

**CAMPBELL COUNTY
UTILITIES AND SERVICE AUTHORITY**

**20644 Timberlake Road
Lynchburg, VA 24502
(434) 239-8654**



**MARTIN DRIVE REGIONAL WWPS
"CONTRACT C"**

CONTRACT DOCUMENTS

February 23, 2026

(BID SET)

PREPARED BY:



TABLE OF CONTENTS

SECTION A. ADMINISTRATIVE CONTRACT DOCUMENTS

A-1	INVITATION TO BID	A-1-1 TO 2
A-2	INSTRUCTIONS TO BIDDERS	A-2-1 TO 2
A-3	BID FORM	A-3-1 TO 5
A-4	ESCROW AGREEMENT	A-4-1 TO 3
A-5	SUPPLEMENTARY CONDITIONS	A-5-1 TO 5
A-6	STANDARD FORMS	
	▪ BID BOND, EJCDC DOCUMENT C-430, “BID BOND (PENAL SUM FORM)”	
	▪ BIDDERS QUALIFICATIONS	
	▪ AGREEMENT, EJCDC DOCUMENT C-520 “STANDARD FORM OF AGREEMENT BETWEEN OWNER AND CONTRACTOR ON THE BASIS OF A STIPULATED PRICE”	
	▪ NOTICE OF AWARD, EJCDC DOCUMENT C-510, “NOTICE OF AWARD”	
	▪ NOTICE TO PROCEED, EJCDC DOCUMENT C-550, “NOTICE TO PROCEED”	
	▪ PERFORMANCE BOND, EJCDC DOCUMENT C-610, “PERFORMANCE BOND”	
	▪ PAYMENT BOND, EJCDC DOCUMENT C-615, “PAYMENT BOND”	
	▪ APPLICATION FOR PAYMENT, EJCDC DOCUMENT C-620, “APPLICATION FOR PAYMENT NO. _____”	
	▪ CHANGE ORDER, EJCDC DOCUMENT C-941, “CHANGE ORDER”	
	▪ CERTIFICATE OF SUBSTANTIAL COMPLETION, EJCDC DOCUMENT C-625, “CERTIFICATE OF SUBSTANTIAL COMPLETION”	
	▪ GENERAL CONDITIONS, EJCDC DOCUMENT C-700, “STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT”	

SECTION B. CONSTRUCTION MATERIALS

B-2	WASTEWATER RELATED.....	B-2-1 TO 10
-----	-------------------------	-------------

SECTION C. CONSTRUCTION PROCEDURES

C-1	GENERAL REQUIREMENTS	C-1-1 TO 13
C-2	SITE PREPARATION.....	C-2-1 TO 4
C-3	TRENCHING AND BACKFILLING	C-3-1 TO 6
C-5	WASTEWATER SYSTEM.....	C-5-1 TO 7
C-6	SEEDING	C-6-1 TO 3

Division 1

Operation & Maintenance Data	017823
Project Record Documents	017839

Division 3

Cast-in-Place Concrete.....	033000
-----------------------------	--------

Division 26

Wastewater Pump Station Control Panel.....	262420
--	--------

Packaged Engine Generator.....	263213
Transfer Switches.....	263600

Division 31

Site Clearing.....	311000
Earth Moving	312000
Dewatering.....	312319
Erosion Controls	312513

Division 32

Chain Link Fences & Gates	323113
---------------------------------	--------

Division 33

Common Work Results for Utilities	330500
Wastewater Pumping Station	333200

Division 40

Instrumentation & Controls General Requirements.....	406101
Programmable Logic Controllers.....	406343
Control System Equipment Panels & Racks.....	406700

