damage to the film is immediately repaired by application of an additional coat of compound.
3. Immediately after the forms are removed (fixed form and slip form), coat the entire area of the sides of the slab with white membrane curing compound at the rate specified for the pavement surface, regardless of whether or not further concrete placement will be made against the pavement edge. Approved hand spray equipment will be permitted only for the application of curing compound on the sides of the slab, for repairing damaged areas and for hand finished areas. Repair any damaged areas caused by joint sawing.

3.10 OPENING TO TRAFFIC

- A. No motorized traffic is allowed on the pavement until all of the following conditions are met.
 1. Construction Traffic Only.
 - a. The flexural strength of the pavement shall meet or exceed 450 psi. Determine the flexural strength of the pavement by testing flexural strength specimens utilizing the third point loading method, or by use of a calibrated maturity meter.
 - b. If testing is not done, observe a 4 day curing period before allowing motorized traffic on the pavement.
 - c. Provide protection to keep foreign material out of the unsealed joints by an approved method.
 2. All Traffic.
 - a. In addition to requirements for Construction Traffic Only given above, the joints shall be sealed according to this Section.
 - b. The pavement surface shall be swept and/or washed down to remove all dirt, debris or foreign materials prior to opening to traffic
 3. The Contractor may, at own expense, increase the cement content from the minimum as per Division 03 Concrete to accelerate the strength gain of the Portland Cement Concrete Pavement.

3.11 COLD WEATHER CURING.

- A. Maintain the concrete pavement at a minimum temperature of 40°F, as measured along the surface of the concrete, for a minimum of 4 days after placing. When the ambient air temperature is expected to drop below 35°F, anytime during the curing period, take precautions to maintain the concrete temperature. Keep a sufficient supply of approved moisture barrier material, other than liquid curing compound, and suitable blanketing material, such as straw, hay and burlap close by. Be prepared to cover the pavement with a moisture barrier and protect all pavement less than 4 days old with blanketing material. Remove, dispose of and replace concrete damaged by cold weather, as determined by the RPR.

3.12 QUALITY CONTROL.

- A. Field testing and sampling of materials shall conform to the requirements of Division 03 Concrete.
- B. Laboratory testing of materials shall conform to the requirements of Division 03 Concrete
- C. Correction of deficient materials shall conform to the requirements of Division 03 Concrete.

END OF SECTION

SECTION 32 17 23
PAVEMENT MARKINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes pavement markings applied to asphalt and concrete pavement.

1.2 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Pavement Marking Paint
 - 2. Thermoplastic Materials.
 - 3. Cold Plastic Materials.
 - 4. Glass Beads.
 - 5. A copy of the manufacturer's application instructions.
- B. Contractor Certifications
 - 1. Provide a letter of certification from the pavement marking manufacturer indicating the Contractor's qualifications to install their product.
 - 2. Provide a minimum of 1 employee on the project holding an American Traffic Safety Services Association (ATSSA) pavement marking certification and experienced in the application of the appropriate type of pavement marking material.

1.3 FIELD CONDITIONS

- A. Environmental Limitations: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 45° F, and not exceeding 95° F.

PART 2 - PRODUCTS

2.1 PAVEMENT-MARKING PAINT

- A. Pavement-Marking Paint: Alkyd-resin type, lead and chromate free, ready mixed, complying with AASHTO M 248, Type N; colors complying with FS TT-P-1952.
 - 1. Color: As indicated.

2.2 THERMOPLASTIC PAVEMENT MARKING MATERIAL

- A. This specification covers thermoplastic materials suitable for use as retroreflective pavement markings on asphalt and Portland Cement concrete pavements. The material is applied to the pavement in molten form. Glass beads are pre-mixed into the material furnished, and also dropped on the surface of the molten material immediately after it is applied to the pavement surface, at a rate specified. Upon cooling to normal pavement temperature, it produces an adherent retroreflectorized stripe of specified thickness and width, capable of resisting deformation by traffic.
- B. The following General Requirements shall apply:
1. Provide the material in white and/or yellow as specified.
 2. A binder-sealer is required for applications involving asphalt over 2 years old, or for asphalt surfaces that are worn or oxidized to a condition where 50% or more of the wearing surface is exposed aggregate.
 3. Do not commingle materials from different manufacturers.
- C. Thermoplastic Material and Premix Beads.
1. Provide thermoplastic material that complies with AASHTO.
 2. M 249 with the following restrictions:
 - a. Only maleic modified glycerol ester alkyd based resins will be allowed for the binder system.
 - b. Yellow pigments must comply with the latest OSHA standards for toxic heavy metals.
- D. When binder-sealer is specified, provide one that is recommended by the manufacturer of the thermoplastic material, and apply it according to the manufacturer's instructions. The binder-sealer must be compatible with the pavement material, and form a tight bond between the pavement and the thermoplastic material.
- E. Color: For yellow, meet the following minimum chromaticity coordinates:

TABLE I CHROMATICITY COORDINATES								
COLOR	1		2		3		4	
	X	Y	X	Y	X	Y	X	Y
Yellow	0.475	0.450	0.490	0.433	0.520	0.450	0.495	0.475

The yellow lines must also display a nighttime presence of yellow when viewed under automobile headlights.

- F. Provide thermoplastic that complies with the minimum retroreflectivity requirements in Table 2 using an acceptable 30-meter retroreflectometer:

TABLE 2 THERMOPLASTIC RETROREFLECTIVITY REQUIREMENTS	
Color	millicandelas/sq m/lux (min.)
White	300
Yellow	225

2.3 COLD PLASTIC

- A. This specification covers cold plastic pavement marking materials for use on both concrete and asphalt surfaces.
- B. Provide performed pavement markings that comply with ASTM D 4505 with the following exceptions and additions:
 - 1. Delete all references to application temperatures.
- C. Retroreflectivity: Provide pavement markings that comply with the following minimum retroreflectivity requirements in Table 3 using and acceptable 30-meter retroflectometer:

TABLE 3 COLD PLASTIC RETROREFLECTIVITY REQUIREMENTS	
Color	millicandelas/sq m/lux (min.)
White	250
Yellow	175

2.4 MULTI-COMPONENT LIQUID PAVEMENT MARKING

- A. This specification covers multi-component, liquid materials suitable for use as retroreflecting pavement markings on Portland Cement concrete or asphalt pavements. These can be modified urethanes, polyureas, methylmethacrylates, special epoxies or other applicable materials. Glass beads or other reflective elements are dropped at a specified rate on the surface of the liquid material immediately after it is applied to the pavement surface. Upon curing, it produces an adherent retroreflective marking of specified thickness and width, capable of resisting deformation by traffic.
- B. Provide the material in white and yellow. For yellow, meet the following minimum chromaticity coordinates:

TABLE 4 CHROMATICITY COORDINATES								
COLOR	1		2		3		4	
	X	Y	X	Y	X	Y	X	Y
Yellow	0.461	0.445	0.490	0.424	0.520	0.450	0.495	0.475

- C. Provide material that is a homogeneous blend of liquid resins, pigments, and fillers and is also free of lead and other toxic heavy metals.

2.5 EPOXY LIQUID PAVEMENT MARKING

- A. This specification covers epoxy resin and glass beads suitable for use as reflective pavement markings on Portland Cement concrete or asphalt pavement.
- B. General:
 - 1. Provide an epoxy resin material that is toxic heavy metal free, 2-component, 100% solids, and is formulated and tested to perform as a pavement marking material with glass beads applied to the surface. The 2 components are an epoxy resin and an amine curing agent. Provide complete manufacturer's specifications and material safety data sheets to the Engineer for all material provided.
 - 2. Provide a material that does not exude toxic fumes when heated to application temperature.
 - 3. Provide a material that, when mixed in the proper ratio and applied at 0.02 inch wet film thickness at 75° F with the proper saturation of glass beads, has a no tracking time of less than 40 minutes for slow curing material and less than 10 minutes for rapid curing material. Provide a material that is capable of fully curing under a constant surface temperature of 32° F or above.
- C. Properties of Cured Material.
 - 1. Color. Provide white and yellow material that complies with the following Daylight Reflectance values and minimum chromaticity coordinates:

TABLE 5	
COLD PLASTIC RETROREFLECTIVITY REQUIREMENTS	
Color	45 Degrees – 0 Degrees, % Min.
White	75
Yellow	45

TABLE 6 CHROMATICITY COORDINATES								
COLOR	1		2		3		4	
	X	Y	X	Y	X	Y	X	Y
Yellow	0.461	0.445	0.476	0.424	0.520	0.450	0.495	0.475

2. Retroreflectivity. Provide epoxy pavement marking material that meets the following minimum retroreflectivity requirements using an acceptable 30-meter retroreflectometer:

TABLE 7 EPOXY RETROREFLECTIVITY REQUIREMENTS	
Color	millicandelas/sq m/lux (min.)
White	325
Yellow	250

3. Hardness. Provide material with Shore D hardness of 75 minimum.
4. Bond Strength to Concrete. Provide material that when catalyzed, has such a high degree of adhesion to the specified concrete surface that there is a 100% concrete failure. Apply the material at a film thickness of 0.01 ± 0.001 inch to concrete with a minimum compressive strength of 4000 psi. Allow the material to cure for 72 hours at 77° F before the test is performed.
5. Yellowness Index. White only. Value after 72 hours in QUV – 30 maximum when tested at 0.01 ± 0.001 inch and a 72-hour cure.

2.6 GLASS BEADS FOR DROP-ON APPLICATION

- A. Provide regular beads that are specifically manufactured to be compatible with the marking system used, and comply with AASHTO m 247, Type I.
- B. When a double drop system using both regular beads and large beads is specified, provide large beads that are also compatible with marking system used, and comply with AASHTO M 247, except with the following gradations *FP-96, Type 4):

TABLE 8 GLASS BEAD	
Sieve Size	Percent Passing
No. 10	100
No. 12	95-100
No. 14	80-95
No. 16	10-40
No. 18	0-5
No. 20	0-2

PART 3 - EXECUTION

3.1 GENERAL

- A. Verify that pavement is dry and in suitable condition to begin pavement marking according to manufacturer's written instructions.
- B. Proceed with pavement marking only after unsatisfactory conditions have been corrected.
- C. Use equipment designed for the preparation and application of the appropriate type of pavement marking material.
- D. On existing pavements, remove the existing pavement markings according to the recommendations of the manufacturer of the new pavement markings. Remove the existing pavement markings and symbols without damaging the pavement surface. As the work progresses, remove all material deposited on the pavement as a result of the removal operations. Use methods approved by the Engineer to repair all pavement damaged during the pavement marking removal operations. Remove temporary pavement markings, if any, the same day the durable pavement markings are applied. Remove loose particles, dirt, tar, grease, residue of prior pavement markings and other deleterious material from the pavement surfaces.
- E. Lay out the pavement marking as detailed in the Drawings. If the Drawings do not provide details, submit to the Engineer for approval, a layout plan for the pavement markings that complies to the MUTCD. Locate longitudinal pavement marking stripes a minimum of 2 inches and a maximum of 8 inches from longitudinal joints. Provide adequate guide marks (approximately 2 inches by 12 inches at approximately 30 to 50 foot intervals) for the application of the pavement markings.
- F. Apply the pavement markings according to the manufacturer's recommendations.
- G. Follow the manufacturer's recommendations regarding pavement and ambient temperature at the time of application. The Engineer will verify the pavement and ambient temperatures before beginning work and when deemed necessary. Apply pavement markings straight and close to the intended alignment without abrupt changes that result in an unacceptable appearance.

3.2 PAINTED PAVEMENT MARKING

- A. Allow asphalt paving to age for a minimum of 30 days before starting pavement marking.

- B. Marking-paint manufacturers caution that paint will bleed or tear surface of new asphalt unless asphalt is aged before painting. This aging period may vary from 30 to 90 days. If pavement marking must proceed immediately, consider revising text to a phased application of a thin first coat followed by a thicker second coat once asphalt has aged. Verify that two-coat application is recommended by marking-paint manufacturer.
- C. Sweep and clean surface to eliminate loose material and dust.
- D. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.
 - 1. Apply graphic symbols and lettering with paint-resistant, die-cut stencils, firmly secured to pavement. Mask an extended area beyond edges of each stencil to prevent paint application beyond the stencil. Apply paint so that it cannot run beneath the stencil.
 - 2. Broadcast glass beads uniformly into wet markings at a rate of 6 lb/gal.

3.3 COLD PLASTIC/PATTERNED COLD PLASTIC PAVEMENT MARKING

- A. Grind an inset for the pavement marking into the surface of the pavement. Grind the inset 0.04 ± 0.01 inch deep, with the width and length of the inset a maximum of 2 inches greater than the dimensions of the pavement marking.
- B. On new or existing PCCP, cut the marking tape at any joint in the pavement that is crossed by the tape.
- C. When recommended by the manufacturer, use heat, solvent or other types of adhesive primer.

3.4 EPOXY LIQUID PAVEMENT MARKING

- A. When pavement markings are applied to Portland Cement Concrete pavement or bridge decks less than 1 year old, remove all curing compounds and laitance by shot or sand blasting.
- B. Use a slower curing epoxy material (40 minutes) for pavement markings applied to Portland Cement Concrete. For other surfaces, fast setting (10 minutes) epoxy material may be used with approval of the Engineer.
- C. Apply the epoxy liquid material closely behind the surface cleaning procedures.
- D. Before mixing the components of the pavement marking material, heat the individual components to the temperature ranges recommended by the manufacturer of the material. Do not exceed the maximum recommended temperature at any time.

- E. Apply the epoxy liquid pavement marking material at a thickness of 20 mil \pm 5 mil on asphalt and Portland Cement Concrete.
- F. Immediately apply all glass beads (double drop system) to the epoxy liquid pavement marking at the rate of 25 pounds per gallon of epoxy liquid, equally divided between the large and regular bead gradations. Do not mix large and regular gradation beads. Keep and apply large and regular beads separately. Apply the large beads on the first drop and the regular beads on the second.

3.5 MULTI-COMPONENT LIQUID PAVEMENT MARKING

- A. When pavement markings are applied to Portland Cement Concrete Pavement or bridge decks less than 1 year old, remove all curing compounds and laitance by shot or sand blasting.
- B. Apply the multi-component liquid material closely behind the surface cleaning procedures.
- C. Before mixing the components of the pavement marking material, heat the individual components to the temperature ranges recommended by the manufacturer of the material. Do not exceed the maximum recommended temperature at any time.
- D. Apply the multi-component liquid pavement marking material at the thickness recommended by the manufacturer on asphalt and concrete surfaces. Immediately apply the glass beads (double drop system) to the multicomponent liquid pavement marking at the rate recommended by the manufacturer to obtain the required level of retroreflectivity, equally divide between the large and regular bead gradations. Apply the large beads on the first drop and the regular beads on the second.

3.6 INTERSECTION GRADE PAVEMENT MARKING

- A. For Multi-Component Materials: Follow subsection 3.4 above.
- B. High Durability Tape. Grind an inset for the pavement marking into the surface of the pavement. Grind the inset 40 mil \pm 10 mil deep with the width and length of the inset a maximum of 2 inches greater than the dimensions of the pavement marking.
- C. On new or existing Portland Cement Concrete, cut the marking tape on either side of any joint in the pavement that is crossed by the tape.
- D. When recommended by the manufacturer, use heat, solvent or other type of adhesive primer.
- E. Preformed Thermoplastic. Use a heating device recommended by the material manufacturer to fuse the preformed thermoplastic to the pavement. Apply the pavement markings as recommended by the manufacturer.

- F. When recommended by the manufacturer, use solvent or other type of adhesive primer.

3.7 ALL THERMOPLASTIC PAVEMENT MARKING

- A. Apply thermoplastic pavement markings between April 15 and October 15. If the manufacturer's recommendations allow, the Engineer may waive the date restrictions. The Engineer will notify the Contractor in writing of any allowed variance.
- B. Thermoplastic Pavement Marking
 1. The required thickness for longitudinal markings is a minimum of 90 mil at the edges, and a maximum of 125 mil at the center of the stripe. The required thickness for transverse markings and symbols is a minimum of 125 mil at the edges, and a maximum of 160 mil at the center.
 2. If used, apply the binder-sealer according to the manufacturer's recommendations. The Engineer will not approve the application of the thermoplastic material until the binder-sealer applied to the pavement is devoid of all solvent or water. The Engineer may waive the use of binder-sealer on new pavement and existing surfaces with less than 20% exposed aggregate.
 3. Apply prepared thermoplastic material in a molten state within a temperature range of 400 to 440 ° F. The Engineer will not approve the use of scorched material or prepared material that has been maintained at 440 ° F for a period exceeding 4 hours.
 4. Apply Type 1 glass beads at a minimum rate of 15 pounds per 100 square foot. Embed glass beads in the thermoplastic material so that 40 to 50% of the sphere's cross-sectional diameter remains exposed.
- C. Sprayed Thermoplastic Pavement Marking
 1. Apply the pavement markings as recommended by the manufacturer at a thickness of 40 ± 5 mils.
 2. Apply prepared thermoplastic material in a molten state within a temperature range of 375 to 425 ° F. The Engineer will not approve the use of scorched material or prepared material that has been maintained at 425 ° F for a period exceeding 4 hours.

3.8 BASIS OF ACCEPTANCE

- A. Alignment: Lines that deviate laterally from the intended alignment more than 2 inches in 200 feet may be rejected.
- B. Defects: Remove and replace pavement markings that:
 1. Have drag marks, gashes, gouges, foreign covering, discolored areas or areas that have failed to solidify.
 2. Have improper adhesion, width, length or thickness.

3. Have areas that present a ragged appearance, areas that do not present sharply defined edges, or areas with abrupt unintended changes in alignment.
- C. Provide an acceptable 100 foot retroreflectometer to use on the project which will remain the property of the Contractor. In the presence of the Engineer, measure the retroreflectivity between 12 hours and 14 days after the application. Take a minimum of 10 readings per color line evenly spaced over the Project Limits. The Engineer will average all of the readings for each color line to determine the retroreflectivity.
 - D. Remove and replace all unsatisfactory pavement markings that do not comply with minimum retroreflectivity requirements as stated in Table 5.

TABLE 9 MINIMUM RETROREFLECTIVITY REQUIREMENTS		
Type of Material	Color	millicandelas/sq m/lux (minimum)(Initial)
Cold Plastic	White	250
	Yellow	175
Patterned Cold Plastic	White	475
	Yellow	375
Epoxy	White	325
	Yellow	250
High Durability Tape	White	225
	Yellow	175
Thermoplastic	White	300
	Yellow	225
Preformed Thermoplastic	White	300
	Yellow	225
Spray Thermoplastic	White	300
	Yellow	225
Multi Component	White	325
	Yellow	250

3.9 PROTECTING AND CLEANING

- A. Protect pavement markings from damage and wear during remainder of construction period.
- B. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION

SECTION 32 92 00
TURF AND GRASSES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Turf Grass Seeding.
2. Hydro Mulching.
3. Plugging.
4. Sprigging.
5. Pasture and/or Native Grasses.

1.2 SUBMITTALS

- A. Certification of Grass Seed: From seed vendor for each grass-seed monostand or mixture stating the botanical and common name, percentage by weight of each species and variety, and percentage of purity, germination, and weed seed. Include the year of production, date of packaging, and origin of seed (State).
- B. Product Certificates: For fertilizers, from manufacturer.

1.3 DELIVERY, STORAGE, AND HANDLING

- A. Seed and Other Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of conformance with state and federal laws, as applicable.
- B. Bulk Materials:
1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.

1.4 PROJECT CONDITIONS

A. Planting Seasons:

1. Seeding (Cool Season Grasses)
 - a. Spring Planting: February 15 - April 20.
 - b. Fall Planting (Preferred): August 15 - October 15.

2. Seeding (Warm Season Grasses)
 - a. November 15 - June 1.
3. Seeding (Pasture/Native Grass)
 - a. August 15 - September 20.
- B. The Engineer reserves the right to delay the drilling or seeding of any seeds or to vary the permissible seeding seasons listed above due to weather or soil conditions or for other causes.
- C. Maintenance Period:
 1. Seeded Turf: 60 days from date of planting completion.
 - a. When initial maintenance period has not elapsed before end of planting season, or if turf is not fully established, continue maintenance during next planting season.
 2. Plugged Turf: 30 days from date of planting completion.
 3. Sprigged Turf: 30 days from date of planting completion.
 4. Prairie Grass and/or Wildflowers: 60 days from date of planting completion.