Appendix A

Geotechnical Engineering Report

LIST OF CONTRACT DRAWINGS

Martin Drive Regional WWPS

Cover.....	G-101
Notes	G-102
ESC Notes.....	G-103
Sanitary Sewer Plan and Profile Sta. 6+50 – 11+00	C-100
Sanitary Sewer Plan and Profile Sta. 11+00 – 23+50	C-101
Sanitary Sewer Plan and Profile Sta. 23+50 – 35+50	C-102
Sanitary Sewer Plan and Profile Sta. 35+50 – 49+50	C-103
Sanitary Sewer Plan and Profile Sta. 49+50 – 63+50	C-104
Sanitary Sewer Plan and Profile Sta. 63+50 – 76+50	C-105
Sanitary Sewer Plan and Profile Sta. 76+50 – 79+50	C-106
Sanitary Sewer Plan and Profile Sta. 0+00 – 9+25	C-107
Sanitary Sewer Plan and Profile Sta. 0+00 – 12+50	C-108
Sanitary Sewer Plan and Profile Sta. 12+50 – 25+50	C-109
Pump Station Site Plan.....	C-110
Details	C-501
Details	C-502
Pump Station Details.....	C-503
Pump Station Site Details	C-504
Retaining Wall Details.....	C-505
Traffic Control Details.....	C-601
Pavement Restoration	C-602
Legend, Abbreviations, and General Notes	E-001
Power Distribution Diagram and Plan	E-100
Enlarged Site Plans	E-101
Pump Station Plans and Details	E-102
Details	E-501

Schedules and Calculations.....	E-601
Legend And Notes	I-001
SCADA Control Panel Layout.....	I-100.1
SCADA Control Panel Interior	I-100.2
SCADA Panel Bill of Materials.....	I-101
SCADA Panel Power Distribution.....	I-102
Main PLC Base I/O (PLC1).....	I-103
Discrete Input Expansion Module	I-104
Analog I/O Expansion Module	I-105
Backup Base I/O (PLC2) & Intrinsic Barrier.....	I-106
Network Communication.....	I-107
Field Terminations	I-108
Antenna Installation.....	I-109

SECTION A

ADMINISTRATIVE CONTRACT

DOCUMENTS

SECTION A-1

INVITATION TO BID

Re: Martin Drive Regional WWPS
Campbell County Utilities and Service Authority (Owner)

1. The Campbell County Utilities and Service Authority will receive sealed bids for the furnishing of all labor, materials and equipment, and the performing of all work for the above referenced project. Contract C is work related to the installation of approximately 5,695 lf of gravity sewer, and other appurtenances. Project starts at manhole A8 and continues to manhole A27 & J4, however, manhole J4 cannot be installed until the Martin Drive WWPS is in operation. The project includes associated erosion and sediment control measures necessary to construct the project.

All Bids shall be submitted as hard copies to the CCUSA office. Bids will be received until 2:00 p.m. on March 12, 2026 at the Office of the Authority, 20644 Timberlake Road, Lynchburg, Virginia, 24502. In addition, sealed bids can be received electronically through eVA but a hard copy of the bid must be submitted as well. Bids should be submitted as a **PDF** electronically through eVA's procurement portal. This portal allows you access to view business opportunities and submit bids and proposals digitally and securely. Proposals must be submitted electronically at: <https://eva.virginia.gov/>. Attachments must be smaller than 10MB in order to be received by eVA. If Working papers are submitted, they should be a separate PDF and labeled clearly. Bids will be publicly opened and read aloud at the following times:

-Contract C: 2:00 pm Thursday, March 12, 2026

Bids are to be submitted, single copy, on the bid form, in a sealed envelope clearly marked "Bid on Project Martin Drive Regional WWPS"

2. Title 54.1, Chapter 11, Section 54.1-1112, Code of Virginia requires bidders to show evidence of a certificate of registration before a bid may be received and considered. In compliance with this requirement, the bidder shall place on the outside of the envelope containing its bid the following notation: "Registered Virginia Contractor No. _____," the bidder's name, and business address.
3. Bids must be accompanied by a Cashier's Check or acceptable Bid Bond for not less than 5 percent of the bid, made payable to the Campbell County Utilities and Service Authority.
4. Contract Documents may be obtained from the office of Hurt & Proffitt, Inc., 2524 Langhorne Road, Lynchburg, VA 24501 (telephone 434-847-7796) upon non-refundable payment of \$200.00 per set by check or money order. A complete set of documents for the Project may be downloaded free of charge from <http://www.handp.com/>. Include complete street mailing address with zip code, telephone and fax number with area code, and contractor's license number, if applicable. No partial sets will be distributed. The contact person for the project with Hurt & Proffitt is Mike Wilson, PE. Documents may be viewed at the following locations:

- 1) Campbell County Utilities and Service Authority Office located at 20644 Timberlake Road, Lynchburg, Virginia, 24502
- 2) Hurt & Proffitt, Inc., Inc., 2524 Langhorne Rd., Lynchburg, VA, 24501.
- 3) McGraw-Hill Construction/Dodge, 18 Almond Circle, Blue Ridge, VA 24064.
- 4) Valley Construction News, 356 West Campbell Ave., Roanoke, VA, 24016

5. Should a bidder find it necessary to receive clarifications concerning the Contract Documents, or should the bidder be in doubt as to the meaning thereof, the bidder should at once notify the Engineer. Any interpretation of the Contract Documents shall be made only by addenda. Addenda will be delivered to bidders prior to bid opening. The Owner will not be responsible for any other explanation of the Contract Documents.
6. All blank spaces on the bid form must be filled in, in ink or typewritten, and must be fully completed.

For unit price contracts, the product of each unit price and the bid quantity shall govern in evaluating bids received. The summary of all total item prices is included in the schedule of prices for the purpose of convenience only in announcing an apparent low bidder at the time of opening and has no meaning otherwise. All bids are subject to review and checking for completeness and accuracy by the Owner or its agents.
7. Bid award shall be made to the lowest responsive and responsible bidder. Whenever such low bid exceeds available funds, the Owner reserves the right to negotiate with the lowest responsive and responsible bidder in order to obtain a contract price within funds available. Negotiations with the lowest bidder may include modifications to the bid price and changes in the scope of work as outlined by the technical specifications and the Drawings.
8. The Owner reserves the right to reject any and all bids and to waive any informality so designated by the Code of Virginia in bids received.
9. The Owner will act on bona fide bids within 60 days after the opening of all bids and a bidder may not withdraw his bid within this period except as indicated below. However, in the event of unintentional arithmetic or similar mistake made directly in the compilation of the bid, the bidder may withdraw its bid in accordance with Title 2.2, Chapter 43, Section 2.2-4330(A) of the Code of Virginia. By the giving of this written notice for the causes cited, the bidder may withdraw its bid within 2 business days after the conclusion of the bid opening procedure.
10. The bidders business practices shall conform to Title 2.2, Chapter 43, Section 2.2-4311, prohibition of employment discrimination and Section 2.2-4312, provision of a drug free work place, as described by the Code of Virginia and further detailed in the Standard Form of Agreement.
11. A **mandatory** Pre Bid conference will be held at the Office of the Authority at 11:00 am on March 5, 2026.
12. **This project is being funded with Federal and State money made available through the American Rescue Plan Act. Bidder must comply with the following: the President's Executive Order #11246 prohibiting discrimination in employment regarding race, color, creed, sex, or national origin; the President's Executive Orders #12138 and 11625 regarding utilization of MBE/WBE firms; and the Civil Rights Act of 1964. MBE/WBE firms are encouraged to submit bids. Bidders must provide certification that they do not or will not maintain or provide for their employees facilities that are segregated based on race, color, creed, or national origin. Bidders must comply with the President's Executive Order 13658 regarding minimum wages on federal funded construction contracts.**

Campbell County Utilities and Service Authority

BY: Timothy R. Wagner, P.E., Engineering Director

SECTION A-2

INSTRUCTIONS TO BIDDERS

1. It is the declared and acknowledged intent of these standards to provide and secure the construction of the project identified in Invitation to Bid in Campbell County, Virginia, complete, tested, and ready for service. The work includes furnishing all labor, materials and equipment, and performing all work necessary to complete the project as described in the Contract Documents and as shown on the Drawings.
2. Bidders are urged to visit the site of the proposed work and satisfy themselves as to the surface and subsurface conditions in and adjacent to the site, the availability of water, electricity, telephone, sanitary facilities, access roads, storage sites, and related factors.
3. The Owner will act upon bids as indicated in the Invitation to Bid. The acceptance of a proposal shall bind the successful bidder to execute the Agreement when presented to it. All terms and conditions of the Agreement shall be effective upon acknowledgment by the Contractor of receipt of the notice of award.
4. Any Contractor whose proposal shall be accepted will be required to execute the Agreement within 10 business days after Notice of Award. Failure or neglect to do so shall constitute a breach of the Agreement effected by the acceptance of the proposal. The damages to the Owner for such breach will include loss from interference with its construction program and other items whose accurate amount will be difficult or impossible to compute. Therefore, the amount of the Bid Bond or Cashier's Check accompanying the proposal shall become the property of the Owner.