PART 2 - PRODUCTS

2.1 SEED

- A. Purity/Germination: The Contractor shall provide grass seed of the variety and the rates as required to produce the live seed rates shown below or as specified on the Drawings. Live seed for each grass species is the product of the percentage of purity and the percentage of germination. The seed shall be new-crop seed complying with and labeled in accordance with U.S. Department of Agriculture "Rules and Regulations and the Federal Seed Act" in effect at date of purchase of seed. All seed shall be furnished in standard containers. Seed which has become moldy, wet, or otherwise damaged in transit or storage shall not be accepted.
- B. Seed/Fertilizer rates:
 1. Temporary Seeding

a. Annual Ryegrass

- 1) Seed Rate: 4 lbs per 1,000 sq.ft.

2. Cool Season Grass

a. Turf Type Tall Fescue Seed Blend (Kansas Premium Blend by Gard'n Wise or equal as approved by the Engineer).

- 1) Seed Rate: 8 lbs per 1,000 sq.ft. (minimum 95% purity, 80% germination)
- 2) Fertilizer: (12-24-12) @ 350 lbs per acre.

2.2 SPRIGS

- A. Sprigs shall be of the grass species specified on the Drawings, and shall be healthy, living stems and roots freshly harvested without adhering soil or weeds and obtained from heavy, vigorous growing and mowed turf. After loosening sprigs from the soil, they shall be immediately gathered in piles or windrows and kept moist until planted.

2.3 PASTURE/NATIVE GRASS AREAS

- A. Pastures and native grassed areas shall be reseeded as shown below:

TABLE 1	
SEED	APPLICATION RATE
Big Bluestem	8 lbs/acre
Brome Grass	8 lbs/acre
Switch Grass	3 lbs/acre
Western Wheatgrass	8 lbs/acre
Indian Grass	8 lbs/acre
Little Bluestem	5 lbs/acre
Side Oats	5 lbs/acre
Total	45 lbs/acre

- B. Seed Application will be 1lb/1,000 sq.ft.
- C. Fertilizer application (N-P-K) will be 12-24-12
- D. Mulch will be prairie hay applied at a rate of 2 tons/acre

2.4 FERTILIZERS

- A. Fertilizer: Fertilizer shall be proportioned as specified herein or on the Drawings and shall be of commercial grade, uniform in composition, free-flowing and suitable for application with approved equipment, delivered to the site in bags or other convenient containers, each fully labeled, conforming to the applicable State Fertilizer Laws, and bearing the same trade name or trade mark, analysis and warranty of the producer.

2.5 MULCHES

A. Hay Mulch

1. Prairie hay mulch shall normally be used. The hay shall not contain an excessive quantity of noxious weed seeds. The mulch shall be a sharp grade prairie hay, sedan grass hay or brome sedge or any other type of native hay or grass. Straw shall be 8 inches minimum; 50% shall be 10 inches in length or longer.

B. Hydro Mulch

1. Hydro-mulch shall be a bonded fiber matrix (BFM) product made from non-toxic, biodegradable, thermally processed, virgin, wood fibers that contains no growth or germination inhibiting factors and complies with the table below:

TABLE 2 - HYDRO-MULCH	
PROPERTY	REQUIREMENT
Virgin wood fibers	90% minimum
Organic matter	99% minimum
Hydrocolloid-based binder	10% minimum
“Dry” Moisture Content	9 - 15%
pH	5.5 - 7.5
Water holding capacity	13 times own weight
Dye agent color	Green or Yellow

2.6 WATER

- A. Water shall not contain substances in the amounts considered harmful for the normal growth of vegetation.

PART 3 - EXECUTION

3.1 SOIL PREPARATION

- A. Project Coordination: After the construction has been completed, (except as provided below), the site has been brought to final grades as shown on the Drawings, and other

plantings have been accomplished, the Contractor shall prepare the areas to be grassed as specified. When so directed or permitted by the Engineer, portions of the construction site may be grassed at different periods of time provided that the planting occurs in proper seasons as specified. Any grassed areas damaged by subsequent operations of the Contractor shall be replanted as directed by the Engineer at no additional cost to the Owner.

- B. Tillage: The areas required to be grassed shall be prepared for planting by cultivation, removal of all objectionable material, and filling of the gullies or depressions. The soil preparation shall be accomplished by disking, harrowing firming. (Plowing will also be required if so indicated on the Drawings.) The minimum depth of soil preparation shall be three (3) inches. Existing weed stubble, small weeds and grass that can be disked shall be cut by the disk and partially incorporated into the soil. Several diskings and harrowings over some areas may be required to provide a satisfactory seedbed. Areas too steep or otherwise inaccessible for disking shall be prepared by hand methods. The minimum depth of preparation of the seedbed where hand methods must be employed shall be two (2) inches. Disking, harrowing and raking shall be done longitudinally on slope areas. The soil preparation on all slope areas shall be performed with disks and harrows unless demonstration shows such methods impracticable and that hand methods must be used.
- C. Protection: During the process of soil preparation, extreme care shall be exercised to avoid injury to all trees that have been planted or designated by the Engineer to be saved. The Engineer may designate local areas of desirable native perennial grasses to be omitted during the soil preparation.
- D. Weed Destruction: Areas of annual grasses such as cheat, crab grass, triple-awn, etc., shall be destroyed by thorough disking prior to seeding.

3.2 TEMPORARY SEEDING

- A. Regardless of planting season, the Contractor shall seed all areas disturbed by construction activities with temporary seeding (rye grass). This temporary seeding may be omitted only if other seeding is required in accordance with project requirements. Temporary seeding or permanent seeding/sodding shall be applied within 14 days after the area has been disturbed. All costs for temporary rye grass seeding shall be considered subsidiary to other bid items, unless a specific bid item is included in the bid form.

3.3 SEEDING

- A. Seed Application: Seeds shall be uniformly distributed with acceptable drills, hydraulic-slurry, or other equipment approved by the Engineer. Broadcasting with a standard grass seeder will be required on areas where it is impossible to operate a drill and this method may also be required for certain small seeds.

- B. Combined Seeding/Fertilizing: When a standard drill with fertilizer attachment is used, certain mixed seeds may be placed in the seed box and the fertilizer placed in the fertilizer compartment. Both may be applied during one (1) operation, unless notes on the Drawings require separate applications. Fertilizer may be drilled into the soil or applied by the hydraulic-slurry. Broadcasting fertilizers is permissible on rough, rocky slopes where drills cannot operate.
- C. Broadcasting: Kentucky bluegrass, Bermuda grass and seeds of similar size shall not be mixed with the coarse types of seeds. The finer seeds may be planted with certain drills by removing the seed tubes or they may be broadcast with hand seeders. Broadcast seeding shall be done when the weather is reasonably calm so that the seed will lodge on the prepared seed bed areas.
- D. Equipment: All drills shall be fully adjustable so that they will deliver the seeds and fertilizer at the rates specified on the Drawings or ordered by the Engineer. Drills that are poor repair or that do not deliver the seeds and fertilizer uniformly in each drill furrow, shall not be used. Drills shall be adjustable so that the seeds can be planted and covered a maximum depth of 1/2 inch.
- E. Seed Covering: Most of the seeds should be drilled about one-half (1/2) inch deep in a well-prepared and firm seedbed. When the fertilizing and seeding operations start on an area, that area shall be completed as soon as possible. No seeding shall be done during windy weather or when the ground is wet or otherwise non-tillable. The grass seed shall then be covered, using a flexible toothed weeder or other suitable equipment. As soon as this covering operation has been completed, the seeded area shall be rolled again with the Culti-packer, the Culti-packer being run over the area only once parallel with the contours of the ground.
- F. Watering: The Contractor shall water the seeded areas as required to assure an acceptable stand of grass.

3.4 SPRIGGING

- A. Pre-watering: The areas to be sprigged shall be watered prior to planting when the ground is excessively dry.

- B. Sprigging: Grass sprigs of the variety and spaced as shown on the Drawings shall be established by setting root divisions in furrows two (2) inches deep, parallel to the contours, and the roots placed so that they lie end to end in the furrow. The roots shall be covered approximately one (1) inch deep, thoroughly watered and firmed. The furrows shall be left partly open to facilitate additional watering and to hold any mulch applied on slope areas. FIRMING shall be done with an approved type roller, so that the top of the sprigs will be slightly below the surrounding surface after the firming process is completed.
- C. Watering:
 - 1. Sprigged Areas: Sprigged areas shall be kept thoroughly watered for twenty (20) days. Immediately following, the Contractor shall cultivate all areas between the sprigs with hand tools, to kill all weed growth and leave the soil loose and friable. At the time of cultivating, areas that do not have a satisfactory stand of grass shall be replanted as directed by the Engineer.

3.5 APPLICATION OF FERTILIZER

- A. Fertilizer shall be distributed uniformly at rates indicated and over the area to be planted, and shall be incorporated into the soil to a depth of at least 2 inches by disking, harrowing or other methods approved by the Engineer. Distribution by means of an approved seed drill or hydro seeder equipped to sow seed and distribute fertilizer at the same time will be acceptable unless otherwise noted on the Drawings.

3.6 APPLICATION OF MULCH

- A. Applying Hay Mulch: Hay mulch shall be the required mulching material, unless specified otherwise on the Drawings or directed by the Engineer. After seeding operations are complete the mulch shall be spaced uniformly by hand, manure spreader, or other suitable equipment. The mulch shall be anchored to the soil by a V-type wheel land packer, a disk harrow set to cut slightly, or bunching by wind. Spacing between disks shall not exceed 8 inches. Apply hay mulch at the rate of 2 tons per acre or 90lbs. per 1000 sq.ft.

3.7 HYDROMULCHING

- A. Mix the BFM at a rate of 50 pounds per 100 gallons of water.

- B. Apply the BFM at the rate of (DRY) 3,500 pounds per acre of seeded and cultipacked slope, immediately after the seeding and cultipacking to maximize adhesion and minimize slumping. Obtain complete coverage with 65% of the coverage obtained from the primary angle of application and 35% of the coverage obtained from the secondary angle of application. Maintain secondary angles of coverage between 175° and 185° from the primary angle.
- C. Mixing proportions, application methods, and rates may be adjusted based on the manufacturer's recommendations and Engineer's approval.

3.8 SATISFACTORY TURF

- A. Turf installations shall meet the following criteria as determined by Engineer:
 - 1. Satisfactory Seeded Turf: At end of maintenance period, a healthy, uniform, close stand of grass has been established, free of weeds and surface irregularities, with coverage exceeding 90 percent over any 10 sq. ft. and bare spots not exceeding 5 by 5 inches.
 - 2. Satisfactory Plugged Turf: At end of maintenance period, the required number of plugs has been established as well-rooted, viable patches of grass, and areas between plugs are free of weeds and other undesirable vegetation.
 - 3. Satisfactory Sprigged Turf: At end of maintenance period, the required number of sprigs has been established as well-rooted, viable plants, and areas between sprigs are free of weeds and other undesirable vegetation.
- B. Use specified materials to reestablish turf that does not comply with requirements and continue maintenance until turf is satisfactory. All costs in connection with replanting grassed areas shall be borne by the Contractor until an acceptable stand of grass is obtained, with no additional cost of the Owner.

3.9 CLEANUP AND PROTECTION

- A. Promptly remove soil and debris created by turf work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.
- B. Erect temporary fencing or barricades and warning signs as required to protect newly planted areas from traffic. Maintain fencing and barricades throughout initial maintenance period and remove after plantings are established.
- C. Remove non-degradable erosion-control measures after grass establishment period.

END OF SECTION

SECTION 33 05 24
HORIZONTAL DIRECTIONAL DRILLING, BORING AND JACKING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Excavation for approach trenches and pits
 - 2. Horizontal Directional Drilling
 - 3. Boring and Jacking
 - 4. Casing Pipe

1.2 DEFINITIONS

- A. AASHTO: American Association of State Highway and Transportation Officials
- B. ANSI: American National Standards Institute
- C. ASTM: ASTM International
- D. AWWA: American Water Works Association
- E. CCS: Copper Clad Steel
- F. CI: Cast Iron
- G. EPA: Environmental Protection Agency
- H. HDPE: High Density Polyethylene
- I. IPS: Iron Pipe Size
- J. O&M: Operation and Maintenance
- K. OSHA: Occupational Safety and Health Administration

1.3 COORDINATION

- A. Contractor shall coordinate work with the City of Valley Center Public Works and utilities within construction area.
- B. Contractor shall obtain all necessary permits required to install the pipe using trenchless methods and for the proper disposal of drilling materials (mud, screenings, water, etc.).

- C. Contractor shall furnish all labor, materials, and equipment required to install the pipe using the trenchless methods of installation, all in accordance with the requirements of the Contract Documents. The pipe size, type and length shall be as specified herein or as shown on the drawings. Work shall include and not be limited to proper installation, testing, grouting, restoration of underground utilities and environmental protection and restoration.
- D. Contractor shall be sufficiently trained and knowledgeable of the construction technique required by the use of these trenchless methods. Contractor shall furnish all directional drilling and boring equipment, qualified laborers and equipment operators necessary to complete the required work in accordance with the project manual and associated drawings.
- E. Contractor shall obtain all additional easements or right of way required to perform the trenchless pipe installation.
- F. The length of the drill or bore shown on the drawings is the minimum required length of the installation. The Contractor may, at his option and at no expense to the Owner or Engineer, increase the length of the drill or bore during construction with approval from the Engineer.
- G. Gravity lines shall not be drilled unless otherwise approved in writing by the Engineer.

1.4 SUBMITTALS

- A. Submittals shall be made by the Contractor in accordance with the procedures set forth in Division 01.
- B. Contractor shall provide with their installation schedule, the manufacturer's catalog cuts, technical data, and/or shop drawings for the following system components (shop drawings shall be drawn to a scale sufficiently large to show all pertinent aspects of the item and its method of connection to the work):
 - 1. Pipe (Carrier and/or Casing)
 - 2. Fittings, sleeves and couplings
 - 3. Pipe restraints and welds
 - 4. Casing Spacers and End Seals
 - 5. Tracer wire
 - 6. Detectable warning tape

C. Shop Drawings:

1. Submit technical data for equipment, method of installation, and proposed sequence of construction.
2. Include information pertaining to pits, dewatering, method of spoils removal, equipment size and capacity, equipment capabilities including installing pipe on radius, type of drill bit, drilling fluid, method of monitoring line and grade and detection of surface movement, name plate data for drilling equipment and mobile spoils removal unit.
3. Data supporting the directional drilling Contractor's qualifications and experience.

D. Submit permit for installations on public right of way and lands.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Contractor shall submit a plan for installation of piping and appurtenances including their location in relation to other services or pipes in same area, drawn to scale. Show size, location and elevation of the piping and appurtenances.
- B. Field quality-control test reports.

1.6 QUALITY ASSURANCE

- A. Regulatory Requirements:
 1. Comply with the requirements including proof of insurance, and other permit requirements for construction across or along railroads, highways, local or county roads, or drainage ways.
 2. Comply with the requirements for NPDES permitting, including best management practices for storm water discharges from the construction site.
 3. Comply with requirements of utility company supplying water. Includes tapping of water mains and backflow prevention.
 4. Comply with standards of authorities having jurisdiction for potable-water-service piping, including materials, installation, testing, and disinfection.
 5. Comply with standards of authorities having jurisdiction for fire-suppression water-service piping, including materials, hose threads, installation, and testing.
 6. Comply with local, state, and federal requirements for proper disposal of drilling materials (mud, screenings, water, etc.).
- B. All applicable permits and applications must be in place prior to beginning construction. Contractor shall perform the work in accordance the permit requirements.

- C. All trenchless pipe installation operations shall be performed by a qualified Contractor with at least three (3) years of experience involving work of a similar nature to the work required for this project.
- D. All work shall be performed in the presence of the Engineer or the Resident Project Representative.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Delivery, Storage and Handling shall be in accordance with Division 33.
- B. Conduct operations so as not to interfere with, interrupt, damage, destroy, or endanger the integrity of surface or subsurface structures or utilities, and landscape in immediate or adjacent areas.
- C. Maintain access to existing items/areas indicated to remain. Modify pipe installation to maintain access to existing facilities.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Trenchless methods of pipe installation may be used in lieu of traditional trenching methods as approved by the Engineer.
- B. Should the Contractor choose to utilize trenchless installation methods in lieu of traditional trenching, no additional payment will be made unless otherwise specified or approved in writing by the Engineer.

2.2 HORIZONTAL DIRECTIONAL DRILLING (HDD)

- A. Performance / Design Criteria:
 - 1. HDD construction methods shall comply with the latest revisions of ASTM F1962. Pipe used for HDD construction must meet project specifications and shall include the use of restrained joints or butt-fused joints as specified in Division 33.
 - 2. Tracer wire, where required, shall meet the requirements as outlined in Division 33.

B. Drilling Fluid:

1. Liquid bentonite clay slurry; totally inert with no environmental risk.
2. Polymers to produce high yield bentonite can be added with approval by the Engineer.

C. Equipment:

1. Drilling Rig: Directional drilling rig shall consist of a hydraulically powered system to rotate and push hollow drilling pipe into the ground at a variable angle while delivering a pressurized fluid mixture to a guidable drill head. The machine shall be anchored to the ground to withstand the pulling, pushing and rotating pressure required to complete the installation.
 - a. The hydraulic power system shall be self-contained with sufficient pressure and volume to power drilling operations.
 - b. Hydraulic system shall be free of leaks.
 - c. Rig shall have a system to monitor and record maximum pullback pressure during pullback operations.
 - d. There shall be a system to detect electrical current from drill string and an audible alarm that automatically sounds when an electrical current is detected.
2. Drill Head: The drill head shall be steerable by changing its rotation and shall provide necessary cutting surfaces and drilling fluid jets.
3. Motors: Motors shall be of adequate power to turn the required drilling tools.

D. Drilling Fluid (Mud) System:

1. Mixing System: A self-contained, closed, drilling fluid mixing system shall be of sufficient size to thoroughly mix and deliver drilling fluid. The drilling fluid reservoir tank shall be a minimum of 1,000 gallons and the mixing system shall continually agitate the drilling fluid during operations.
2. Drilling Fluid: Drilling fluid shall be composed of potable water, bentonite clay and appropriate additives. Water shall be from an authorized source with pH of 8.5 to 10. Water with a lower pH or with excessive calcium shall be treated with the appropriate amount of sodium carbonate or approved equal. No additional material may be used in drilling fluid without prior approval by the Engineer. The bentonite mixture shall have the minimum viscosities as measured by a Marsh funnel in accordance with ASTM A139.

TABLE 1	
Soil Type	Viscosity Requirement
Rocky Clay	60 Seconds
Hard Clay	40 Seconds
Soft Clay	45 Seconds
Sandy Clay	90 Seconds
Stable Sand	80 Seconds
Loose Sand	110 Seconds
Wet Sand	110 Seconds

E. Tracking:

1. The system shall be capable of tracking at all depths of up to fifty feet in any soil condition, including hard rock and shale.
2. The Contractor shall supply all components and materials to install, operate and maintain the guidance system.

2.3 BORING AND JACKING

A. Auger Boring

1. Contractor shall use a steel encasement pipe (of approximate diameter of the pipe to be installed).
2. The auger shall be equipped with a cutter head to perform the excavation. Auger used shall be sized to convey the excavated material to the work pit.

B. Jacking:

1. Contractor shall use heavy duty jacks to complete the installation.
2. Jacking head and bracing between the jacks shall apply uniform pressure around the pipe.
3. Guides and support shall be used to direct the pipe to the proper line and grade as shown on the drawings.

2.4 STEEL CASING

- A. Steel pipe casing shall conform to the latest revision of ASTM A53 for Grade B and ASTM A139 for Grade A having a minimum diameter as shown on the drawings.
- B. Steel pipe shall be Grade B under railroads and Grade A on all other uses.