The Owner may make such investigations as it deems necessary to determine the ability of the bidder to perform the work. If requested, the bidder shall furnish, within 5 days of the Owner's request, any information pertinent to the determination of its experience and financial capability to perform this work. Should this evidence not satisfy the Owner that such bidder is properly qualified to carry out the obligations of the Agreement and the work contemplated therein, the bid may be rejected.

5. Bidders must be responsible parties, regularly and practically engaged in the installation of the class of work, and known to possess ample facilities for doing this work.

Title 59.1, Chapter 5, Code of Virginia, requires Contractors operating as a partnership or under an assumed or fictitious name to file a Certificate of Ownership with the State Corporation Commission and to appoint an attorney for service of process.

6. The Contractor shall furnish bonds executed by an acceptable Surety Company duly authorized to do business in the Commonwealth of Virginia or a Letter of Credit by a bank duly licensed to do business in the Commonwealth of Virginia, in an amount at least equal to 100 percent of the contract price, as security both for faithful performance and for payment of all persons performing labor and furnishing materials in connection with this contract.
7. The Contractor shall furnish evidence of insurance coverage as detailed in the Supplementary Conditions.
8. The Contractor shall commence the work within 10 business days of the Notice to Proceed.
9. The Contractor shall employ an individual certified by the Department of Environmental Quality as the Responsible Land Disturber. This person shall be responsible for the proper functioning of the erosion control devices throughout the project.

10. The entire Virginia Work Area Protection Manual of the Virginia Department of Transportation (VDOT), latest edition, and requirements of the VDOT Land Use Permit obtained by the Owner shall be included as part of this Information to Bidders as if attached hereto. Signs, traffic control devices, and other details outlined therein shall be specifically followed when working within or adjacent to the VDOT's right-of-way. Should traffic control signal persons be employed on the work, the Contractor shall assure these persons are properly certified signal persons with their certificates available for inspection at the site.
11. In accordance with Title 2.2, Chapter 43, Section 2.2-4334, of the Code of Virginia, for certain construction contracts valued in excess of \$200,000, for construction of roads, pump stations and water, gas and sewage mains (but not water and or waste treatment plants), the Contractor may have the option to utilize the escrow account procedure for investment of partial payment retainage amounts. Should the Contractor elect this option, the Escrow Agreement form shall be executed and returned to the Owner within 15 calendar days of the Notice of Award. If the form is not furnished within the 15-day period, the Contractor shall forfeit its right to use the escrow account procedure. The Escrow Agreement form contained on the following pages shall be included as part of this information for bidders.
12. During the performance of this contract, the Contractor agrees as follows:
 - A. The Contractor will not discriminate against any employee or application for employment because of race, religion, color, sex or national origin, except where religion, sex, or national origin is a bona fide occupational qualification reasonably necessary to the normal operation of the Contractor. The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices setting forth the provisions of this nondiscrimination clause.
 - B. The Contractor, in all solicitations or advertisements for employees placed by or on behalf of the Contractor, will state that such Contractor is an equal opportunity employer.
 - C. Notices, advertisements, and solicitations placed in accordance with federal law, rule, or regulation shall be deemed sufficient for the purpose of meeting the requirements of this Section.
 - D. The Contractor will include the provisions of the foregoing Paragraphs A, B, and C in every subcontract or purchase order of over \$10,000, so that the provisions will be binding upon each subcontractor or vendor.
13. **This project is being funded with Federal and State money made available through the American Rescue Plan Act. Bidder must comply with the following: the President's Executive Order #11246 prohibiting discrimination in employment regarding race, color, creed, sex, or national origin; the President's Executive Orders #12138 and 11625 regarding utilization of MBE/WBE firms; and the Civil Rights Act of 1964. MBE/WBE firms are encouraged to submit bids. Bidders must provide certification that they do not or will not maintain or provide for their employees facilities that are segregated based on race, color, creed, or national origin. Bidders must comply with the President's Executive Order 13658 regarding minimum wages on federal funded construction contracts.**

SECTION A-3

BID FORM

Campbell County Utilities and Service Authority (Owner)
20644 Timberlake Road
Lynchburg, Virginia 24502
Attn: Authority Administrator

Gentlemen:

The undersigned, having visited and examined the site and having carefully studied the Contract Documents for Martin Drive Regional WWPS hereby proposes to furnish all labor, equipment, materials, and services and to perform all operations necessary to execute and complete the work required for the project, in strict accordance with the Contract Documents prepared by the Engineer, dated March 5, 2025 together with addenda numbered _____, issued during bidding period and hereby acknowledged, subject to the terms and conditions of the Agreement for the sum of

Contract C Base Bid, Lump Sum of

_____ Dollars (\$_____).

The Base Bid and any Add Alternates are founded upon furnishing equipment and materials of specified manufacturers.

It is understood and agreed that the Owner, in protecting his best interest, reserves the right to reject any or all bids, or accept any bid at the Base Bid price, whereupon the Contractor shall furnish equipment and materials as specified.

The Base Bid and any add alternates of the Base Bid plus additive alternate price shall include the quantities on the attached Bid Schedule. The bidder declares that he understands that the quantities shown in the Bid Schedule are approximate only; and are subject to either increase or decrease based on the work shown on the Drawings and for changes in the work as directed by the Owner and that should the quantities of any of the items of work be increased, the undersigned proposes to do the additional work at the unit price set out herein, and should the quantities be decreased, he also understands that payment will be made on the actual quantities installed at the unit prices, and will make no claim for the anticipated profits for any decrease in the quantities. Actual quantities will be determined upon completion of the work. Lump sum bid items will not be adjusted.

We are properly equipped to execute work of the character and extent indicated by the Contract Documents and so covered by this bid and will enter into Agreement for the execution and completion of the work in accordance with the Drawings, project manual, and this bid; and we further agree that if awarded the contract, we will commence the work on the date stated in "Notice to Proceed" and the work be substantially complete within 330 calendar days.

The Owner and Contractor recognize that time is of the essence with this Agreement and that the Owner will suffer financial loss if the work is not completed within the number of calendar days listed above for all work associated with the Martin Drive Regional WWPS. They also recognize the delays, expense, and difficulties involved in proving the actual loss suffered by the Owner if the work is not completed on time. Accordingly, instead of requiring any such proof, the Owner and Contractor agree that, as liquidated damages for delay (but not as a penalty), the Contractor shall pay the Owner (\$500.00) for each day that expires after the time specified for substantial completion of the project.

Bid Schedule:

Contract C Schedule of Values:

Sanitary Sewer					
Item #	Description	Quantity	Unit	Unit Price	Total
1	Sanitary Manhole - 6" Extended Base	28	EA		
2	Manhole Frame & Cover - Watertight	28	EA		
3	Manhole Vent	5	EA		
4	8" Gravity Sewer Line - Protecto 401 lined DIP	1,025	LF		
5	8" Gravity Sewer Line - SDR 35 PVC	4,670	LF		
6	18" Casing Bore & Jack – Farfields Drive	59	LF		
7	18" Casing Bore & Jack – Arrowhead Drive	56	LF		
8	18" Casing Bore & Jack – Whitestone Drive	50	LF		
9	18" Casing Open Cut – Lake Court Avenue	20	LF		
10	Stream Crossing	4	EA		
11	Service Lateral Main Connection	9	EA		
12	4" PVC Double Cleanout Assembly	6	EA		
13	6" PVC Double Cleanout Assembly	3	EA		
Other					
14	Abandon Existing Pump Station	1	LS		
15	Rock Excavation	50	CY		
16	Tree Removal	1	LS		
17	Seeding & Fine Grading	1	LS		
18	Traffic Control	1	LS		
19	Construction Stakeout	1	LS		
20	Mobilization/Demobilization (Max 5% of Bid)	1	LS		

Enclosed herewith is the following security, offered as evidence that the undersigned will enter into Agreement for the execution and completion of the work in accordance with the Contract Documents:

Cashier's Check for the Sum of _____

Name of Bank _____

Bidder's Bond in Amount of _____

Bond Issued by _____

The undersigned further agrees that in case of failure on his part to execute the said Agreement within the 10 days after written notice being given on the award of the contract, the monies payable by the securities accompanying this bid shall be paid to the Owner as liquidated damages for such failure; otherwise, the securities accompanying this bid shall be returned to the undersigned.