- C. Steel pipe shall have a minimum wall thickness as shown in the following table:

TABLE 2		
Diameter of Casing - Inches	Minimum Wall Thickness In Inches	
	Under Railroads	All Other Uses
Less than 12	0.250	0.188
12	0.250	0.188
14	0.312	0.188
16	0.312	0.188
18	0.312	0.250
20	0.375	0.250
22	0.375	0.250
24	0.437	0.281
26	0.437	0.281
28	0.437	0.312
30	0.500	0.312
32	0.500	0.312
34	0.500	0.312
36	0.562	0.344
38	0.562	0.344
40	0.562	0.344
42	0.562	0.344
44 through 48	0.625	0.344

2.5 PIPE

- A. Pipe shall be as specified in Division 33.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Proper alignment and elevations shall be maintained throughout the directional drilling or boring operation.
- B. Pipe shall be installed to meet or exceed the requirements of ASTM and AWWA approved installation methods.
- C. Testing of the pipe shall be in accordance with the testing requirements as outlined in Division 33.

3.2 PREPARATION

- A. The entire drill path shall be accurately surveyed by the Contractor with entry and exit pit stakes placed in the appropriate locations within the areas indicated on the drawings.
- B. If using the magnetic guidance system, the drill path shall be surveyed by the Contractor for any surface geomagnetic variations.
- C. Contractor shall locate all utilities before performing Work.
 - 1. Request underground utilities to be located and marked within and surrounding construction areas.
 - 2. Locate, identify, and protect utilities indicated to remain from damage.

3.3 DEWATERING

- A. Intercept and divert surface drainage, precipitation, and groundwater away from excavation through use of dikes, curb walls, ditches, pipes, sumps or other means.
- B. Develop and maintain substantially dry subgrade during drilling and pipe installation.
- C. Comply with all local, state and federal requirements for discharging water to watercourse, preventing stream degradation, and erosion and sediment control.

3.4 EXCAVATION

- A. Excavate approach trenches and pits as site conditions require. Minimize number of access pits.
- B. Restore areas after completion of drilling and carrier pipe installation.

3.5 DIRECTIONAL DRILLING

- A. Entrance and exit pits shall be located to avoid conflicts with the public utilities, and other agencies.
- B. Provide sump areas to contain drilling fluids.
- C. Pipe sections shall be joined together per the manufacturer's specifications. When required, tracer wire shall be attached to the pulling eye and the crown of the pipe with tape at 24 inch increments along the pipe and a minimum of two full wraps around the pipe. Contractor shall test tracer wire for continuity for each section before acceptance.
- D. Guide drill remotely from ground surface to maintain alignment by monitoring signals transmitted from drill bit.

1. Monitor depth, pitch, and position.
 2. Adjust drill head orientation to maintain correct alignment.
- E. Inject drilling fluid into bore to stabilize hole, remove cuttings, and lubricate drill bit and pipe.
1. The drilling slurry shall be in a homogenous/flowable state serving as an agent to carry the loose cuttings to the surface through the annulus of the bore hole.
 2. The volume of bentonite mud required for each pull back shall be calculated based on soil conditions, largest diameter of the pipe system component, capacity of the bentonite mud pump and the speed of pullback as recommended by the bentonite drilling fluid manufacturer.
 3. Bentonite slurry is to be contained at the entry or exit side of the drill pits or holding tanks.
 4. Slurry may be recycled for reuse in the opening operation or shall be hauled by the Contractor to an approved disposal/dump site for proper disposal.
 5. The Contractor and Resident Project Representative shall document all drilling fluid products being used, the pumping pressure, rate of pumping and details relative to drilling fluid circulation at the end points of the drill.
 6. The right of way and surrounding areas should be examined regularly for inadvertent returns. If inadvertent returns are discovered, they could be contained or cleaned up in accordance with federal, state or local regulations. These areas shall be monitored for continuing problems.
- F. Continuously monitor drilling fluid pumping rate, pressure, viscosity, and density while drilling pilot bore, back reaming, and installing pipe to ensure adequate removal of soil cuttings and stabilization of bore.
1. Provide relief holes when required to relieve excess pressure.
 2. Minimize heaving during pullback.
- G. Calibrate and verify the accuracy of the electronic monitor in presence of the Engineer or Resident Project Representative before proceeding with other drilling. When required accuracy is not met, adjust equipment or provide new equipment capable of meeting required accuracy.
- H. Readings shall be recorded after advancement of each successive drill pipe (no more than 10 feet). Access to all recorded readings and plan/profile information shall be made available to the Engineer or the Resident Project Representative at all times. At no time shall the deflection radius of the drill pipe exceed the deflection limits of the carrier pipe.

- I. Drill pilot hole with vertical and horizontal alignment with no deviations greater than 5% of depth over the length of the drill unless previously agreed to by the Engineer.
 - 1. In the event that the pilot does deviate from the drill path more than 5%, the Contractor shall notify the Engineer. The Contractor may be required to pull back and re-drill from the location along the drill path before the deviation.
 - 2. In the event of a drilling fluid fracture, inadvertent returns, or returns lost during drilling operations, the Contractor shall cease drilling and wait at least 30 minutes, inject drilling fluid with a viscosity exceeding 120 seconds as measured by a Marsh funnel and wait another 30 minutes. If mud fracture continues, Contractor shall notify the Engineer for alternate methods.
- J. The pilot bore shall be approved by the Engineer or Resident Project Representative prior to commencement of the reaming phase. The diameter of the bore hole shall be increased to accommodate the pull-back operation of the required carrier pipe. The Contractor shall select the proper reamer with the final hole opening being a maximum of 1.5 times larger than the outside diameter of the pipe to be installed.
- K. Protect and support pipe so it moves freely and is not damaged during installation. Contractor shall provide pipe rollers, slings or other appurtenances to assist in supporting the pipe during installation.

3.6 BORING AND JACKING

- A. As the boring progresses, it shall be concurrently supported with a welded continuous, permanent, new steel pipe casing conforming to ASTM A139 and having a minimum diameter as shown on the drawings.
- B. Once the jacking operation has commenced, it shall be continued uninterrupted until the conduit has been installed to the specified limits.
- C. Borings and encasement shall be constructed so they will drain and shall be bored in a single direction. The pipe shall be pulled or pushed into the casing on premanufactured casing spacers as manufactured by RACI, CCI Pipeline Systems, Cascade or approved equal or wood skids as shown in the details and approved by the Engineer. The entire void area between the casing and the pipe shall be filled with jetted sand. The ends of the encasement pipe shall be sealed with flexible, synthetic rubber end seals with 304 stainless steel bands.
- D. All voids or abandoned holes caused by boring or jacking are to be filled by pressure grouting when deemed necessary by the Engineer representative. The grout material shall be a sand cement slurry with a minimum of two sacks of cement per cubic yard and a minimum of water to assure satisfactory placement.

3.7 OBSTRUCTIONS AND UNEXPECTED UTILITIES

- A. When obstructions or unexpected utilities are encountered during the boring or directional drilling process, the Contractor shall notify the Engineer immediately. Do not proceed around obstruction without Engineer's approval.
- B. For conditions requiring deviation in horizontal or vertical alignment, the Contractor shall submit a proposed alignment to Engineer for approval before resuming work.

3.8 LINE AND GRADE TOLERANCES

- A. The installed pipe and/or casing shall not deviate from the line and grade as shown on the drawings.
- B. Horizontal Tolerance:
 - 1. Pipe shall not deviate horizontally from what is shown on the drawings unless approved by the Engineer.
- C. Vertical Tolerance:
 - 1. Pipe shall not deviate vertically from what is shown on the drawings unless approved by the Engineer.

3.9 DISPOSAL OF SPOILS

- A. Remove, transport and legally dispose of drilling spoils.
 - 1. Do not discharge drilling spoils in sanitary sewers, storm sewers, or other drainage systems.
 - 2. When drilling in suspected contaminated soil, test drilling fluid for contamination before disposal.
 - 3. Spoils shall be disposed of on sites provided by the Contractor. Disposal sites must be approved by KDHE.
 - 4. Any material dumped in waters of the United States or wetlands is subject to U.S. Corps of Engineers permitting regulations.
- B. Slurry Removal for Horizontal Directional Drilling
 - 1. Contractor is responsible for removal and proper disposal of all slurry in accordance with the local, state and federal requirements.
 - 2. Contractor shall contain excess drilling fluids at entry and exit points until recycled or removed from site. Provide recovery system to remove drilling spoils from access pits.

3. When drilling fluid leaks to surface, immediately contain leak and barricade area from vehicular and pedestrian travel before resuming drilling operations.
4. Complete cleanup of drilling fluid at end of each work day.

3.10 CLEANING

- A. Upon completion of drilling and pipe installation, remove drilling spoils, debris, and unacceptable material from approach trenches and pits. Clean up excess slurry from ground.
- B. Restore approach trenches and pits to original condition.

END OF SECTION

SECTION 33 11 16
WATER DISTRIBUTION PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes water-distribution piping and related components for water distribution systems and water service connections.
- B. The Contractor shall provide all labor, supervision, materials, equipment, supplies, incidentals and services; and shall perform all Work necessary for the installation and testing of the water distribution system.
- C. The water distribution system shall be constructed in accordance with the Contract Documents and the applicable laws, rules, ordinances, standards, and regulatory agencies.

1.2 DEFINITIONS

- A. ANSI: American National Standards Institute
- B. ASTM: ASTM International
- C. AWWA: American Water Works Association
- D. CCS: Copper Clad Steel
- E. CI: Cast Iron
- F. CICL: Cast Iron Cement Lined
- G. DI: Ductile Iron
- H. DICL: Ductile Iron Cement Lined
- I. DIPS: Ductile Iron Pipe Size
- J. DR: Dimension Ration
- K. EPA: Environmental Protection Agency
- L. IPS: Iron Pipe Size
- M. KDHE: Kansas Department of Health & Environment

- N. MJ: Mechanical Joint
- O. NPDES: National Pollutant Discharge Elimination System
- P. NSF: NSF International
- Q. O&M: Operation and Maintenance
- R. OSHA: Occupational Safety and Health Administration
- S. PSI: Pounds per Square Inch
- T. PVC: Polyvinyl Chloride
- U. RJ: Restrained Joint
- V. SJ: Slip Joint

1.3 ACTION SUBMITTALS

- A. General: Submittals shall be made by the Contractor in accordance with the procedures set forth in Division 01.
- B. Contractor shall provide manufacturer's catalog cuts, technical data, and/or shop drawings for the following system components (shop drawings shall be drawn to a scale sufficiently large to show all pertinent aspects of the item and its method of connection to the work):
 - 1. Pipe
 - 2. Tracer wire and marking tape
 - 3. Fittings, sleeves and couplings
 - 4. Hydrants
 - 5. Pipe restraints
 - 6. Bedding Material
 - 7. Appurtenances - including water sampling stations, corporation stops, and service saddles
 - 8. Meter boxes and meter setters
 - 9. Meter vaults - including sump, ladders, steps, frame and cover, and rebar
 - 10. Gauges
- C. Provide pipe certifications and cut sheets for pipe and fittings.
- D. Provide pipe laying schedule for pipe and fittings on large diameter piping (24 inches and greater), including laying lengths and corresponding pipe line stationing.

E. Shop Drawings:

1. Detail precast concrete structures/vault assemblies and indicate dimensions, method of field assembly, and components.
2. Wiring Diagrams: Power, signal, and control wiring for alarms.

1.4 INFORMATIONAL SUBMITTALS

- A. Field quality-control test reports.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For water appurtenances to include in emergency, operation, and maintenance manuals.

1. Submit complete Installation, Operation and Maintenance Manuals, including, test reports, maintenance data and schedules, description of operation, and spare parts information.
2. Furnish Operation and Maintenance Manuals in conformance with the requirements of Division 01.
3. Manufacturer's qualifications including list of existing installations with contact names and telephone numbers.

1.6 QUALITY ASSURANCE

- A. Regulatory Requirements:

1. Comply with the requirements including proof of insurance, and other permit requirements for construction across or along railroads, highways, local or county roads, or drainage ways.
2. Comply with the requirements for NPDES permitting, including best management practices for storm water discharges from the construction site.
3. Comply with requirements of utility company supplying water. Includes tapping of water mains and backflow prevention.
4. Comply with standards of authorities having jurisdiction for potable-water-service piping, including materials, installation, testing, and disinfection.
5. Comply with standards of authorities having jurisdiction for fire-suppression water-service piping, including materials, hose threads, installation, and testing.
6. Comply with all local, state and federal regulations.
7. Compliance with the Reduction of Lead in Drinking Water Act (2014) is required and all applicable products must meet the lead-free requirements and conform to NSF 372.

- B. Piping materials shall bear label, stamp, or other markings of specified herein.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- D. Products for potable water applications shall be NSF 61 product certified.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Delivery:

- 1. Deliver materials to the Site to ensure uninterrupted progress of the Work.
- 2. Upon delivery inspect pipe and appurtenances for cracking, gouging, chipping, denting, and other damage and immediately remove from Site and replace with acceptable material.
- 3. No other pipe or material of any kind shall be placed inside of any pipe or fitting.
- 4. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.

B. Storage:

- 1. Use precautions for pipe and fire hydrants, according to the following:
 - a. Do not remove end protectors unless necessary for inspection; then reinstall for storage.
 - b. Protect from weather. Store indoors and maintain temperature higher than ambient dew-point temperature. Support off the ground or pavement in watertight enclosures when outdoor storage is necessary.
- 2. Store materials to allow convenient access for inspection and identification.
- 3. Store material off ground using pallets, platforms, or other supports. Protect packaged materials from corrosion and deterioration.
- 4. Do not remove end protectors or supports unless necessary for inspection; these should be reinstalled for storage.
- 5. Pipe and fittings other than PVC may be stored outdoors without cover. Cover PVC pipe and fittings stored outdoors.
- 6. Protect stored piping from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when storing inside.
- 7. Store plastic piping protected from direct sunlight. Support to prevent sagging and bending.
- 8. Protect flanges, fittings, and specialties from moisture and dirt.

C. Handling:

1. Use sling to handle fire hydrants if size requires handling by crane or lift. Rig valves to avoid damage to exposed parts.
2. Handle pipe, fittings and appurtenances carefully in accordance with pipe manufacturer's recommendations. Do not drop or roll material off trucks. Do not drop, roll or skid piping.
3. Avoid unnecessary handling of pipe.
4. The interior of all pipe shall be thoroughly cleaned of all foreign matter before being lowered into the trench, and shall be kept clean during laying operations by means of plugs or other approved methods. In all cases water shall be kept out of the trench until the material in the joints has hardened. At all times when work is not in progress, all open ends of pipes and fittings shall be securely closed so that no trench water, earth or other substances will enter the pipe or fittings.
5. Protect interior linings and exterior coatings of pipe and fittings from damage. Before lowering and while suspended, pipe shall be inspected for defects and cracks. Defective, damaged or unsound pipe shall be rejected.
6. If coating becomes damaged, Contractor shall notify pipe and coating manufacturer to determine if repair of damaged area or re-coating is required. Perform repairs using recommended procedures and materials provided by manufacturer, as accepted by Engineer. Pipe and fittings requiring re-coating shall be removed from Site and returned to manufacturer's facility. Repaired or re-coated pipe and fittings shall meet all requirements of this section.

1.8 PROJECT CONDITIONS

- A. Interruption of Existing Water-Distribution Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water-distribution service according to requirements indicated:
1. Notify the Owner no less than 72 hours in advance of proposed interruption of service.
 2. Do not proceed with interruption of water-distribution service without the Owner's written permission.

1.9 COORDINATION

- A. Coordinate connection to water main with water system personnel.
- B. Review installation procedures under other Sections and coordinate the installation of items that must be installed with or before the water main construction.
- C. When it is necessary to take any water mains and/or fire hydrants out of service due to construction of the project, the Contractor shall notify the utility company and fire

department at least 72 hours prior to initiation of construction. Notification must be made when those same mains and hydrants are returned to service.

- D. The Contractor shall determine if any authorization to use water from the public fire hydrants for construction, testing and flushing is needed. If so, the Contractor shall apply for a permit at the appropriate City office to authorize usage of water for settlement of backfill where applicable, flushing and testing from public fire hydrants. The Contractor shall pay any required fees or costs associated with purchasing water to be used.
- E. Coordinate connections to existing water mains with the utility company. Connections shall be made to minimize disruptions to utility customers.
- F. Operation of existing valves shall be performed by the project Owner. Contractor may operate valves only if a utility company's representative is on site coordinating the opening and closing of these valves.

1.10 WARRANTY

- A. In addition to the requirements of the General Conditions and the Supplemental Conditions, the Contractor shall require the manufacturer to furnish a warranty valid through the warranty period to assure that any equipment specified herein which does not meet the performance requirements for the specifications, is repaired to the Owner's satisfaction or replaced with equipment that does meet the performance requirements of the specification.
- B. The Contractor and/or equipment manufacturer shall be responsible for all costs of warranty repair work including removal, shipping, reinstallation and restart-up during the warranty period.
- C. The Contractor will be required to fill any areas of settlement and re-seed/sod/mulch. Also, all erosion protection measures shall be removed within the warranty period after an acceptable stand of grass is achieved.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Proprietary products: Whenever materials or equipment are described using a certain brand, make, supplier, manufacturer or by specification, such naming shall be regarded as a standard and be intended to convey function, design features, general style, type, materials of construction, character and quality of material or equipment, serviceability and other described essential characteristics.

- B. Other materials may be considered by the Engineer in accordance with the General Conditions of this project manual.
- C. All pipe, fittings, fire hydrants and appurtenances shall be new material unless otherwise specified. Nuts and bolts shall be stainless steel unless otherwise specified.
- D. All pipe products, gaskets, and lubricants shall be NSF 61 product certified.
- E. All pipe installed by directional drilling shall be restrained joint pipe.

2.2 PIPE AND FITTINGS

A. Ductile Iron Pipe:

1. General:

- a. DI pipe shall be furnished in 18 or 20 foot laying lengths.
- b. DI pipe shall conform to the requirements of ANSI/AWWA A21.51/C151.
- c. The manufacturer's mark, country where cast, year the pipe was produced, and the letters "DI" or words "Ductile Iron" shall be cast or stamped on the pipe.
- d. Unless otherwise specified, the following pressure classes are required as a minimum:
 - 1) Pipe 3 inches through 24 inches: Pressure Class 350
 - 2) Pipe 30 inches through 48 inches: Pressure Class 250
 - 3) Pipe 54 inches and greater: Pressure Class 150
- e. Lining and coating:
 - 1) Pipe and fittings shall be cement lined in accordance with ANSI/AWWA A21.4/C104.
 - 2) Pipe and fittings to be buried shall be seal coated with an approved bituminous seal coat in accordance with ANSI/AWWA A21.4/C104.
 - 3) Pipe and fittings to be installed inside structures shall be provided without exterior bituminous coating and shall be coated with 100 percent solids, thermosetting, dry powder epoxy, such as Tnemec Series 66 High Build Epoxy or approved equal, in conformance with AWWA C116.
- f. Encasement: All buried DI pipe, fittings, fire hydrants and appurtenances shall be encased in a minimum 8 mil low density polyethylene tube encasement in accordance with AWWA C105.

2. Joints:

a. Buried joints:

- 1) Unless otherwise specified, buried DI pipe may be bell and spigot or mechanical joint.
 - 2) Mechanical joints shall conform to ANSI/AWWA A21.11/C111.
 - 3) Restrained joints shall include the use of a pre-tensioned lock ring and shall be American Flex Ring, US Pipe TR Flex, Griffin Pipe Snap-lok or approved equal.
 - b. Exposed joints:
 - 1) Unless otherwise specified, all exposed DI pipe shall be flanged. All flanges shall be American Standard B 16.1, Class 125, ASA flanges with full face red rubber gaskets.
3. Fittings:
- a. Fittings shall be cast iron or ductile iron, cement lined, conforming to AWWA C110 or AWWA C153 unless otherwise specified. PVC fittings are not allowed.
 - b. Fittings shall have interior and exterior coatings as specified for DI pipe.
 - c. For pipe 4 inches to 48 inches in diameter, compact mechanical fittings with a minimum pressure class of 350 and conforming to AWWA C153 may be used.
 - d. Where approved or specified, grooved end fittings shall conform to ANSI/AWWA A21.10/C110 for center-to-end dimensions and ANSI/AWWA A21.1/C110 for wall thickness. Couplings shall be equipped with flush seal gaskets per ASTM D2000.