This bid is subject to acceptance within a period of 60 days from this date.

Respectfully Submitted,

Contractor

By _____

Address

Telephone Number

Date _____

Contractor's Current Virginia
License Number _____ Code _____

If determined to be the successful low bidder(s), the above-signed elects to use the escrow account procedure, a copy of which is attached to this bid proposal package.

Write "Yes" or "No" on
Above Line.

In the event the successful bidder elects to use the escrow account procedure, the "Escrow Agreement" form shall be executed and submitted to the Owner within 15 days after notification. If the "Escrow Agreement" form is not submitted within the fifteen-day period, the Contractor shall forfeit his rights to the use of the escrow account procedure.

EQUAL OPPORTUNITY REPORT STATEMENT

The bidder shall complete the following statement by checking the appropriate blank as follows.

The bidder has _____ has not _____ participated in a previous contract subject to the non-discrimination clause prescribed by Executive Order 10925, dated March 6, 1961, or Executive Order 11114 dated June 22, 1963, and Executive Order 11246 dated September 24, 1965.

In conjunction with the goals established for this project for minority and women business enterprises, the bidder has solicited quotations for labor, material, and/or services from the following:

<u>Name of Firm</u>	<u>Person(s) Contacted</u>	<u>Date</u>
_____	_____	_____
_____	_____	_____
_____	_____	_____

Of those listed above, we intend, at this time, to utilize the following in the completion of the work required by this contract:

“This firm assures that it will give its best efforts to utilize disadvantaged business enterprises wherever possible.”

Certified by: _____ (Signature)
_____ (Typed/Printed Name & Title)

Bidder's Name: _____

IRS Number: _____

ANTI-COLLUSION STATEMENT

In the preparation and submission of this proposal on behalf of, we did not either directly or indirectly enter into any combination or arrangement with any person, firm or corporation, or enter into any agreement, participate in any collusion, or otherwise take any action in the restraint of free competition in violation of the Sherman Anti-Trust Act, 15 USC Sections 1 et seq; the Virginia Antitrust Act, Virginia Code Sections 59.1-9.1 through 59.19.18, and the Conspiracy to Rig Bids to Government Statutes, Virginia Code Sections 59.1-68.6 through 59.1-68.8.

The undersigned Contractor hereby certifies that this agreement, or any claims resulting there from, is not the result of, or affected by, any act of collusion with, or any act of, another person or persons, firm or corporation engaged in the same line of business or commerce; and that no person acting for, or employed by, the Campbell County Utilities and Service Authority has an interest in, or is concerned with, this proposal; and, that no person or persons, firm or corporation, other than the undersigned, have or are interested in this proposal.

Certified by: _____ (Corporate Seal)

Acknowledged before me this _____ day of _____, _____

Notary Public

SECTION A-4

ESCROW AGREEMENT

This Escrow Agreement, made and entered into this _____ day of _____, 20____, by between and among the Campbell County Utilities and Service Authority, the Contractor, _____, the Bank, trust company or savings institution named herein _____ with its principal office located in the Commonwealth of Virginia, at _____, and the Surety, _____, with its home office located at _____ provides that:

ARTICLE I. The Owner and the Contractor have entered into a contract Agreement for construction of a project entitled _____.

This Escrow Agreement is pursuant to, but in no way amends or modifies, the contract Agreement. Payments made hereunder or the release of funds from escrow shall not be deemed approval of or acceptance of the performance of the Contractor.

ARTICLE II. In order to assure full and satisfactory performance by the Contractor of its obligations under the contract Agreement, the Owner is required thereby to retain certain amounts otherwise due the Contractor. The Contractor has, with the approval of the Owner, elected to have these retained amounts held in escrow by the Bank. This Escrow Agreement sets forth the terms of such escrow. The Bank shall not be deemed a party to, bound by or required to inquire into the terms of, the contract Agreement or any other instrument or Agreement between the Owner and the Contractor.

ARTICLE III. The Owner shall from time-to-time pursuant to its contract Agreement pay to the Bank amounts retained by it under the contract Agreement. Except as to amount actually withdrawn from escrow by the Owner for just cause, the Contractor shall look solely to the Bank for the payment of funds retained under the contract Agreement and paid by the Owner to the Bank.

The risk of loss by diminution of the principal of any fund invested under the terms of this Escrow Agreement shall be solely upon the Contractor.

Funds and securities held by the Bank pursuant to this Escrow Agreement shall not be subject to levy, garnishment, attachment, lien, or other process whatsoever. Contractor agrees not to assign, pledge, discount, sell or otherwise transfer or dispose of his interest in the escrow account or any part thereof, except to the Surety.

ARTICLE IV. Upon receipt of checks or warrants drawn by the Owner and made payable to it as escrow agent, the Bank shall promptly notify the Contractor, negotiate the same and deposit or invest and reinvest the proceeds in approved securities in accordance with the written instructions of the Contractor. In no event shall the Bank invest the escrowed fund in any security not approved.

ARTICLE V. The following securities, and no other, are approved securities for all purposes for this Escrow Agreement.

- 1. United States Treasury Bonds, United States Treasury Notes, United States Treasury Certificates of Indebtedness or United States Treasury Bills.

2. Bonds, notes, and other evidences of indebtedness unconditionally guaranteed as the payment of principal and interest by the United States.
3. Bonds or notes of the Commonwealth of Virginia.
4. Bonds of any political subdivisions of the Commonwealth of Virginia, if such bonds carried, at the time of purchase by the Bank or deposit by the Contractor, a Standard and Poor's or Moody's Investors Service rating of at least "A".
5. Certificates of deposit issued by commercial Banks located within the Commonwealth, including, but not limited to, those insured by the Bank and its affiliates.
6. Any bonds, notes or other evidences of indebtedness listed in 1. through 3. Herein may be purchased pursuant to a repurchase Agreement with a Bank, within or without the Commonwealth of Virginia having a combined capital, surplus, and undivided profit of not less than \$25,000,000.00, provided the obligation of the Bank to repurchase is within the time limitations established for investment as set forth herein. The repurchase Agreement shall be considered a purchase of such securities even if Title, and/or possession of such securities is not transferred to the Escrow Agent, so long as the repurchase obligation of the Bank is collateralized by the securities themselves, and the securities have on the date of the repurchase Agreement a fair market value equal to at least 100 percent of the amount of the repurchase obligation of the Bank, and the securities are held by a third party, and segregated from other securities owned by the Bank.

No security is approved hereunder which matures more than 5 years after the date of its purchase by the Bank or deposit by the Contractor.

ARTICLE VI. Upon receipt of a direction signed by the Owner, the Bank shall pay the principal of the fund, or any specified amount thereof, to the Owner in the event that Contractor has not progressed the work in accordance with the contract Agreement. Such payment shall be made in cash as soon as is practical after receipt of the direction.

Upon receipt of a direction signed by the Owner, the Bank shall pay and deliver the principal of the fund, or any specified amount thereof, to the Contractor, in cash or in kind, as may be specified by the Contractor. Such payment and delivery shall be made as soon as is practical after receipt of the direction.

ARTICLE VII. For its services hereunder the Bank shall be entitled to a reasonable fee in accordance with its published schedule of fees or as may be agreed upon by the Bank and the Contractor. Such fee and any other cost of administration of this Escrow Agreement shall be paid from the income earned upon the escrowed fund and, if such income is not sufficient to pay the same, by the Contractor.

ARTICLE VIII. The net income earned and received upon the principal of the escrowed fund shall be paid over to the Contractor in quarterly installments. Until so paid or applied to pay the Bank's fee or any other costs of administration, such income shall be deemed a part of the principal of the fund.

ARTICLE IX. The Surety undertakes no obligation hereby but joins in this Escrow Agreement for the sole purpose of acknowledging that its obligations as Surety for the Contractor's performance of the contract are not affected hereby.

Witness the following signatures, all as of the day and year first above written.