B. PVC Pipe:

1. General:
 - a. PVC pipe shall be furnished in 13 to 20 foot laying lengths.
 - b. The PVC pipe laying condition is for flexible pipe.
 - c. PVC pipe, couplings and fabricated fittings shall NSF 61 product certified with seal indicating certification.
 - d. Pipe shall bear identification markings that will remain legible during normal handling, storage and installation. The markings shall be applied in a manner that will not reduce the strength of the pipe or coupling or otherwise damage either. Pipe markings shall be applied at intervals not to exceed 5 feet and shall include the nominal size and outside diameter, PVC, DR-18, AWWA Pressure Class, manufacturer's name or trademark and production record code, and the seal of the testing agency that verified the suitability of the pipe material for potable water service.
 - e. Unless otherwise specified, pipe must conform to the following requirements:

- 1) Pipe smaller than 2 inches: ASTM D2241, NSF 61 product certified and Schedule 40.
- 2) Pipe 2 inches to 3 inches in diameter: ASTM D-1784 and D-2241, NSF 61 product certified and Schedule 80.
- 3) Pipe 4 inches to 12 inches in diameter: AWWA C900, pressure class 235 (DR-18).
- 4) Pipe 14 inches through 48 inches in diameter: AWWA C905, pressure class 235 (DR-18)

2. Joints:

- a. Unless otherwise specified, joints shall be push-on type with a flexible factory-assembled elastomeric ring in the integral bell end.
- b. Joint material including gaskets and lubricants shall conform to AWWA C900.
- c. Joint designs shall be submitted to the Engineer for approval.
- d. Where PVC restrained joint pipe is required, Certa-Lok restrained joint couplers as manufactured by Certainteed Corporation, or approved equal, shall be used.
- e. Joint adaptors will be provided for all gate valves, fittings or changes in pipe material.

3. Fittings:

- a. For pipe 2 inches and smaller, fittings shall conform to AWWA C900.
- b. For pipe 4 inches and larger, fittings shall be Ductile Iron or Cast Iron as specified in this section.
- c. Fittings shall have the same pressure ratings as specified for the PVC pipe.
- d. Fittings shall have the same coatings as specified for the PVC pipe.
- e. The dry fit of fitting sockets must be snug. If the fit is loose, the pipe and/or fittings will be rejected as faulty because of improper size. Building up the joint to overcome a loose fit will not be permitted.

2.3 BURIED PIPE IDENTIFICATION

A. Underground warning tape:

1. Tracer tape shall be aluminum foil encased in an impervious Mylar plastic coating on both sides.
2. Tracer tape shall be 5 mils thick and three inches in width.
3. The tape shall be blue in color and the printed message shall be black in color.
4. Message shall read, "CAUTION - BURIED WATER LINE BELOW" with bold letters approximately two inches high. Message shall be printed at maximum intervals of two feet.
5. The color and printing shall be under the impervious Mylar plastic coating.

B. Marking service lines:

1. The Contractor shall provide the plastic flagging material used for marking the ends of the service lines on water line projects.

C. Tracer wire for non-metallic pipe:

1. Tracer wire shall be installed to locate PVC or any nonmetallic waterline pipes.
2. The wire shall extend the entire length of the proposed pipe and shall be taped to the pipe. Snake bite locking wire connectors as manufactured by Copperhead or approved equal shall be used at splice locations.
3. Electrical tape shall cover splice locations so that no bare wire is exposed.
4. Test stations shall be installed adjacent to all fire hydrants along the waterline and at blowoff assemblies or valves near the ends of the waterlines. Any exceptions to locations of test stations shall be approved by the Engineer. At each test station, the tracer wire shall be connected to a one pound zinc or magnesium anode.
5. Anodes shall also be attached to the tracer wire at both the beginning and end of the proposed waterline. Anodes shall be buried at the same elevation as the waterline at each test station. The anodes shall be connected to the CCS wire which shall be extended to the test station.
6. The tracer wire shall be Blue No. 12 CCS wire with thermal plastic insulation as manufactured by Copperhead or approved equal. The insulation shall be heat, oil and gasoline resistant as manufactured by Temple Electric or approved equal.
7. To allow for grade adjustment, a minimum of 12 inches of excess wire shall be coiled at the bottom of the test station for all wires. The insulation sheathing shall be removed such that 1 inch bare copper wire is exposed at the connection. Contractor shall attach wire being installed with proposed water main to any tracer wire installed with adjacent waterline projects.
8. Test stations:
 - a. Test stations for fire hydrant applications shall be a Snake bite magnetized tracer box as manufactured by Copperhead or approved equal with a removable solid cover having two leads extending from the face or approved equal. Test stations for valve applications shall be 2 inch flush style test station T2PS3B as manufactured by Handley Industries or approved equal.
 - b. The "condulet" style test station shall be attached to a 1 inch rigid galvanized conduit with a minimum length of 36 inches and plastic end bushing. The flush style shall have the word "WATER" stamped or molded into the lid. All test stations shall be molded using blue tops or sufficiently coated with blue enamel paint.
 - c. Tracer wire and anode wire shall be installed to allow 10 inches of wire within the test station. In concrete environments such as sidewalks, the contractor shall use flush style test stations.
 - d. The location of all test stations shall be approved by the engineer, recorded and shown on the record drawings.

2.4 SLEEVES AND COUPLINGS

A. Sleeves:

1. Mechanical joint sleeves shall be solid type, long or short body pattern as approved by the Owner, manufactured in accordance with ANSI/AWWA A21.10/C110. Sleeves shall have a minimum pressure rating of 350 psi. Glands, gaskets, bolts, and nuts shall be in accordance with ANSI/AWWA A21.11/C111.
2. Sleeves shall not be machined in order to facilitate use with pipe of a class or type other than that for which the sleeve was manufactured.

B. Couplings:

1. The use of bolted steel couplings shall be restricted to joining pipes of different outside diameters, and joining pipes of dissimilar materials.
2. Ferrous surfaces shall be coated with an epoxy coating; enamel coatings are not acceptable.
3. Bolted steel transition couplings shall be Rockwell 413, Dresser style 162, or approved equal.
4. Bolted steel reducing couplings shall be Rockwell 415, Dresser style 62, or approved equal.
5. Bolted steel couplings for joining pipes of the same outside diameter shall be Rockwell 411, Dresser style 38, or approved equal.

2.5 WATER METERS AND SERVICES

A. Water meters will be furnished by the City of Valley Center.

B. Service materials furnished by the contractor shall include the following:

1. Corporation stops
2. Service saddles
3. Plastic or copper tubing
4. Unions and couplings
5. Copper Setters
6. Meter boxes
7. Meter rings and lids

C. Meter settings shall include meter yoke, meter box, and all appurtenances necessary for providing customer water service at the location designated on the Drawings. Meter box shall be as shown on the drawings.

D. CORPORATION STOP

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or pre-approved equal:

- a. Mueller
- b. McDonald

2. Description:

- a. Corporation stop shall be brass, compression type for copper tubing size furnished with stainless steel insert.

E. Service Saddles:

- 1. Service saddle shall be designed and sized for the water on which the saddle is to be installed.
- 2. Stainless steel saddle bodies shall be 18-8, Type 304, stainless steel with all welds fully passivated to restore stainless steel characteristics.
- 3. Ductile iron saddle bodies shall conform to ASTM A-536 and have a fusion applied NSF 61 product certified epoxy coating 12-mils dry thickness (D.T.). Straps shall be stainless steel, 18-8, Type 304 fully passivated for corrosion resistance.
- 4. Threads shall be AWWA C800 CC/Taper.
- 5. The saddle shall be provided with a Buna-N rubber gasket meeting ASTM D2000 to seal the saddle and the main pipe.
- 6. The nuts, washers, bands, and bolts shall be 18-8 stainless steel.
- 7. Manufacturers: subject to compliance with requirements, provide products by one of the following or pre-approved equal:
 - a. McDonald
 - b. Mueller

F. Service tubing shall be HDPE or Type "K" Copper. HDPE shall comply with AWWA C901 DR 11 (minimum).

G. Meter setter

- 1. Meter setters shall be copper with an inlet ball valve, pack joint for copper or plastic tubing (CTS) inlet and outlets and has a height of 15 inches.
- 2. Meter setters shall have a 15" extended leg on the customer side of the meter.
- 3. Manufacturers: Subject to compliance with requirements, provide products by one of the following, or pre-approved equal:
 - a. Mueller
 - b. A.Y. McDonald

2.6 CONCRETE VAULTS

A. Concrete for precast vaults shall be as specified in Division 03.

- B. Dimensions and vault accessories including the floor drain, access hatch or cover, and signage shall be as shown on the drawings.

2.7 FIRE HYDRANTS

- A. Fire hydrants shall be a Clow Valve Co. Model F-2545.
- B. Description:
 - 1. The fire hydrant assembly shall include the following: the hydrant valve anchor tee, the 6 inch MJ gate valve, the 6 inch valve box, the variable length of 6 inch CICL SJ pipe, the fire hydrant, all hydrant barrel extensions required to bring the fire hydrant to grade, the gravel for drain, and all concrete thrust blocking required for the hydrant tee and fire hydrant.
 - 2. All threads and connectors to be reviewed with the local fire department.
 - 3. Fire hydrants shall be located and installed as shown on the drawings. Hydrants shall be set according to the requirements of AWWA C600 except as specifically amended on the drawings or specifications. Each hydrant shall be set to stand plumb and shall be oriented such that immediate access is provided.
 - 4. The pumper nozzle shall be a 5 inch Storz pumper nozzle of a one-piece design compatible with 5 inch Storz hose couplings. The Storz pumper nozzle shall be an integral part of the fire hydrant and must be furnished by the manufacturer. Storz adapters will not be acceptable.
 - 5. Fire hydrants shall conform to AWWA C502.

2.8 FLUSHING HYDRANTS

- A. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Kupferle Foundry Co. Eclipse #2 Post Hydrant
- B. Description: Nonfreeze and drainable, of length required for shutoff valve installation below frost line.
 - 1. Pressure Rating: 150 psig minimum.
 - 2. Barrel Steel pipe with breakaway feature.
 - 3. Valve: Bronze body with bronze-ball or plunger closure, and automatic draining.
 - 4. Security: Locking device for padlock.
 - 5. Exterior Finish: Red gloss enamel paint, unless otherwise indicated.
 - 6. Operating Wrench: One for each unit.

PART 3 - EXECUTION

3.1 GENERAL

- A. All water mains shall have a minimum depth of bury of 42 inches from top of pipe, unless otherwise approved by the Engineer.
- B. Water mains shall be buried at a minimum depth of 7 feet below the streambed of a navigable stream and 5 feet below the streambed of all other streams.
- C. Installation of DI pipe shall be in accordance with AWWA C600.
- D. Installation of PVC pipe shall be in accordance with AWWA C605.
- E. Any section of pipe already laid and found to be defective shall be taken up and replaced without additional expense to the Owner.

3.2 EARTHWORK

- A. Refer to Division 31 for excavating, trenching, and backfilling.

3.3 PIPE INSTALLATION

- A. Preparation:
 - 1. Cutting of pipe shall be done in a neat and workmanlike manner by a method which will not damage the pipe. Unless otherwise authorized, all cutting shall be done by means of mechanical cutters of an approved type. Wheel cutters shall be used whenever practicable.
 - 2. Prior to laying, the pipe bedding material shall be placed by slicing with a shovel or mechanical tamping, according to the type of material.
 - 3. Before jointing, all lumps, blisters and excess coating materials shall be removed from the bell and spigot ends of the pipes. The outside of the spigot and the inside of the bell shall then be wire brushed and/or wiped clean and dry. All oil or grease shall be removed. Flanged joints shall be faced true, and made up perfectly square and tight. Ductile iron wedges shall be used as needed to give proper slope or direction to the line.
- B. Pipe Laying:
 - 1. Any pipe that has its grade or joint disturbed after laying shall be taken up and relaid.
 - 2. Pipe shall be laid to a true, uniform line and grade. High points, other than those indicated on the Drawings where an air vent assembly is to be placed, shall be avoided.

3. Pipe laying shall be in accordance with the manufacturer's recommendations. Pipe laying shall proceed, bells ahead. Each section of pipe shall be laid to form a close concentric joint with the adjoining section and to prevent sudden offsets in the flow line. Each section of pipe, as it is laid, shall be backfilled as specified in the Contract Documents, at least up to the centerline, before the next joint is made.
4. As the work progresses, the interior of the pipe shall be cleared of dirt and superfluous material.
5. Trenches and other excavations shall be kept free of water until backfilled. Concrete or masonry work shall not be constructed in water, nor shall water be allowed to rise over the work until concrete or mortar has had ample time to set.
6. When work is not in progress, open ends of pipe and fittings shall be closed, to the satisfaction of the Owner, so that trench water, earth, and other substances will not enter the pipe or fittings.
7. Whenever a pipe requires cutting for the insertion of valves, fittings, closure pieces, or to bring it to the required location, the work shall be performed in a satisfactory manner so as to leave a beveled end in accordance with the manufacturer's instructions or recommendations. Cuts shall be made at 90 degrees with the centerline of the pipe so that a framing square placed against the side of the pipe will reveal not more than 1/4 inch variation across the diameter of the pipe in any direction. The pipe shall be cut with an abrasive wheel, rotary wheel cutter, guillotine pipe saw, milling wheel saw or other equipment specifically designed for that purpose. The Contractor shall grind smooth cut ends and rough edges and for push-on connections, the cut ends should be beveled slightly. Pipe damaged by the Contractor in cutting shall be replaced at the Contractor's expense.
8. Laying of the pipe shall commence immediately after the excavation is started, and every means must be used to keep pipe laying closely behind the trenching. No more than 300 feet of trench may be open ahead of the pipe laying operation, unless otherwise specified. Holes shall be scooped out where the bells occur leaving the entire barrel of the pipe bearing on the pipe bed.
9. Pipe joint assembly practices and joint assembly materials such as lubricants, primers and adhesives to be NSF 61 product certified and shall be in accordance with the manufacturer's recommendations and specifications, and in accordance with ANSI/AWWA A21.11/C111.
10. Pipe shall not be laid on frozen bedding.

C. Alignment and Grade:

1. The Contractor shall not deviate from the line and grade indicated on the Drawings, except with approval of the Owner.
2. Where it is necessary to deflect pipelines to avoid obstructions, the amount of deflection shall not exceed 1/2 of that recommended by the manufacturer of the pipe. Where necessary to maintain the required line, short sections of pipe and fitting shall be provided.

3. The Contractor shall investigate the proposed location of the main far enough in advance of the work to determine where conflicts will occur and to determine joint deflections necessary to clear any obstructions.
4. Deflection of C-900 PVC pipe shall not be permitted except at couplings and fittings. Deflection at couplings and fittings shall be limited to 4 degrees for 12 inches in diameter or smaller. To follow a curve, the C-900 PVC pipe may be cut to short lengths and additional couplings may be used. Short lengths shall be no shorter than 6 feet 6 inches unless approved by the RPR.

D. Thrust Restraint:

1. Reaction backing: Plugs, caps, tees, and bends deflecting 11-1/4 degrees or more on pipes 4 inches in diameter or larger shall be provided with reaction backing which shall be concrete Class II, unless a restrained joint system is designed for resisting thrust forces. Backing shall be placed between solid ground and the fitting to be anchored. The area of bearing shall be as shown or as directed. Unless otherwise shown or directed, the backing shall be so placed that the fitting joints will be accessible for repair.
2. Restrained Joints: The Contractor may utilize restrained joint methods of pipe installation as a means of thrust restraint.

E. Warning Tape and Tracer Wire Installation:

1. For protection and identification of water mains, the Contractor shall install a detectable metallic warning tape in the trench over the water main at the time of backfilling. The warning tape shall be placed in the trench at a depth of one foot, but not exceeding three feet below the proposed final grade of the ground over the centerline of the water main.
2. The tape shall be spread flat with message side up before backfilling.

F. Tracer wire installation:

1. Conductive type pipe locator/tracer wire shall be installed to locate non-metallic waterline pipes. The wire shall extend the entire length of the proposed pipe.
2. The wire shall be attached every 10 feet to the piping system with plastic strapping and pulled with the pipe.
3. The wire shall terminate above ground at every valve box and air vent assembly.
4. Connectors shall be used at splice locations. Electrical tape shall cover all splices so no bare wire is exposed. The wire shall be installed adjacent to all fire hydrants along the water line and at blowoffs or valves along the water line so as to provide an accessible location to the wire.
5. To allow for grade adjustment, a minimum of 12 inches of excess wire shall be coiled at the bottom of the valve boxes for all wires.
6. Contractor shall attach wire being installed with proposed water main to any tracer wire installed with adjacent water line projects.

3.4 HYDRANT INSTALLATION

- A. Hydrants shall be installed as indicated in the Drawings and Standard Details.
- B. The hydrant shall be plumb with the pumper nozzle facing the curb (or roadway). Nozzles shall be set a minimum of 16 inches to 24 inches above the finished grade to the centerline of the nozzle, unless otherwise directed by the Owner.
- C. Newly installed hydrants not yet in service shall be covered with a bag (or other Owner approved system), securely tied in place indicating that the hydrant is not usable.
- D. Fire hydrants shall not be installed on water mains less than 6 inches in diameter.

3.5 INSTALLATION OF FITTINGS AND OTHER APPURTENANCES

- A. All appurtenances (fittings and meter settings) shall be installed in accordance with the manufacturer's recommendations and as indicated on the Drawings and Standard Details.

3.6 RESTRAINTS

- A. Fittings, pipe joints and hydrants shall be restrained as indicated on the Drawings. Alternate methods of thrust restraint other than those specified herein may be used only with the written approval of the Owner.
- B. Blocking shall be placed between undisturbed earth and the fitting to be restrained. The blocking shall be in accordance with the Drawings and Standard Details, oriented to contain the resultant thrust force and to leave the fitting joints accessible.
- C. All exposed piping, flanges, couplings, nuts and bolts shall receive a minimum of two coats of an approved protective coating.

3.7 WATER MAINS PARALLELING AND CROSSING SEWER LINES

- A. When potable water pipes and sanitary sewers are laid parallel to each other, the horizontal distance between them shall be not less than 10 feet. The laying of water pipes and sanitary sewers shall be in separate trenches with undisturbed earth between them.
- B. When a water pipe and a gravity sanitary sewer cross and the sewer is two feet or more (clear space) above or below the water pipe, no extra protection to the latter is needed. At all other crossings, the sewer is to be constructed of one of the following materials (or approved equal) with joints in the sewer pipe located as far as practical from the intersected water main and pressure tested to assure water tightness pursuant to the most

recent revision of KDHE's Minimum Standards of Design of Water Pollution Control Facilities:

1. Ductile Iron pipe conforming to ASTM A536 or ANSI/AWWA C151/A21.51 with minimum thickness class 50, and gasketed, push-on, or mechanical joints in conformance with ASNI/AWWA C110/A21.10 or ANSI/AWWA C111/A21.11.
 2. PVC pipe conforming to ASTM D3034 with minimum wall thickness of SDR 41, ASTM F679, or ASTM F794, with gasketed push-on joints in conformance with ASTM D3212.
 3. Reinforced Concrete pipe conforming to ASTM C76 with gasketed joints in conformance with ASTM C361 or ASTM C443.
- C. Where a water main is laid across or through an area where there is an existing gravity sanitary sewer, which is not constructed of one of the above materials and is 2 feet or less of vertical separation from the water pipe at the crossing, the existing sewer shall be encased in concrete for a distance of 10 feet in either direction from the crossing. Joints are not to be in the immediate vicinity of the water main and as far from it as practicable. Where water mains are laid across or through an area where there are existing sewers and the extra protection is needed, the existing sewers may be encased in concrete with a minimum of 6 inches thickness for the required distance on each side of the crossing.
- D. When pressure sewer lines (force mains) run parallel to water lines, the separation distance shall be as far as practical, maintaining a minimum horizontal separation distance of at least 10 ft. (3.0m). There shall be at least a 2 ft. (0.6m) vertical separation at crossings with the water main always crossing above the sewer force main. Where this is not possible, equivalent protection by other methods shall be provided as approved by KDHE on a case-by-case basis.
- E. Separation of Water Mains and Other Pollution Sources
1. It is of the utmost importance that potable water lines be protected from any source of pollution. The following shall pertain to instances where septic tanks, absorption fields, waste stabilization ponds, feedlots, or other sources of pollution are encountered.
 - a. A minimum distance of 25 ft. (7.6 m) shall be maintained between all potable water lines and all pollution sources, e.g. septic tanks, septic tank absorption fields, waste stabilization ponds, sewage contamination, wastewater, landfill leachate, and all CAFO facilities.
 - b. Under no circumstances shall a water line be extended through an area that is a real or potential source of contamination to the water line or water supply.
 - c. Under no conditions shall the encasement of a water line be considered as adequate protection of a water line or a water supply for the purpose of extending the water line through a real or potential source of contamination.

3.8 OTHER PROTECTION CONSIDERATIONS

A. Sewer Connections

1. There are to be no physical connections between any parts of a potable water system and building sewers, sanitary sewers, or wastewater treatment facilities by means of which it would be possible for sewage, even under exceptional circumstances, to reach a well, storage reservoir, or distribution system.

B. Sewer Manholes

1. No water pipe shall pass through or come in contact with any part of a sewer manhole. Required horizontal separation distances between water mains and manholes are equivalent to those for water mains and gravity sanitary sewers.

C. Storm Sewers

1. The separation distance between storm sewer (which is not combined storm/sanitary sewer) and a water main should be based on geotechnical considerations. Required separation distances between water mains and combined storm/sanitary sewers are equivalent to those for water mains and gravity sanitary sewers.

D. Drains

1. Underground drains from fire hydrants, pits, and underground structures in general (valve pits, meter pits, underground pumps stations, etc.) shall not be directly connected to sanitary or storm drains.

E. Cross Connections

1. There shall be no physical connection between the PWSS and any pipes, pumps, hydrants, tanks, or non-potable water supplies whereby unsafe water or other contaminating materials may be discharged or drawn into the system. KDHE approval shall be obtained for interconnections between potable water supplies. KDHE does not approve of the interconnection of any public water supply water line with any individual or independent water supply source such as home well. Neither steam condensate nor cooling water from engine jacket or other heat exchange devices shall be returned to the potable water supply.
2. KSA 65-171g prohibits the contamination of water (and air) by sewage through direct connection or back siphonage and KAR 28-15-18 9f) requires each PWSS to have a formal cross-connection prevention program. Publications regarding cross connection control are available from AWAA (2004a), USEPA (2003c), and University of Southern California (1993).
3. The water purveyor should be aware of any situation requiring an inspection and/or reinspection necessary to detect hazardous conditions resulting from cross

connection. If, in the opinion of the water purveyor, effective measures consistent with the degrees of the hazards created by the cross-connections have not been taken, then the water purveyor should be immediately take such measures as are deemed necessary to ensure that the PWSS is protected from any contamination arising from any of the cross-connections. Appropriate measures may include requiring the installation of a backflow protection device consistent with the degree of hazard or discontinuance of service.

F. Mechanical Encasement

1. Where a water line must be sleeved within a pipe in order to protect the water line, such as a road, railroad, or pipe way crossings, the waterline must be sleeved with seamless, jointless pipe of equal or greater mechanical strength for distance of at least 10 ft. (3.0m) beyond the crossing in both direction, kept separate from the sleeve pipe with plastic spacers or wooden skids, and the annular spaces formed at the ends of the carrier/sleeve pipes must be made watertight with flexible pull-over, boot type end seals sealed to the sleeve pipe and waterline with stainless steel bands.

3.9 FIELD QUALITY CONTROL AND TESTING

A. General:

1. The Contractor shall provide the Owner at least 72 hours' notice prior to scheduled testing and inspection.
2. Only properly functioning and clean equipment shall be used for flushing, pressure testing and disinfecting water mains.
3. Where any section of a water main is provided with concrete reaction backing for fittings or hydrants, the hydrostatic pressure test shall not be made until at least five days after installation of the concrete reaction backing, unless otherwise approved.
4. Test shall be conducted in accordance with AWWA Standards or as required by KDHE. Simultaneous pressure and leakage tests may be performed if permitted by the Engineer and must be at least 2 hours.

B. Pressure Testing:

1. After the pipe is laid, the joints completed, fire hydrants permanently installed, and the trench backfilled, the newly laid piping or any valved section of piping shall, unless otherwise specified, be filled with clean water and subjected for one hour to a hydrostatic pressure test at the rated working pressure of the pipe.
2. Testing shall be performed on each section of pipe between main line valves. The pressure test shall be conducted at 150 psi or 150% of working pressure in the line. Working pressure is defined as the maximum anticipated sustained operating pressure in the line being tested.
3. Care must be taken not to exceed the pressure ratings of the pipes, valves, fittings, and other appurtenances.

4. The Contractor shall furnish all pumps, fittings, and gauges as necessary to fill the line with potable water, displace air from the system, and pressurize the pipeline for the tests.
5. The Contractor shall provide all necessary temporary restraint and support, and will be responsible for providing proper safety measures during pressure testing operations.
6. Each valve shall be opened and closed several times during the test.
7. The pressure during the pressure test shall not vary by more than 5 psi from the designated test pressure.
8. Joints showing visible leakage shall be replaced or remade as necessary. Leaking rubber-gasketed joints shall be remade, using new gaskets if necessary. Cracked or defective pipe, mechanical joints, fittings, valves or hydrants discovered in consequence of this pressure test shall be removed and replaced with sound material, and the test shall be repeated until the test results are satisfactory.
9. Pressure test must be at least 1 hour.

C. Leakage Testing:

1. The duration of each leakage test shall be at least 2 hours, and during the test the main shall be subjected to the 150% of the working pressure at the lowest point and not less than 125% of the working pressure at the highest point. Leakage is defined as the quantity of water to be supplied into the newly laid pipe, or any valved section thereof, necessary to maintain the specified leakage test pressure after the pipe has been filled with water and the air expelled. No piping installation will be accepted until the leakage is less than the number of gallons per hour as determined by the formula:

$$L = \frac{SD\sqrt{P}}{148,000}$$

2. In which L equal the allowable leakage in gallons per hour; D is the nominal diameter of the pipe, in inches; S is the length of pipe tested, in feet; and P is the average test pressure during the leakage test, in pounds per square inch. The pressure during the pressure or leakage test shall not vary by more than 5 psi from the designated test pressure.

D. Disinfection:

1. General:
 - a. Disinfection of water mains shall be in accordance with Appendix D of the Kansas Department of Health and Environment Design Requirements for Public Water Supply Systems.
 - b. Before acceptance of the new water piping for domestic use by the Owner, the contractor shall flush and disinfect all newly completed piping as prescribed by AWWA Standard C651 and as required in these specifications.

- c. The Contractor shall provide plugs, chemicals, tests, and all materials, equipment, tools, and labor necessary for the satisfactory flushing and disinfection of the new water line as required in these specifications.
2. Preventive Measures: The Contractor shall take precautions to protect all interiors, fittings, valves, and assemblies from contamination during work. When pipe laying is not in progress (for example, at the close of a working day), all openings in the installed pipeline shall be plugged watertight and all joints of pipe in the trench shall be completed before work is stopped. If water accumulates in the trench, the plugs shall remain in place until the trench is dry.
3. The Contractor shall take reasonable measures in scheduling of material and equipment deliveries and in the prosecution of the work to minimize delay in completion of the work and to minimize exposure of the materials to possible contamination.
4. Flushing: The new water piping shall be flushed prior to disinfection, except when the Engineer has approved the use of tablets for disinfection. Piping shall be flushed at blow-off assemblies and at fire hydrants at terminal points of the piping.
5. Chlorination:
 - a. After flushing has been completed, the water line shall be disinfected by the "continuous feed" method using an approved liquid chlorine solution.
 - b. The disinfecting chemical shall be fed so as to maintain a chlorine concentration of at least 25 mg/l in the water throughout the new piping system.
 - c. During disinfection, valves shall be manipulated to prevent backflow of the treated water into the existing water system and also to ensure that all valves and appurtenances are disinfected.
 - d. The chlorinated water shall be retained in the pipe line for at least 24 hours. At the end of the 24 hour contact period, the treated water shall contain a free chlorine residual of not less than 10 mg/l.
 - e. At the Contractor's request, use of the "tablet method" of disinfection will be given consideration. The Contractor shall submit in writing, for the Engineer's approval before using this method a description of the type and number of tablets and the proposed procedure to be used.
 - f. Chlorine source is to be NSF 60 product certified.

6. Dechlorination: neutralization of the chlorine residual remaining in the water can be accomplished by the use of a dechlorination chemical to the highly chlorinated water. Typical dechlorination chemicals employed are sulfur dioxide (SO₂), sodium bisulfate (NaHSO₃), sodium sulfite (Na₂SO₃) and sodium thiosulfate (Na₂S₂O₃ 5H₂O). The amount of these chemicals required to neutralize the residual chlorine concentrations in 100,000 gallons of water as listed in the following table:

TABLE 1				
Residual Chlorine Concentration (mg/l)	Chemical Required			
	Sulfur Dioxide (lb)	Sodium Bisulfate (lb)	Sodium Sulfate	Sodium Thiosulfate
1	0.8	1.2	1.4	1.2
10	8.3	12.5	14.6	12.0
25	20.9	31.3	36.5	30.0
50	41.7	62.6	73.0	60.0

7. Final Flushing: After satisfactory disinfection of the water line, the heavily chlorinated water shall be flushed from the piping until the chlorine concentration in the water leaving the main is no higher than that generally prevailing in the water system, or less than 1.0 mg/l. Piping shall be flushed at blow-off assemblies and at fire hydrants at terminal points of the piping.
8. Bacteriological Testing: Following disinfection and final flushing the contractor shall obtain two (2) samples within a 24 hour period from each section of completed pipeline and have those samples tested by a State approved Laboratory for compliance with the State requirements for bacterial contamination. At least one (1) sample shall be collected from every 1200 feet of new main, one (1) set from the end of the line and at least one (1) set from each branch. Testing shall conform to the requirements of Option A of AWWA C651 and should provide the type, number, and frequency of samples for bacteriological tests. If tests fail then the Contractor shall repeat disinfection, flushing and testing procedures.

END OF SECTION

SECTION 33 12 16
VALVES AND APPURTENANCES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Butterfly Valves
 - 2. Swing Check Valves
 - 3. Gate Valves – Resilient Wedge
 - 4. Air Release Valves
 - 5. Valve Boxes, Lids and Covers
 - 6. Tapping Sleeves and Tapping Valves

1.2 DEFINITIONS

- A. AWWA: American Water Works Association
- B. CWP: Cold working pressure.
- C. EPDM: Ethylene propylene copolymer rubber.
- D. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.
- E. NPS: Nominal Pipe Size
- F. NRS: Nonrising stem.
- G. NSF: NSF International
- H. OS&Y: Outside screw and yoke.
- I. PSI: Pounds per Square Inch
- J. RS: Rising stem.
- K. SWP: Steam working pressure.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of valve indicated.

1.4 QUALITY ASSURANCE

- A. General: Submittals shall be made by the Contractor in accordance with the procedures set forth in Division 01.
- B. Contractor shall provide manufacturer's catalog cuts, technical data, and/or shop drawings for all the following components (shop drawings shall be drawn to a scale sufficiently large to show all pertinent aspects of the item and its method of connection to the work):
 - 1. Valves
 - 2. Valve Boxes, Lids and Covers
 - 3. Tapping Sleeves and Tapping Valves
- C. NSF Compliance: Valves and appurtenances shall be NSF 61 product certified. All interior valve coatings shall be NSF 61 product certified.
- D. Compliance with the Reduction of Lead in Drinking Water Act (2014) is required and all applicable products must meet the lead-free requirements and conform to NSF 372.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
 - 1. Protect internal parts against rust and corrosion.
 - 2. Protect threads, flange faces, grooves, and weld ends.
 - 3. Gate valves shall be closed to prevent rattling
 - 4. Butterfly valves shall be closed or slightly open.
 - 5. Check valves in either closed or open position.
- B. Use the following precautions during storage:
 - 1. Maintain valve end protection.
 - 2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.
- C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

- A. Refer to valve schedule articles for applications of valves.

- B. Valves and appurtenances shall be installed in compliance with the latest versions of the ASTM and AWWA standards listed as references.
- C. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- D. Valve Sizes: Same as upstream piping unless otherwise indicated.
- E. Valve Actuator Types:
 - 1. Gear Actuator: For quarter-turn valves NPS 8 and larger.
 - 2. Handwheel: For valves other than quarter-turn types.
 - 3. Handlever: For quarter-turn valves NPS 6 and smaller.
 - 4. Wrench: For valves with square heads. Furnish Owner with 1 wrench for every 10 valves, for each size square valve head.
 - 5. Chainwheel: Device for attachment to valve handwheel, stem, or other actuator; of size and with chain for mounting height, as indicated in the "Valve Installation" Article.
- F. Valve-End Connections:
 - 1. Valve end connections shall be as shown on the drawings.

2.2 BUTTERFLY VALVES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or pre-approved equal:
 - 1. Clow
- B. Valve Requirements:
 - 1. The butterfly valves shall be AWWA Class 150B unless otherwise shown on the drawings.
 - 2. Ends shall be flanged and shall be suitable for installation between ANSI Class 125 or Class 150 flanges.
 - 3. Valves shall be suitable for Bi-Directional service.
 - 4. Shaft Bearing Surfaces and Packing:
 - a. 2" to 20": Nylon, Reinforced Teflon
 - b. 24" to 48": Reinforced Teflon
 - c. Shaft seals shall be provided with a minimum of three rings of chevron v-type self-adjusting packing. O-rings not acceptable.
 - 5. Valve shall be cast iron or ductile iron as shown on the drawings.
 - 6. Valve shaft shall be stainless steel.

7. Port diameter shall be within one inch of nominal valve size. Stops in the valve body are not acceptable.
8. Discs shall be cast iron in accordance with ASTM A 126 or ductile iron in accordance with ASTM A 536.
9. Seats shall be synthetic rubber compound and body mounted. Natural rubber is not acceptable. Mating seat surfaces shall be type 316 stainless steel or plasma applied nickel chrome.
10. Shaft to Disc connection shall be made with stainless steel dowel or taper pins extending through both sides of the shaft and disc.
11. Manual valves shall be readily adaptable to the installation of cylinder or electrical motor operator. All operators and cylinders on the 12" and 14" valves shall be the same size. Operators on the 4" and 6" valves shall be the same size.
12. Valves shall be coated in accordance with AWWA C504. Finish coat shall be an epoxy coating.

C. Operators:

1. Gear Operator:
 - a. Manual operators shall be of the traveling nut or worm gear type and shall be designed to hold the valve in any intermediate position between fully open and fully closed without creeping or fluttering. Operators shall be equipped with mechanical stop-limiting devices inside the operator to prevent overtravel of the disc in the open and closed positions. Valves shall close with a clockwise rotation. Operators shall be fully enclosed with a removable cover to permit inspection and adjustment of the mechanism and shall be designed to produce the specified torque with a maximum pull of 80 lb. on the handwheel or chainwheel. Operator components shall withstand an input per AWWA standard include 450 ft lb input stops. Manual actuator shall not rely on a bearing track machined into the back of the valve cover. All internal components shall operate as intended with or without the cover in place.

2.3 SWING CHECK VALVES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or pre-approved equal:
 1. Clow
- B. Valve Requirements:
 1. Furnish and install cast iron, swing type check valves with outside spring and lever, stainless steel hinge pin and stainless steel trim.
 2. Meet the material and design requirements of AWWA specification C508.

3. Rate for a non-shock working pressure of 175 psi (2"-12") or 150 psi (14" and larger,) and hydrostatically tested at double the working pressure.
4. Ends shall be 125# ANSI flanged.
5. Valve shall be constructed so that by unbolting and lifting off the cover, the internal working parts may easily be removed and replaced without removing the valve from the line.
6. 4" and larger: Full, clear port through the valve when open.
7. Interior and exterior protective epoxy coating shall meet the requirements of AWWA C550 as 8 mils fusion bonded epoxy interior and exterior.
8. All external bolts shall be stainless steel.

2.4 GATE VALVE – RESILIENT WEDGE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or pre-approved equal:
 1. Clow
- B. Valve Requirements:
 1. Furnish and install a resilient wedge gate valve, including all operators and appurtenances for use in water application.
 2. Valve body and bonnet shall be meet the material and design requirements of AWWA specification C509.
 3. Valves shall be rated for working pressures of not less than 150 psi.
 4. The full diameter of the valve shall be smooth and unobstructed with internal parts being accessible without removing the body from the line.
 5. All exposed interior and exterior iron surfaces shall be protected with a fusion bonded epoxy coating.
 6. Valves shall be non-rising stem.
 7. Wedge shall be cast iron or ductile iron, completely encapsulated with resilient material permanently bonded to the wedge.
 8. All bolts and nuts shall be 316 stainless steel unless otherwise specified.
 9. Valves shall have a minimum of two (2) O-ring seals above the thrust collar area, both of which shall be field replaceable without removing the valve from service.
 10. Valves shall be supplied with anti-friction thrust bearings at the collar area to reduce operating torque in both the opening and closing directions.
 11. Valves shall have joints as required for the piping in which they are installed.
- C. Operating Nuts or Handwheel Requirements:
 1. Valves shall be provided with either a 2" square operating nut or a handwheel, as shown on the Drawings, with the word OPEN and an ARROW cast in the metal to indicate direction to open.
 2. All buried valves shall be provided with a 2" square operating nut.
 3. Valve shall open by turning the nut or handwheel counterclockwise.

2.5 AIR RELEASE VALVE AND COMBINATION AIR/VACUUM RELEASE VALVES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or pre-approved equal:
 - 1. ARI
 - 2. APCO
- B. Valve Requirements:
 - 1. Furnish and install the air release valve for use in water application.
 - 2. Valve body shall meet the material and design requirements of AWWA specification C512.
 - 3. Valves shall be rated for working pressures of not less than 150 psi.
 - 4. Orifice shall be sized to accommodate the air/flow expected through the valve.

2.6 VALVE BOXES, LIDS AND COVERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or pre-approved equal:
 - 1. Clow
 - 2. Clay and Bailey
 - 3. Tyler Union
- B. Description:
 - 1. PVC or cast iron, complete with lock type cover, and screw-type extension adjustment.
 - 2. Install over each outside valve unless otherwise shown.
 - 3. Length as will be adjusted, without full extension, to the depth of cover required.
 - 4. Furnish at least one valve wrench for each depth of setting.
- C. Description:
 - 1. Valve box shall be 6" cast iron.
 - 2. Lid and cover shall be Clay and Bailey #2194.
 - 3. Cover shall be lock type.
 - 4. Install over each outside valve unless otherwise shown.

2.7 TAPPING SLEEVES AND TAPPING VALVES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or pre-approved equal:
 - 1. Mueller

B. Description:

1. Tapping Sleeve:

- a. Body, flange, bolts, and nuts shall be grade stainless steel.
- b. Provide with a complete full circle rubber gasket permanently attached to body.
- c. Verify pipe size and class prior to ordering the tapping sleeve.
- d. Provide a minimum rated working pressure of 150 PSIG.

2. Tapping Valve:

- a. Resilient seat non-rising stem gate valve with flange end to mate to the tapping sleeve and a mechanical joint end to connect the pipe.
- b. Mechanical joint end with slotted bolt holes to fit a standard tapping machine.
- c. Minimum rated working pressure of 150 PSIG.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- B. Operate valves in positions from fully opened to fully closed. Examine guides and seats made accessible by such operations.
- C. Examine threads on valve and mating pipe for form and cleanliness.
- D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves in horizontal piping with stem at or above center of pipe.

- D. Install valves in position to allow full stem movement.
- E. Install chainwheels on operators for valves NPS 4 and larger and more than 96 inches above floor. Extend chains to 60 inches > above finished floor. Include safety cable kit to prevent chainwheel from falling if it comes loose from the actuator due to corrosion or breaking.
- F. Install check valves for proper direction of flow and as follows:
 - 1. Swing Check Valves: In horizontal position with hinge pin level.

3.3 ADJUSTING

- A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.
- B. Select valves, except wafer types, with the following end connections:
 - 1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
 - 2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
 - 3. For Copper Tubing, NPS 5 and Larger: Flanged ends.
 - 4. For Steel Piping, NPS 2 and Smaller: Threaded ends.
 - 5. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
 - 6. For Steel Piping, NPS 5 and Larger: Flanged ends.
 - 7. For Grooved-End Copper Tubing and Steel Piping: Valve ends may be grooved.

END OF SECTION

SECTION 33 31 00
SANITARY SEWERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Sanitary Sewer Pipe and fittings
2. Cleanouts
3. Encasement for Piping
4. Manholes
5. Testing Requirements

1.2 DEFINITIONS

- A. ANSI: American National Standards Institute
- B. ASTM: ASTM International
- C. AWWA: American Water Works Association
- D. CPVC: Chlorinated Polyvinyl Chloride
- E. DI: Ductile Iron
- F. DIPS: Ductile Iron Pipe Size
- G. EPA: Environmental Protection Agency
- H. FRP: Fiberglass-Reinforced Plastic.
- I. HDPE: High Density Polyethylene
- J. IPS: Iron Pipe Size
- K. NACE: National Association of Corrosion Engineers
- L. O & M: Operation and Maintenance
- M. OSHA: Occupational Safety and Health Administration
- N. PVC: Polyvinyl Chloride
- O. RPR: Resident Project Representative

- P. SDR: Standard Dimensional Ratio
- Q. S.R.C.A.R.: Steel Reinforced Concrete Adjustment Rings
- R. SSPC: Society for Protective Coatings
- S. VCP: Vitrified Clay Pipe

1.3 ACTION SUBMITTALS

- A. General: Submittals shall be made by the Contractor in accordance with the procedures set forth in Division 01.
- B. Product Data: Provide manufacturer's catalog cuts, technical data, and/or shop drawings for the following system components (shop drawings shall be drawn to a scale sufficiently large to show all pertinent aspects of the item and its method of connection to the work):
 - 1. Pipe
 - 2. Marking tape
 - 3. Fittings, sleeves and couplings
 - 4. Pipe restraints
 - 5. Manhole Structures
 - 6. Manhole Frame and Cover
 - 7. Bedding Material
- C. Shop Drawings: For manholes include drawings, elevations, sections, details, gaskets and frames and covers.
- D. Provide pipe certifications and cut sheets for pipe and fittings.
- E. Tests:
 - 1. Description of proposed testing methods, procedures, and apparatus and obtain acceptance by Engineer prior to testing.
 - 2. Provide report for each test to include date or dates of testing, specified requirements for which testing was performed, and the results of the test or tests.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Delivery:
 - 1. Deliver materials to the Site to ensure uninterrupted progress of the Work.
 - 2. Upon delivery inspect pipe and appurtenances for cracking, gouging, chipping, denting, and other damage and immediately remove from site and replace with acceptable material.

3. No other pipe or material of any kind shall be placed inside of any pipe or fitting.
4. Contractor shall provide all storage areas, unless designated otherwise on the drawings.

B. Storage:

1. Store materials to allow convenient access for inspection and identification.
2. Store material off ground using pallets, platforms, or other supports. Protect packaged materials from corrosion and deterioration.
3. Do not remove end protectors or supports unless necessary for inspection; these should be reinstalled for storage.
4. Pipe and fittings other than PVC and CPVC may be stored outdoors without cover. Cover PVC and CPVC pipe and fittings stored outdoors.
5. The pipe and fittings shall be protected and stored at the site to avoid any damage to the pipe, pipe coatings, and joint system. When the pipe is laid out along the trench, the same precautions shall be taken to prevent damage to the pipe or joint systems.

C. Handling:

1. Handle pipe, fittings, specials, and accessories carefully in accordance with pipe manufacturer's recommendations. Do not drop or roll material off trucks. Do not drop, roll or skid piping.
2. Avoid unnecessary handling of pipe.
3. The interior of all pipe shall be thoroughly cleaned of all foreign matter before being lowered into the trench, and shall be kept clean during laying operations by means of plugs or other approved methods. At all times when work is not in progress, all open ends of pipes and fittings shall be securely closed with mechanical caps/plugs so that no trench water, earth or other substances will enter the pipe or fittings.
4. Protect interior linings and exterior coatings of pipe and fittings from damage. Before lowering and while suspended, pipe shall be inspected for defects and cracks. Defective, damaged or unsound pipe shall be rejected.
5. If coating becomes damaged, Contractor shall notify pipe and coating manufacturer to determine if repair of damaged area or re-coating is required. Perform repairs using recommended procedures and materials provided by manufacturer, as accepted by Engineer. Pipe and fittings requiring re-coating shall be removed from Site and returned to manufacturer's facility. Repaired or re-coated pipe and fittings shall meet all requirements of this section.

1.5 PROJECT CONDITIONS

A. Interruption of Existing Sanitary Sewerage Service and Temporary Wastewater Diversion Plan:

1. Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
 - a. Notify Owner no fewer than 72 hours in advance of proposed interruption of service.
 - b. Do not proceed with interruption of service without written permission of the Owner.
 2. Temporary Wastewater Diversion Plan:
 - a. Where normal wastewater flows will be interrupted as part of construction efforts, the Contractor will be required to submit a plan for approval for diversion or bypassing of wastewater flows throughout the duration of construction. The plan shall include any temporary pumps and sizing, routing of temporary piping, operation or sequencing plan, and hydraulic capacities of proposed temporary materials.
 - b. All temporary plugs used for diversion of wastewater flows shall be mechanical type plugs.
 - c. Any items to be utilized for temporary diversion of flows shall be submitted for approval prior to use.
 - d. Contractor shall submit a plan for monitoring the system should bypass operation extend through times when crews are not present on site, such as overnight or periods of inclement weather.
 - e. Contractor shall include all costs for temporary diversion of wastewater flows under other related items of work unless a bid item is included specifically for this work. No additional payment will be made for the work associated with the temporary diversion of wastewater flows.
- B. Manhole coatings:
1. Applicator shall conform with all local, state and federal regulations including those set forth by OSHA, RCRA and the EPA and any other applicable authorities.
 2. The applicator shall meet all confined space requirements prior to entry into any manholes.
- C. Manufacturer Qualifications:
1. Manufacturer shall have a minimum of five years of experience producing the type of pipe and fittings utilized for the project, and shall be able to show evidence of at least five installations in satisfactory operation for at least five years.

D. Regulatory Requirements:

1. Comply with the requirements including proof of insurance, and other permit requirements for construction across or along railroads, highways, local or county roads, or drainage ways.
2. Comply with the requirements for NPDES permitting, including best management practices for storm water discharges from the construction site.
3. The Contractor shall determine if any authorization to use water from the public fire hydrants for construction, cleaning and television inspection is needed. If so, the Contractor shall apply for a permit at the appropriate City Office to authorize usage of water for settlement of backfill, cleaning, testing and television inspection from public fire hydrants. The Contractor shall determine metering requirements and pay any costs associated with using public water for work associated with the project.
4. Pipe lines, fittings, and valves shall conform to the specifications as set forth in this section. All pipe, valves, fittings and appurtenances shall be new material unless otherwise specified. Any section of pipe already laid and found to be defective shall be taken up and replaced without additional expense to Owner.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Pipe may be of any of the materials outlined within this section unless indicated otherwise on the drawings, in the proposal, or in the specifications.
- B. The Contractor shall furnish certified records of the tests for each type of pipe to be used in the work. Tests and certifications shall be provided by the Contractor and made by a reliable commercial laboratory. These items shall be submitted to the Engineer for approval prior to ordering and shipment of pipe.
- C. Trenching and backfill conditions are integral parts of the piping system, therefore, all parts will be considered for acceptance or rejection and for performance and maintenance of the sewer pipe in place.
- D. The minimum material thickness for each type and size of pipe shall be as required by the Engineer. All pipe not meeting the flexibility tolerances of the Engineer, will not be accepted. The stiffness factor will be used for determination of each pipe's flexibility. The stiffness factor is a product of the moment of inertia of the pipe cross-section and the modulus of elasticity of the pipe material. When requested by the Engineer, the Contractor shall provide certified test results by the pipe manufacturer for the pipe to be used.

2.2 GRAVITY SEWER PIPE (FLEXIBLE)

A. PVC Pipe and Fittings:

1. The pipe shall have integral wall bell and spigot joints conforming to ASTM D 3212. The bell shall consist of an integral wall section with a solid cross-section elastomeric ring, factory assembled, securely locked in place to prevent displacement.
 2. Pipe and Fittings 8 inches to 15 inches in diameter:
 - a. Pipe and fittings shall meet and/or exceed all of the requirements of the latest revision of ASTM Specification D-3034 and conform to SDR 35 unless otherwise indicated on the drawings. Pipe lengths shall have terminals fabricated for the approved joint system and such length to permit ease of handling and installation without damage to the pipe sections. Joints shall be slip joint with a rubber (Neoprene) gasket to form a tight compression seal. Fittings and or adapters shall be as approved by the Engineer. The pipe shall be protected against ultra-violet light degradation. Each pipe length shall be identified with the manufacturer's name, pipe designation, and date of manufacture.
 - b. Before any PVC pipe is used on this Project, the Contractor shall supply certifications, signed by an authorized agent of the seller or manufacturer, stating that the material has been sampled, tested, and inspected in accordance with ASTM D 3034.
 3. Pipe and fittings less than 8 inches:
 - a. Pipe and Fittings which are smaller than 8 inches in diameter shall be Schedule 40 PVC pipe, meeting all of the requirements of the latest revision of ASTM D1785. Joints shall be elastomeric seals meeting the latest revision of ASTM D3212 or solvent welded joints.
 - b. Before any PVC pipe is used, the Contractor shall supply certifications, signed by an authorized agent of the seller or manufacturer, stating that the material has been sampled, tested, and inspected in accordance with ASTM D 1785.
- MANHOLES AND
CLEANOUTS

B. Manholes:

1. Manholes shall be constructed to be watertight. A bituminous or other approved coatings shall be applied to the exterior of the manhole as directed by the Engineer. All work in connection with the application of the coatings shall be considered subsidiary to the unit cost for the manhole and shall be at no additional cost to the Owner.

2. The invert channels shall be smooth and semi-circular in shape conforming to the inside of the adjacent sewer section. Changes in direction of flow shall be made with a smooth curve of as large a radius as the size of the manhole will permit. Changes in size and grade of the channels shall be made gradually and evenly. The invert channels shall be formed directly in the concrete of the manhole base, or shall be constructed by laying a full section of sewer pipe through the manhole and cutting out the top half after the surrounding concrete has hardened. The floor of the manhole outside the channels shall be smooth and shall slope toward the channels not less than 1 inch per foot nor more than 2 inches per foot unless otherwise noted.
3. Drop manholes shall be constructed whenever the free drop would otherwise be greater than 2 feet and shall be outside drop as shown on the drawings. Inside drop manholes shall be a minimum of 5 feet in diameter.
4. Concrete: Shall comply with Division 03 except as noted herein.
5. Quick Set Hydraulic Cements: Thoro "Water Plug", Quikcrete "Waterstop" or equal.
6. PreCast Reinforced Concrete Manholes:
 - a. Precast Reinforced Concrete manholes shall conform to the latest revision of ASTM C478 except for the following modifications:
 - 1) Cement used in construction of precast reinforced concrete manholes shall conform to the requirements of the Standard Specifications for Portland cement (ASTM Designation: C150).
 - 2) Thickness of precast sections shall be at least one-twelfth of the internal shell diameter plus one inch, or 5 inches total, whichever is greater. The minimum internal diameter of manholes shall be 4 feet.
 - 3) Precast reinforced concrete manholes constructed downstream of a force main (receiving manholes), shall include installation of specialized manhole coating outlined in this section.
 - 4) Joints between precast reinforced concrete sections shall provide for the use of mastics or rubber gaskets (natural or synthetic) to prevent leakage or infiltration. All mastic shall be trimmed flush on the inside of the manhole sections and cleaned from the interior surfaces of the manhole.
 - 5) Precast sections shall be adequately reinforced with steel to withstand erection and temperature stresses.
 - 6) The manufacturer of precast manhole sections shall submit tests from a certified lab detailing quality of aggregates and the mix design, which shall be in accordance with ASTM C478 or the specifications as herein stated.
 - 7) The Contractor must submit certified test results showing that a random number of precast sections have been sampled and tested in accordance with ASTM C497 prior to moving precast sections to the job site. All costs to complete the preceding test are at no additional cost to the Owner.

- b. Sand for Mortar: Concrete sand (fine aggregate) sieved through 8 mesh screen.
- c. Mortar: Eight (8) sacks of Type I cement per cubic yard. Use of hydrated lime shall not be allowed.
- d. Gaskets:
 - 1) Mastic: Fed. Spec. SS-S-210; K.T. Snyder "RamNek" or ConSeal CS-102, or approved equal.
 - 2) Rubber: Neoprene or other synthetic, 40 plus or minus 5 hardness when measured by ASTM D2240, Type A durometer.
- e. Mastic Sealing: Koppers "Bitumastic SuperService Black", Tnemec "450 Heavy Tnemecol", or USS "Tarmastic 103" or approved equal.
- f. Castings: ASTM A48-83, Class 35B. Frames and covers as shown on the drawings. All weights as given are approximate and average. Variation will not exceed the specified weight by more than 4%. Castings are to be manufactured true to pattern and with satisfactory fit of component parts. Castings shall be free of defects. Dimensions as detailed on drawings shall not deviate by +/- 1/16 inch per foot. Castings shall be furnished with machined horizontal bearing surfaces.
- g. Bolt-down Castings: Where indicated on the drawings, bolt-down frame and cover shall be Deeter Foundry #1295, socket hinge manhole frame and cover with Cam Lock or approved equal. Bolts for castings shall be stainless steel unless otherwise indicated.

C. Manhole Coatings:

1. Existing Structures:

- a. Cementitious patching and repair materials should not be used unless their manufacturer provides information as to its suitability for top coating with coating. Project specific submittals should be provided including application, cure time and surface preparation procedures which permit optimum bond strength with the coating. New concrete must cure 28 days prior to coating application.
- b. Specified steel surfaces will be thoroughly inspected and, after blast preparation may be ultrasonically tested to detect thin spots in the shell where the structural integrity of the structure has deteriorated. After blast preparation these spots should be marked with epoxy spray paint or zinc primer.
- c. Existing coatings should be removed or, where bonded well, thoroughly abraded to provide adequate surface profile for mechanical bond by the new protective coating. Applicator is to maintain strict adherence to the protective coatings manufacturer's recommendations with regard to proper surface preparation and compatibility with existing coatings.

2. For Manholes installed on sanitary sewers which are 12 inches or smaller in diameter:
 - a. All interior concrete surfaces above the bench of precast manhole shall be coated with two (2) coats of Wilkopen HB Gray (No 332.98) by Wilko or Tnemec Series 66 Hi-Build Epoxy, dry thickness of 8 mils (min.).
 - b. Exterior manhole walls shall be coated with one coat of Ultra-Shield WB Coating by GMX, Valspar Hi-Build Bituminous Coating 35-J-10, or Tnemec 46-450 Heavy Tnemecol, or approved equal.

PART 3 - EXECUTION

3.1 EARTHWORK

- A. Excavating, trenching, and backfilling are as specified in Division 31.

3.2 PIPING INSTALLATION

- A. General Locations and Arrangements: Drawings and details indicate general location and arrangement of underground sanitary sewer piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.
- B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for using lubricants, cements, and other installation requirements.
- C. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.
- D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

3.3 CONNECTIONS WITH EXISTING PIPELINES

- A. Where connections are made between new work and existing sewers, such connections shall be made in a thorough and workmanlike manner and to the satisfaction of the Engineer. Each connection shall be made in such a manner that adjacent sewers are kept in operation as authorized by the owner of the utility. Before any construction involving a connection to the existing sanitary sewer collection system, the existing system must be isolated from any construction activity. A mechanical plug(s) shall be used. Pneumatic or inflatable plugs are not acceptable. This shall be done with the knowledge of the owner of the utility, who shall be notified 24 hours prior to any intrusion into the existing system. The plug(s) shall stay in position until the new construction is accepted or unless otherwise instructed by the Engineer. Where existing lines pass through new manholes and are above the bottom of the manhole the Contractor must provide pipe support to ensure continuous service. Suitable facilities shall be provided for proper dewatering and drainage. Disposal of all water removed from the dewatered lines and excavation shall not be to a sanitary sewer.

3.4 WATER MAINS PARALLELING AND CROSSING SEWER LINES

- A. When potable water pipes and sanitary sewers are laid parallel to each other, the horizontal distance between them shall be not less than 10 feet. The laying of water pipes and sanitary sewers shall be in separate trenches with undisturbed earth between them.
- B. When a water pipe and a gravity sanitary sewer cross and the sewer is two feet or more (clear space) above or below the water pipe, no extra protection to the latter is needed. At all other crossings, the sewer is to be constructed of one of the following materials (or approved equal) with joints in the sewer pipe located as far as practical from the intersected water main and pressure tested to assure water tightness pursuant to the most recent revision of KDHE's Minimum Standards of Design of Water Pollution Control Facilities:
1. Ductile Iron pipe conforming to ASTM A536 or ANSI/AWWA C151/A21.51 with minimum thickness class 50, and gasketed, push-on, or mechanical joints in conformance with ASNI/AWWA C110/A21.10 or ANSI/AWWA C111/A21.11.
 2. PVC pipe conforming to ASTM D3034 with minimum wall thickness of SDR 41, ASTM F679, or ASTM F794, with gasketed push-on joints in conformance with ASTM D3212.
 3. Reinforced Concrete pipe conforming to ASTM C76 with gasketed joints in conformance with ASTM C361 or ASTM C443.

- C. Where a water main is laid across or through an area where there is an existing gravity sanitary sewer, which is not constructed of one of the above materials and is 2 feet or less of vertical separation from the water pipe at the crossing, the existing sewer shall be encased in concrete with a minimum of 6 inches thickness for a distance of 10 feet in either direction from the crossing. Joints are not to be in the immediate vicinity of the water main and as far from it as practicable.
- D. When pressure sewer lines (force mains) run parallel to water lines, the separation distance shall be as far as practical, maintaining a minimum horizontal separation distance of at least 10 ft. (3.0m). There shall be at least a 2 ft. (0.6m) vertical separation at crossings with the water main always crossing above the sewer force main.
- E. Sewer lines shall not be laid in the same trench as the water main.
- F. Maintain at least 10 ft. of horizontal separation between waterlines and sanitary sewer manholes as measured from their nearest points.

3.5 PIPE LAYING

- A. The interior of all pipe shall be thoroughly cleaned of all foreign matter before being lowered into the trench, and shall be kept clean during the laying operation by means of plugs, pigs, swabs or other approved methods.
- B. Each section of pipe shall be laid to line and grade proceeding upgrade with the spigot ends pointing in the direction of flow. The trench bed shall support the full length of pipe, except for joint recesses, over the bottom quadrant of the pipe circumference unless shown otherwise in the details. Where shown on the drawings, specified, or when directed by the Engineer the pipe shall be supported on special bedding material, concrete cradle, or concrete encasement.
- C. Any pipe that has its grade or joints disturbed after laying shall be taken up and relaid by the Contractor at no additional cost to the Owner. Trenches shall be kept free from water until the pipe sections are joined, and pipe shall not be laid when the condition of the trench or the weather is unsuitable for such work. At times when work is not in progress, open ends of pipe and fittings shall be securely and satisfactorily closed so that no trench water, earth, or other substance will enter the pipe.

- D. All sections of the pipe shall be set to form a close concentric joint with the preceding pipe. Joints shall be made with the pipe in place in the trench unless approved otherwise in writing by the Engineer. All pipe and joint systems shall be installed in accordance with the manufacturer's recommendations except for variations due to special adapters, with all types as approved by the Engineer. Care shall be taken to lubricate joint systems to avoid damage or prevent twisting of rubber gaskets out of position. Pipe having smooth exterior surfaces, unable to make a watertight bond with manhole walls, shall be installed with a rubber water stop, as manufactured by A-Lok or approved equal, at all manhole penetrations as recommended by the pipe manufacturer and as directed by the Engineer.

3.6 WYE BRANCHES

- A. The wye branches on sewer laterals for residential connections shall be 4 inches in diameter unless otherwise specified, and shall be set on the downgrade of every lot, or at such intervals as may be directed by the Engineer. All wye branches shall have a proper gasketed socket on the outer end, and when not immediately used shall be plugged as directed by the Engineer.

3.7 CONCRETE CRADLES AND ENCASEMENT

- A. Where indicated on the drawings or directed by the Engineer, the sewer pipe shall be supported by concrete cradle or concrete encasement in accordance with the details. During the concrete placing operations, the Contractor shall prevent the introduction of foreign matter into the trench or displacement/floating of the sewer pipe.

3.8 MANHOLE INSTALLATION

- A. Install manholes complete with appurtenances and accessories indicated.
- B. Delivery: Precast concrete section shall not be delivered to the job until representative concrete control cylinders have attained strength of at least 80% of the specified minimum. The date of manufacture and manhole number shall be indicated on each manhole section upon delivery.
- C. Manholes shall be constructed and installed in accordance with ASTM Standards. The quality of materials, process of manufacture, and finished manhole products shall be subject to inspection and approval by the Owner. All cracked or otherwise visibly defective units will be rejected.
- D. Manhole covers shall be set so that the top of the frames will be flush with all paved surfaces, other locations will be set 0.4 foot above grade or as otherwise directed by the Engineer or shown on the drawings.

E. Precast Reinforced Concrete Manholes:

1. Precast Reinforced Concrete Manholes shall conform to the latest revision of ASTM C478 except for the following modifications:
 - a. Thickness of precast sections shall be at least 1/12 of the internal shell diameter plus one inch, or 5 inches total, whichever is greater. The minimum internal diameter of manholes shall be 4 feet.
 - b. All precast sections shall be adequately reinforced to withstand erection and temperature stresses as well as other applied loads.
 - c. Joints between precast sections shall provide for the use of mastics or rubber gaskets (natural or synthetic) to prevent leakage or infiltration.
 - d. Prior to moving precast sections to the job site, the Contractor shall submit certified test results showing a random number of precast sections have been sampled, tested for compressive strength and absorption and are in compliance with ASTM-C497.
 - e. Manholes with precast bases may be used at the contractor's option. Manholes with precast bases shall have A-Lok or approved equal gaskets cast into the manhole wall for all pipe penetrations. These manholes shall have an 8 inch minimum base thickness and shall be placed on an 8 inch minimum crushed rock base. Pipes shall be encased with crushed rock to at least 3 feet from the manhole wall. The crushed rock shall meet the requirements for granular bedding material.
2. Cast in Place Manhole Bases:
 - a. Concrete used for cast in place manhole bases shall conform to Division 03.
 - b. Base shall be cast using concrete with a minimum 28 day compressive strength of 3000 psi concrete, vibrated or tamped. The base shall have a minimum diameter of 8 inches greater than the outside diameter of the manhole and shall have a minimum 8 inch thickness below the manhole wall.
 - c. Inverts shall be formed during or immediately after casting the manhole base and brush finished as soon as the concrete has sufficiently set.
 - d. Sewer pipe with top half removed should be laid through the manhole whenever possible.
3. Sewer Connections to Manholes:
 - a. Sewer connections to manholes shall be correctly aligned and connected to the manhole with an approved gasket.
 - b. Flexible Gaskets:
 - 1) Flexible gaskets as manufactured by A-Lok or approved equal may be used as compression connectors whenever a pipe penetrates into a precast manholes or structure.

- 2) Gaskets shall be watertight based on ASTM C 923 to provide a seal between the pipe and the structure wall. Gasket shall be cast integrally with the structure wall during the manufacturing process in a manner that it will not pull out during pipe coupling.
 - 3) Seal between the gasket and the pipe shall be made by the compression connector between the outside circumference of the factory installed over-sleeve or the surface of the pipe and the interior opening of the structure.
 - 4) Flexible gaskets shall not be grouted in place.
- c. Grouted Connections:
- 1) Pipe connections at manhole walls shall be grouted in place with hydraulic cement.
 - 2) Pipes having smooth exterior surfaces, unable to make a watertight bond with manhole walls, shall be installed with a rubber water stop at manhole penetrations. The space between the pipe and manhole shall be completely filled with an approved quick-set hydraulic cement.
- d. Pipe penetrations shall utilize an A-Lok gasket which shall be supported by a crushed rock encasement for a distance of 3 feet minimum from the face of the outside wall, for VCP encasement shall extend to a joint. A-Lok gaskets shall not be grouted in place.
- e. Pipe penetrations that do not utilize an approved A-Lok gasket precast in the manhole wall shall have the pipe supported a minimum of 3 feet from the face of the outside wall with Class I concrete or as shown on the drawings.
- f. Pipe penetrations extending from the wall of a “dog house” style manhole shall utilize an approved waterstop gasket which meets or exceeds the test requirements of ASTM C923. The pipe extending from the manhole wall shall be supported by a crushed rock encasement for a distance of 3 feet minimum from the face of the outside wall.

4. Manhole Adjustment Rings: Elevation of the manhole top shall be set so that the top of the frames will be flush with all paved surfaces unless otherwise shown on the drawings. All other locations will be set as shown in the drawings. Vertical stacks shall be constructed of 4 inch or 6 inch Keyed Steel Reinforced Concrete Adjustment Rings (S.R.C.A.R.), complying with ASTM-C150 and ASTM-C478. When more than one S.R.C.A.R. is required, only one 4 inch ring shall be allowed and it shall be placed at the bottom of the stack. The manhole entry frame and the adjustment rings shall be properly sealed using two rings of mastic (Fed. spec. SS-S210) spaced approximately 2 inches apart. The manhole entry frame shall be 'capped' with a ring of Type 1 concrete complying with ASTM-C150. The cap should extend from a maximum of 1 inch below the top of the frame, to a point beyond the bottom of the frame joint. The surface of the cap shall be hand rubbed to provide a smooth, even texture and appearance. Manhole details are shown on the drawings.

3.9 CLEANOUT INSTALLATION

- A. Install cleanouts and riser extensions from sewer pipes to cleanouts as shown in the drawings.
- B. Install piping so cleanouts open in direction of flow in sewer pipe.

3.10 APPLICATION OF MANHOLE COATINGS

- A. Application and Inspection:
 1. For manholes installed on sewers 12 inches or smaller, the exterior surface of the manhole shall be coated with one (1) coat bituminous coating or approved equal unless otherwise noted in the drawings.
 2. For manholes installed on sewers 12 inches or smaller, the interior surface of the manhole shall be coated with two (2) coats of gray coating or approved equal unless noted otherwise in the drawings.
 3. All work in connection with the application of the coatings shall be considered subsidiary to the unit cost bid for the manhole.
 4. Applicator shall inspect all surfaces specified to receive a protective coating prior to surface preparation. Applicator shall notify Owner of any noticeable disparity in the surfaces which may interfere with the proper preparation or application of the repair mortar and protective coating.
 5. All concrete, brick, or mortar that is not sound or has been damaged by chemical exposure shall be removed to a sound surface.
 6. All contaminants including: oils, grease, unsound or incompatible existing coatings, waxes, form release, curing compounds, efflorescence, sealers, salts, or other contaminants shall be removed.

7. Surface preparation method(s) should be based upon the conditions of the substrate and the requirements of the protective coating to be applied.
8. All surfaces shall be repaired as required by the protective coating system in the intended service condition.
9. Surfaces to receive protective coating shall be cleaned and abraded to produce a sound surface with adequate profile and porosity to provide a strong bond between the protective coating and the substrate. Generally, this can be achieved with a high pressure water cleaning using equipment capable of 5,000 psi at 4 gpm. Other methods such as high pressure water jetting (refer to NACE Standard No. 5/SSPC-SP12), abrasive blasting, shot blasting, grinding, scarifying or acid etching may also be used. Detergent water cleaning and hot water blasting may be necessary to remove oils, grease or other hydrocarbon residues from the concrete. Whichever method(s) are used, they shall be performed in a manner that provides a uniform, sound clean neutralized surface that is not excessively damaged.
10. A mild chlorine solution may be used to neutralize the surface to diminish microbiological bacteria growth prior to final rinse and coating.
11. Test prepared surfaces after cleaning but prior to application of the coating to determine if a specific pH or moisture content of the concrete is required according to manufacturer's recommendations.
12. All surfaces should be inspected during surface prep and before the manhole coating is applied.
13. Loose brick work and voids in mortar joints shall be re-grouted with corrosion resistant mortar that is compatible with the coating.
14. All surfaces should be inspected by the RPR during and after preparation and before the protective coating is applied.
15. Specialized coatings shall be applied to a minimum thickness of 80 mils or as recommended by the manufacturer.
16. If necessary, subsequent top coating or additional coats of the protective coating should occur as soon as the basecoat becomes tack free, ideally within 12 hours but no later than 24 hours after the prior coat has been applied at 75 degrees F unless additional prior coat surface preparation is performed. The protective coating manufacturer must be consulted for any additional-coat surface preparation guidelines if necessary.

3.11 INCIDENTAL CONSTRUCTION

A. Manhole/Inlet Removal/Abandonment:

1. Manholes/Inlets designated for abandonment shall be completely removed to an elevation 4 feet below finished grade. Contractor shall core a hole in the bottom of the structure to prevent the buildup of water in the structure. The remaining portion of the abandoned structures shall be backfilled with sand, flushed and vibrated, or flowable fill to an elevation of 4 feet below grade. The top 4 feet of the excavation shall be backfilled with compacted material similar to the adjacent surface to 95% per the latest revision of ASTM D 698.
2. The excavation shall be backfilled in accordance with the requirements as specified for sewer trench backfill.
3. All castings and covers shall be salvaged, cleaned and delivered at the direction of the Owner.

B. Manhole Adjustments:

1. Manholes designated for adjustment shall be raised or lowered as necessary such that the casting will conform to the required elevation.
2. Construction and material requirements shall conform to the same requirements as specified for new manhole construction. An approved type of flat concrete slab shall be used to support the manhole ring where it is necessary to lower manholes or brick stacks having corbels more than 12 inches. Flat concrete slab manhole tops shall conform to the requirements of ASTM C 478 in addition to the following requirements.
3. A minimum 6 inch collar conforming to the same type of construction as specified for brick manholes shall be installed between the manhole ring and the flat concrete slab to facilitate minor adjustments for elevation unless approved otherwise by the Engineer. All contact surfaces between brick masonry, flat concrete slab and cast iron ring shall be sealed with a layer of mortar. Manholes having corbels which must be raised more than 18 inches will require removing the corbel section completely to facilitate reconstruction of a standard draw section. When it is necessary to adjust a reinforced concrete manhole, this work shall conform to the requirements and details as shown by the drawings.
4. The maximum adjustment shall be no more than 18 inches. Should an adjustment of more than 18 inches be required, the Contractor shall remove the corbel section and restack the manhole with an appropriate sized barrel section.

C. Pipe Abandoned in Place:

1. Both ends of all pipes to be abandoned in place shall be plugged with 3 feet thick concrete or masonry plugs. Pipes abandoned in place having diameters greater than 15 inches shall be filled with flowable fill, sand, Elastizell or other approved material.

D. Riser Pipes:

1. Riser pipe shall be installed to serve individual lots or tracts in conjunction with new sanitary sewer construction, unless otherwise ordered by the Engineer, because of groundwater, unstable soil or unusually deep construction.
2. Riser locations shall be as approved by the Owner with the concurrence of the Engineer. The Contractor will be required to file written documentation with the Engineer on a form approved by the Engineer indicating the locations where risers are to be installed as requested by the property owner or his authorized representative.
3. The riser shall be marked using a 1 inch PVC pipe painted green and installed to be 3 feet above finished grade.
4. Installation of risers on sewers because of unusual depth will be required when the sewer is deeper than 12 feet.
5. Riser pipe construction shall conform to the requirements as shown on the standard riser detail sheet. Contract quantities pertaining to riser installation may or may not be utilized on the project, based on the decision of the Engineer with regard to trench conditions.

E. Pipe Stub-Outs and Plugs:

1. Stub Outs: Four inch (4") and six inch (6") pipe stubs with temporary pipe plugs shall be installed in manholes when shown on the drawings or directed by the Engineer to facilitate connection of building service lines. All stubs shall be a minimum of 3 feet in length and capped with a gasketed cap.
2. Temporary pipe plugs on the ends of lines which are to be extended in the future shall be prefabricated by the manufacturer of the pipe unless approved otherwise by the Engineer. Temporary plugs shall be of such construction that when they are installed, the plug will prevent entrance of any extraneous material into the sewer and such that will facilitate easy removal without undue damage to the sewer pipe when the sewer is extended.
3. Temporary pipe plugs on sewers to be extended in the future will not be paid for directly and this cost shall be included in the price bid for the pipe.

F. Septic Tank System Removal:

1. If in the prosecution of the construction of any sanitary sewer it becomes necessary to remove a portion of, or a complete septic tank, the RPR shall notify the Engineer and the Contractor that if a portion of the tank is removed the entire tank shall be removed and a temporary connection established.
2. Contractor shall follow all requirements including permitting as outlined by the local regulatory agency.
3. The Contractor shall notify the tenant or property owner that the septic system is to be removed and a temporary connection shall be established.

4. In the event the lead line or the laterals from the septic system are encountered in the construction of the sewer, the Contractor shall make all necessary repairs for which no additional payment shall be made.

3.12 FIELD QUALITY CONTROL AND TESTING

A. General:

1. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
2. Test completed piping systems according to requirements of this project manual.
3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
4. A separate report shall be submitted for each test.

B. Testing for Pipes:

1. Deflection Testing and Displacement of Sewers:
 - a. Deflection/Mandrel testing shall be performed on flexible sewer pipes installed on the project.
 - b. A deflection test shall be performed by the Contractor at the Contractor's expense on all flexible pipe after it has been laid and backfilled. The pipe shall be tested by pulling a 9-legged mandrel through the pipe. The maximum allowable deflection shall not exceed 5.0% of the pipe's internal diameter. Sections of pipe barrels having deflections greater than 5% shall be corrected.
 - c. Sewers shall be checked to determine whether any displacement of the pipe has occurred after the trench has been backfilled and compacted as specified.
 - d. Any sewer lines having flow elevations which deviate by more than one inch from a straight line, as determined by the flow line of the two ends of the pipe of any one line between structures, compared with any point between, shall be reconstructed by the Contractor at his expense.
2. Air Testing:
 - a. Contractor shall air test all sewers.
 - b. Contractor may test using infiltration, exfiltration or air testing for sewers with a diameter of 24 inches or larger.

- c. Testing for sanitary sewers shall consist of measuring the amount of time required for air pressure to drop 0.5 psi from a starting pressure of 3.5 psi. The pipe shall be tested by adding air slowly to the test section of pipe until the pressure is raised to 4.0 psi. The pressure shall slowly be decreased to 3.5 psi before commencing with the test. Determine the time required to achieve a 0.5 psi drop, and compare this time with the allowable times for the 0.5 psi drop in the below table or as shown in Table 2 of ASTM F1417. The elapsed time shall be no less than that shown in Table 2 of ASTM F1417. For pipe larger than 36 inches in diameter, Contractor shall contact Engineer for testing duration.

Minimum Specified Time Required for a 0.5 psig Pressure Drop for Size and Length of Pipe Indicated

TABLE 1											
SPECIFICATION TIME FOR LENGTH (L) SHOWN, MIN:SEC											
Pipe Diameter, in.	Minimum Time, min:sec	Length for Minimum Time, ft.	Time for Longer Length, S	100 ft.	150 ft.	200 ft.	250 ft.	300 ft.	350 ft.	400 ft.	450 ft.
4	1:53	597	0.190 L	1:53	1:53	1:53	1:53	1:53	1:53	1:53	1:53
6	2:50	398	0.427 L	2:50	2:50	2:50	2:50	2:50	2:50	2:51	3:12
8	3:47	298	0.760 L	3:47	3:47	3:47	3:47	3:48	4:26	5:04	5:42
10	4:43	239	1.187 L	4:43	4:43	4:43	4:57	5:56	6:55	7:54	8:54
12	5:40	199	1.709 L	5:40	5:40	5:42	7:08	8:33	9:58	11:24	12:50
15	7:05	159	2.671 L	7:05	7:05	8:54	11:08	13:21	15:35	17:48	20:02
18	8:30	133	3.846 L	8:30	9:37	12:49	16:01	19:14	22:26	25:38	28:51
21	9:55	114	5.235 L	9:55	13:05	17:27	21:40	28:11	30:32	34:54	39:16
24	11:20	99	6.837 L	11:24	17:57	22:48	28:30	34:11	39:53	45:35	51:17
27	12:45	88	8.653 L	14:25	21:38	28:51	36:04	43:16	50:30	57:42	64:54
30	14:10	80	10:683 L	17:48	26:43	35:37	44:31	53:25	62:19	71:13	80:07
33	15:35	72	12:926 L	21:33	32:19	43:56	53:52	64:38	75:24	86:10	96:57
36	17:00	66	15:384 L	25:39	38:28	51:17	64:06	76:55	89:44	102:34	115:23

3. Infiltration and Exfiltration Testing:

- Contractor may test using infiltration, exfiltration or air testing for sewers with a diameter of 24 inches or larger.
- The infiltration-exfiltration shall not exceed 250 gallons per day per inch of nominal pipe diameter per mile of sewer line for any section of the system.
- For sewers greater than 24 inches in diameter, infiltration-exfiltration shall not exceed 6,000 gallons per day per mile of pipe.

- d. Where sewers are laid above the ground water table, exfiltration tests shall be conducted. Exfiltration tests must be conducted with a minimum of four feet of static water head above the invert of the sewer at the upstream manhole.
- e. Where sewers are laid within the ground water table, infiltration tests shall be conducted.

4. Television Inspection of Sewer Lines:

- a. All sanitary sewers eight-inch diameter and larger constructed under this contract shall be cleaned and televised by the Contractor prior to final acceptance. All video inspections shall be performed with a representative of the City observing.
- b. Prior to televising the newly constructed sanitary sewer, the Contractor shall clean the pipelines to remove all materials and debris with a hydraulic cleaner. Cleaning water shall not enter the existing sanitary sewer system but shall be removed from the system and disposed of in an approved location. Mechanical plugs shall be utilized in order to isolate the system.
- c. An adequate supply of water shall be maintained in the pipe after cleaning and prior to televising so that any sag in the line can be visually detected during televising.
- d. The video shall be in DVD format, in color, with audio. The manhole number of the upstream manhole, date, and running length of pipe televised (feet) shall be visually displayed on the tape.
- e. The camera shall remain in focus during televising, and adequate lighting shall be provided to see at least three feet in front of the camera. All manholes, taps, and all defects or imperfections shall be noted on the tape audibly, and the camera shall be paused at these locations for a minimum of 10 seconds.
- f. The Contractor shall furnish two (2) copies of the DVD to the Engineer for review prior to final acceptance of the sanitary sewer.
- g. Any defects discovered shall be corrected by the Contractor within 14 days of notification of the defect at no additional cost to the Owner.
- h. Re-televising of sanitary sewer lines is required after correction of defects or additional cleaning by the Contractor and will be paid for by the Contractor.
- i. The camera shall be equipped with a rotating head to allow direct visual inspection of taps and defects or imperfections if warranted.

C. Manhole Testing:

1. Manhole testing shall comply with the latest revision of ASTM C 1244.
2. The Contractor will be allowed to backfill the completed manhole prior to performing the vacuum test. If the Contractor chooses to backfill the completed manhole prior to vacuum testing, any dewatering operations shall be maintained until an acceptable test is accomplished. Tests, sealing, and acceptance shall be according to the procedures described in this section. Prior to testing, all lifting holes and exterior joints shall be filled and pointed with an approved non-shrink grout and coated with the specified manhole coating well in advance of testing so it will have time to cure to its maximum strength. At the Contractors option, the completed manhole may be backfilled prior to testing. Manholes which have been backfilled shall be excavated and cleaned to expose the entire exterior if a failure is reported associated with the vacuum testing. When testing, all manholes shall be free of internal water and all external water shall be removed below the top of the base.
3. All pipes and other openings into the manhole shall be plugged. All plugs shall be securely braced to prevent the plugs from being drawn into the manhole. A plate with an inflatable rubber ring the size of the top of the manhole shall be installed by inflating the ring with air to pressure adequate to prevent leakage of air between the rubber ring and manhole wall. Air shall then be pumped out of the manhole through an opening in the plate until a vacuum is created inside of the manhole equal to 10 inches of mercury on an approved vacuum gauge. The removal of air shall then be stopped and the test time begun.
4. If more than 1 inch drop in vacuum occurs within the first 2 minutes of the test period the manhole has failed the test and shall be repaired or reconstructed, and retested. Following satisfactory test results, the manhole may be backfilled.
5. Existing Manholes that have pipe penetrations added as part of this project shall be vacuum tested at the discretion of the RPR. The pipe penetration into the manhole shall remain exposed during the test. The test parameters shall be as mentioned previously in this section, with the exception that approval will not be based on actual vacuum test results, but on a visual inspection of the manhole during the vacuum test. The Contractor will be responsible for correcting only items such as damage caused by construction activities including the pipe penetrations through the manhole wall.
6. Test plugs in the pipes shall be securely braced so that the vacuum will not displace them. If a general porosity leak is present, the use of smoke will be helpful in locating the leaks.

END OF SECTION

SECTION 33 41 00
STORM UTILITY DRAINAGE PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Storm Water Sewer Pipe.
2. Storm Water Sewer Fittings
3. Storm Water Sewer Structures.
4. Precast Reinforced Concrete Box Culverts.
5. Pipe End Sections.
6. Headwalls.

1.2 DEFINITIONS

- A. AASHTO: American Association of State Highway and Transportation Officials
- B. ACSP: Aluminized Corrugated Steel Pipe
- C. ACPA: American Concrete Pipe Association
- D. ASTM: ASTM International
- E. AWWA: American Water Works Association
- F. NPDES: National Pollutant Discharge Elimination System
- G. RCB: Reinforced Concrete Box
- H. RCP: Reinforced Concrete Pipe
- I. RCPA: Reinforced Concrete Pipe-Arch Pipe
- J. RCPHE: Reinforced Concrete Pipe-Horizontal Elliptical
- K. SRCAR: Steel Reinforced Concrete Adjustment Rings
- L. SWS: Storm Water Sewer

1.3 ACTION SUBMITTALS

- A. General: Submittals shall be made by the Contractor in accordance with the procedures set forth in Division 01.
- B. Product Data: Contractor shall provide manufacturer's catalog lists, technical data, and/or shop drawings for the system components. Provide pipe certifications and cut sheets for pipe and fittings.
 - 1. Storm Water Sewer Pipe
 - 2. Storm Water Sewer Fittings
 - 3. Storm Water Sewer Structures
 - 4. Manhole Frame and Cover
 - 5. Pipe End Sections.
 - 6. Adjustment Rings
- C. Shop Drawings shall be drawn to a large scale, sufficiently showing all pertinent aspects of the item and its method of connection to the work.
 - 1. Storm Water Sewer Structures: Include drawings, elevations, sections, details, frames, covers, and grates.
 - 2. Precast Reinforced Concrete Box Culverts: Include drawings, elevations, sections, details, frames, covers, grates, concrete mix design, and lay schedule/diagram.
 - 3. Precast Reinforced Concrete Headwalls: Include drawings, elevations, sections, details, frames, covers, grates and concrete mix design.

1.4 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.5 REGULATORY REQUIREMENTS

- A. Comply with the requirements including proof of insurance, and other permit requirements for construction across or along railroads, state highways, or local or county roads.
- B. Comply with requirements including proof of insurance, and other permit requirements for construction across or along drainage ways
- C. Comply with all Federal, State and Local Requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Delivery:

1. Deliver materials to the Site to ensure uninterrupted progress of the Work.
2. Upon delivery inspect pipe and appurtenances for cracking, gouging, chipping, denting, and other damage and immediately remove from Site and replace with acceptable material.
3. No other pipe or material of any kind shall be placed inside of any pipe or fitting.

B. Storage:

1. Store materials to allow convenient access for inspection and identification.
2. Store material off ground using pallets, platforms, or other supports. Protect packaged materials from corrosion and deterioration.
3. Do not remove end protectors or supports unless necessary for inspection; these should be reinstalled for storage.
4. Protect stored piping from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when storing inside.
5. Store plastic piping protected from direct sunlight. Support to prevent sagging and bending.
6. Protect flanges, fittings, and specialties from moisture and dirt.

C. Handling:

1. Handle pipe, fittings, specials, and accessories carefully in accordance with pipe manufacturer's recommendations. Do not drop or roll material off trucks. Do not drop, roll or skid piping.
2. Avoid unnecessary handling of pipe.
3. The interior of all pipe shall be thoroughly cleaned of all foreign matter before being lowered into the trench, and shall be kept clean during laying operations by means of plugs or other approved methods. In all cases water shall be kept out of the trench until the material in the joints has set, if applicable. At all times when work is not in progress, all open ends of pipes and fittings shall be securely closed so that no trench water, earth or other substances will enter the pipe or fittings.
4. Protect pipe and fittings from damage. Defective, damaged or unsound pipe and/or fittings shall be rejected.

1.7 PROJECT CONDITIONS

- A. Interruption of Existing Storm Drainage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
 - 1. Notify the Owner no less than 72 hours in advance of proposed interruption of service.
 - 2. Do not proceed with interruption of service without the Owner's written permission.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Pipe material and type shall be installed as detailed in the drawings.
- B. All pipe and fittings, manholes, storm water inlets, pipe end sections and other appurtenances shall be new material unless otherwise specified.

2.2 CONCRETE PIPE AND FITTINGS

- A. Round Reinforced Concrete Pipe (RCP) and Fittings: ASTM C 76.
 - 1. Tongue-and-groove ends and sealant joints with ASTM C 990, bitumen or butyl-rubber sealant.
 - 2. Minimum Class III.
- B. Reinforced Concrete Pipe-Arch Pipe (RCPA) and Fittings: ASTM C 506
 - 1. Tongue-and-groove ends and sealant joints with ASTM C 990, bitumen or butyl-rubber sealant.
 - 2. Minimum Class A - III.
- C. Reinforced Concrete Pipe-Horizontal Elliptical (RCPHE) and Fittings: ASTM C 507
 - 1. Tongue-and-groove ends and sealant joints with ASTM C 990, bitumen or butyl-rubber sealant.
 - 2. Minimum Class HE - III

2.3 STORM WATER SEWER STRUCTURES

A. Storm Water Sewer Structures

1. The invert channels shall be smooth and semi-circular in shape conforming to the inside of the adjacent sewer section. Changes in direction of flow shall be made with a smooth curve of as large a radius as the size of the manhole will permit. Changes in size and grade of the channels shall be made gradually and evenly. The invert channels shall be formed directly in the concrete of the manhole base, or shall be constructed by laying a full section of sewer pipe through the manhole and cutting out the top half after the surrounding concrete has hardened. The floor of the manhole outside the channels shall be smooth and shall slope toward the channels not less than 1 inch per foot or more than 2 inches per foot unless otherwise noted.
2. Concrete: Shall comply with Division 03 except as noted herein.
3. Quick Set Hydraulic Cements: Thoro "Water Plug", Quickcrete "Waterstop" or equal.
4. Non-Shrink Grout: Shall be in accordance with ASTM C1107
5. Reinforced Precast Concrete Storm Water Sewer Structures:
 - a. Precast Reinforced Concrete Storm Water Sewer Structures shall conform to the latest revision of ASTM C478 except for the following modifications:
 - 1) Cement used in construction of precast reinforced concrete storm water sewer structures shall conform to the requirements of the Standard Specifications for Portland Cement (ASTM Designation: C150).
 - 2) Base Section: 6 inch minimum thickness for walls and base riser section, and separate base slab or base section with integral floor.
 - a) Thickness of circular precast sections shall be at least one-twelfth of the internal shell diameter plus one inch, or 5 inches total, whichever is greater. The minimum internal diameter of circular structure shall be 4 feet. (All mastic shall be trimmed flush on the inside of the manhole sections and cleaned from the interior surfaces of the manhole.)
 - 3) Joint Sealant: ASTM C 990, bitumen or butyl rubber.
 - 4) Riser Sections (circular): 6 inch minimum thickness, 48 inch diameter, and lengths to provide depth indicated on the drawings.
 - 5) Top Section (circular): Concentric-cone type unless eccentric-cone or flat-slab-top type is indicated. Top of cone of size that matches grade rings.
 - 6) Brick Adjustment (non-circular inlets): Include at least one row of brick adjustment.

- 7) Grade Adjustment Rings (circular inlets): Include two or three reinforced-concrete rings, of 4 inch to 12 inch total thickness, that match diameter of frame and grate opening.
- 8) Precast sections shall be adequately reinforced with steel to withstand erection and temperature stresses.
- 9) The manufacturer of precast reinforced concrete storm water sewer structures sections shall submit tests from a certified lab detailing quality of aggregates and the mix design, which shall be in accordance with ASTM C478 or the specifications as herein stated.
- 10) Circular structures with precast bases may be used at the contractor's option. These circular structures shall have an 8-inch minimum base thickness and shall be placed on an 8-inch minimum crushed rock base.
- 11) The Contractor must submit certified test results showing that a random number of precast sections have been sampled and tested in accordance with ASTM C497 prior to moving precast sections to the job site. All costs to complete the preceding test are at no additional cost to the Owner.
- 12) Sand for Mortar: Concrete sand (fine aggregate) sieved through 8 mesh screen.
- 13) Mortar: Eight (8) sacks of Type I cement per cubic yard. Use of hydrated lime shall not be allowed.
- 14) Gaskets:
 - a) Mastic: Fed. Spec. SS-S-210; K.T. Snyder "RamNek" or ConSeal CS-102, or approved equal.
 - b) Rubber: Neoprene or other synthetic, 40 plus or minus 5 hardness when measured by ASTM D2240, Type A durometer.
- 15) Mastic Sealing: Koppers "Bitumastic SuperService Black", Tnemec "450 Heavy Tnemecol", or USS "Tarmastic 103" or approved equal.

2.4 PRECAST REINFORCED CONCRETE BOX (RCB) CULVERTS

A. Precast RCB Culverts: ASTM C1577-08 and the latest AASHTO LRFD Specifications.

1. Tongue-and-groove ends and sealant joints with ASTM C990, bitumen or butyl-rubber sealant.
2. Foundation material RCB culverts shall be crushed stone or concrete to the thickness indicated on the drawings. Crushed stone or concrete shall be free of soapstone and shale. Maximum thickness shall be six (6) inches.

2.5 END SECTIONS

A. Precast Concrete End Sections:

1. Conform to applicable requirements of ASTM C76; ASTM C506; or ASTM C507 for the pipe material connected to the end section.

2.6 HEADWALLS

A. Precast Concrete Headwalls:

1. Concrete: Shall comply with Division 03 except as noted herein.
2. Non-Shrink Grout: ASTM C1107
3. Reinforcing Steel: Place reinforcing steel as shown on the drawings.
4. Miscellaneous Metal: Rails or other assemblies shall conform to details as shown on the drawings.

2.7 CASTINGS

- ### A. Castings: ASTM A48-83, Class 35B. Frames and covers as shown on the drawings.
- All weights as given are approximate and average. Variation will not exceed the specified weight by more than 4 percent. Castings are to be manufactured true to pattern and with satisfactory fit of component parts. Castings shall be free of defects. Dimensions as detailed on drawings shall not deviate by +/- 1/16 inch per foot. Castings shall be furnished with machined horizontal bearing surfaces.

PART 3 - EXECUTION

3.1 EARTHWORK

- #### A. Excavation, trenching, and backfilling are specified in Division 31.

3.2 PIPING INSTALLATION

- #### A. General Locations and Arrangements: Drawings and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

- B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
- C. Install manholes or inlets for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated on the drawings.
- D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.
- E. Install gravity-flow, nonpressure drainage piping according to the following:
 - 1. Install piping according to elevations/slopes indicated on the drawings.
 - 2. Install reinforced-concrete sewer piping according to ASTM C 1479 and ACPA's "Concrete Pipe Installation Manual."

3.3 PIPE JOINT CONSTRUCTION

- A. Join gravity-flow, nonpressure drainage piping according to the following:
 - 1. Join reinforced-concrete sewer piping according to ACPA's "Concrete Pipe Installation Manual" for rubber-gasketed joints.

3.4 CONCRETE CRADLES AND ENCASEMENT

- A. Where indicated on the drawings or directed by the Engineer, the sewer pipe shall be supported by concrete cradle or concrete encasement in accordance with the details. During the concrete placing operations, the Contractor shall prevent the introduction of foreign matter into the trench or displacement/floating of the sewer pipe.

3.5 STORM WATER SEWER STRUCTURE INSTALLATION

- A. Install storm water sewer structures complete with appurtenances and accessories indicated.
- B. Delivery: Precast concrete sections shall not be delivered to the job until representative concrete control cylinders have attained strength of at least 80 percent of the specified minimum. The date of manufacture and manhole number shall be indicated on each manhole section upon delivery.

- C. Circular precast structures shall be constructed and installed in accordance with ASTM C478. The quality of materials, process of manufacture, and finished manhole products shall be subject to inspection and approval by the Owner and/or Engineer. All cracked or otherwise visibly defective units will be rejected.
- D. Manhole covers shall be set so that the top of the frames will be flush with all paved surfaces, other locations will be set 0.4 foot above grade or as otherwise directed by the Engineer or shown on the drawings.
- E. Cast in Place Structure Bases:
 - 1. Inverts shall be formed during or immediately after casting the manhole base and brush finished as soon as the concrete has sufficiently set.
- F. Sewer Connections to Storm Water Sewer Structures.
 - 1. Sewer connections to manholes shall be correctly aligned and connected to the manhole with an approved connection. Pipe shall be cut off flush with structure wall.
 - 2. Grouted Connections:
 - a. Rigid pipe connections at manhole walls shall be grouted in place with hydraulic cement.
 - b. Pipes having smooth exterior surfaces, unable to make a watertight bond with manhole walls, shall be installed with a rubber water stop at manhole penetrations. The space between the pipe and manhole shall be completely filled with an approved quick-set hydraulic cement.
 - 3. Flexible Gaskets:
 - a. Flexible gaskets as manufactured by A-Lok or approved equal may be used as compression connectors whenever a pipe penetrates into a precast manholes or structure.
 - b. Gaskets shall be watertight based on ASTM C 923 to provide a seal between the pipe and the structure wall. Gasket shall be cast integrally with the structure wall during the manufacturing process in a manner that it will not pull out during pipe coupling.
 - c. Seal between the gasket and the pipe shall be made by the compression connector between the outside circumference of the factory installed over-sleeve or the surface of the pipe and the interior opening of the structure.
 - d. Flexible gaskets shall not be grouted in place.

- G. Grade Adjustment Rings: Elevation of the structure top shall be set so that the top of the frames will be flush with all paved surfaces unless otherwise shown on the drawings. All other locations will be set as shown in the drawings. Vertical stacks shall be constructed of 4, 5, or 6 inch Keyed Steel Reinforced Concrete Adjustment Rings (S.R.C.A.R.), complying with ASTM-C150 and ASTM-C478. The manhole entry frame and the adjustment rings shall be properly sealed using two rings of mastic sealant spaced approximately 2 inches apart.
- H. Concrete tops to be installed on thin mortar cushion to ensure full support along the inlet.
- I. Invert shall be shaped with concrete to create flow channels and to increase hydraulic efficiency such that the inlet will be self-cleaning between all inlet and/or outlet pipes.
- J. The ends of all pipes installed in inlets shall be cut off flush with the inside face of the inlet wall.
- K. The contractor shall remove lifting hooks after installation. Recesses in inlet walls shall be grouted flush after the inlet is placed.

3.6 PRECAST REINFORCED CONCRETE BOX CULVERT INSTALLATION

- A. Foundation: Excavate and prepare foundation by constructing crushed stone and/or concrete seal course as shown on the drawings.
- B. Precast Sections: Install precast RCB culvert section per the approved lay schedule with the groove end of each section up-grade.
- C. Joint Sealing: Seal joints as shown on the drawings. Install joint sealant according to the manufacturer's recommendations.

3.7 PIPE END SECTION AND HEADWALL INSTALLATION

- A. Precast Concrete End Sections and Headwalls:
 - 1. Install precast unit as indicated, to extent practical, to the dimensions, lines, and grades as shown on the drawings.

3.8 CONCRETE PLACEMENT

- A. Placement of cast-in-place concrete shall conform to Division 03 Concrete.

3.9 INCIDENTAL CONSTRUCTION

A. Structure Removal/Abandonment:

1. Structures designated for abandonment shall be completely removed to an elevation of 4 feet below finished grade. The remaining portion of the abandoned structures shall be backfilled with sand, flushed and vibrated, or flowable fill to an elevation of 4 feet below grade. The top 2 feet of the excavation shall be backfilled with compacted material similar to the adjacent surface to 95 percent per the latest revision of ASTM D 698.
2. The excavation shall be backfilled in accordance with the requirements as specified for sewer trench backfill.
3. All castings and covers shall be salvaged, cleaned and delivered at the direction of the Owner.

B. Structure Adjustments:

1. Structures designated for adjustment shall be raised or lowered as necessary such that the casting will conform to the required elevation.
2. Construction and material requirements shall conform to the same requirements as specified for new manhole construction. An approved type of flat concrete slab shall be used to support the manhole ring where it is necessary to lower structures or brick stacks having corbels more than twelve inches (12"). Flat concrete slab structure tops shall conform to the requirements of ASTM C 478 in addition to the following requirements.
 - a. A minimum six inch (6") collar conforming to the same type of construction as specified for brick manholes shall be installed between the manhole ring and the flat concrete slab to facilitate minor adjustments for elevation unless approved otherwise by the Engineer. All contact surfaces between brick masonry, flat concrete slab and cast iron ring shall be sealed with a layer of mortar. Structures having corbels which must be raised more than eighteen inches (18") will require removing the corbel section completely to facilitate reconstruction of a standard draw section. When it is necessary to adjust a reinforced concrete structure, this work shall conform to the requirements and details as shown on the drawings.
 - b. The maximum adjustment shall be no more than 18 inches. Should an adjustment of more than 18 inches be required, the Contractor shall remove the corbel section and restack the manhole with an appropriate sized barrel section.

C. Pipe Abandoned in Place:

1. Both ends of all pipes to be abandoned in place shall be plugged with 3 feet thick concrete or masonry plugs. Pipes abandoned in place having diameters greater than fifteen inches (15") shall be filled with flowable fill, sand, or other approved material.

3.10 FIELD QUALITY CONTROL

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.

1. Submit separate reports for each system inspection.
2. Defects requiring correction include the following:
 - a. Alignment: Less than full diameter of inside of pipe is visible between structures.
 - b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
 - c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
 - d. Infiltration: Water leakage into piping.
 - e. Exfiltration: Water leakage from or around piping.
3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
4. Reinspect and repeat procedure until results are satisfactory.

B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.

1. Test completed piping systems according to requirements of authorities having jurisdiction.
2. Schedule tests and inspections by authorities having jurisdiction with at least 48 hours' advance notice.
3. Submit separate report for each test.

3.11 CLEANING

A. Flush with water or use methods as required to clean interior of piping of dirt and superfluous materials.

END OF SECTION