Owner Campbell County Utilities and Service Authority

By _____

Title _____

Contractor _____

By _____

Title _____

Attest:

Bank _____

By _____

Title _____

Bank Officer

Attest:

Surety _____

By _____

Title _____

Surety Company

By _____
Resident Virginia Agent

Address

7. The Contractor shall require his insurance agent to certify on the Insurance Certificate that the insurance coverage specified by these Supplementary Conditions is fully in effect, both in scope and amount. If insurance coverage is affected with more than one company, the individual Certificates shall identify the items of insurance which the individual companies cover. The Insurance Certificate shall contain a provision that coverages afforded under the policies will not be canceled or materially changed unless at least 30 days prior written notice has been given to the Owner and the Engineer.
8. All insurance shall be written by insurance companies licensed to do business in the Commonwealth of Virginia.
9. All Certificates of Insurance, except Worker's Compensation, shall name the Campbell County Utilities and Service Authority and the Engineer and the officers and employees of both as Additional Insured.

6.01 Contractor's Responsibilities.

1. Services, Materials and Equipment. Add the following to Paragraph 7.03:

"All material incorporated in the work of this Contract shall be free of asbestos and other hazardous materials."

2. Laws and Regulations. Add the following to Subparagraph 7.10.A:

- (1) Contractor shall be licensed in the Commonwealth of Virginia in accordance with Title 54.1, Chapter 11, Section 54.1-1112, Code of Virginia, as amended.

3. Permits. The Contractor shall obtain and pay for all permits for this project required by Campbell County and the Virginia Department of Environmental Quality. The Owner will obtain and pay for, unless indicated elsewhere, the VDOT Land Use Permit, Railroad Permits, Army Corps of Engineer Permits, Virginia Marine Resources Commission Permit, and Virginia Department of Health Permit, as required for this Project.

4. OSHA Requirements. The Contractor shall be responsible for all safety at the job site and shall comply with OSHA regulations for all work associated with this project.

7.01 Project Representation.

1. Add the following to Article 10, Paragraph 10.03:

10.03 B. The Owner will furnish a Resident Project Representative (RPR), assistants, and other field staff to observe performance of the work of the Contractor. Through more extensive on-site observations of the work in progress and field checks of materials and equipment by the RPR and assistants, the Owner shall endeavor to provide further protection against defects and deficiencies in the work; but, the furnishing of such services will not make the Owner responsible for or give the Owner control over construction means, methods, techniques, sequences or procedures or for safety precautions or programs, or responsibility for Contractor's failure to perform the work in accordance with the Contract Documents. The duties and responsibilities of the RPR are limited to those in the Agreement with the Owner and in the Construction Contract Documents, and are further limited and described as follows:

General: RPR is the Owner's agent at the site, will act as directed by and under the supervision of the Owner and the Engineer, and will confer with the Owner and the Engineer. RPR's dealings in matters pertaining to the on-site work shall in general be with the Owner, the Engineer, and Contractor keeping Owner advised as necessary. RPR's dealings with subcontractors shall only be through or with the full knowledge and approval of Contractor.

8.01 Add the following as Article 11.05.C:

11.05.C Time extensions for abnormal weather:

- (1) This provision specifies the procedure for the determination of time extensions for abnormal weather in accordance with the Contract General Condition 12.03.

This listing below defines the monthly-anticipated working days of adverse weather for each month and is based upon NOAA climatological data for Campbell County, Virginia.

Jan	Feb	Mar	Apr	May	June	Jul	Aug	Sep	Oct	Nov	Dec
8	7	8	7	8	7	8	7	6	6	6	7

- (2) The anticipated days provided above will constitute the baseline for monthly weather time evaluations. Throughout the contract, actual weather working days are to be recorded and compared to the monthly-anticipated working days.
- (3) Once the number of actual adverse weather working days exceeds the anticipated working days, any subsequent days may be used as a basis to determine whether a Contractor is entitled to a time extension. The adverse weather must have prevented work for 50 percent or more of the Contractor's workday and delayed work critical to the timely completion of the Project.
- (4) The Contractor's schedule must indicate the critical (path) work and must reflect the above anticipated adverse weather days on all weather dependent activities.
- (5) At the end of each quarter of the calendar year, the anticipated days scheduled will be balanced with the actual adverse weather days.

9.01 Replace Paragraph 15.01.D with the following:

15.01.D "The Owner will make partial payments to the Contractor within 30 days of billing by check via first class mail through the U. S. Postal Service for a duly certified and approved estimate of work performed during the preceding calendar month (subject to the provisions of Paragraph 14.02.D) and the Agreement. The Contractor shall take one of the two following actions within 7 days after receipt of payment from the Owner with regards to work performed by a subcontractor and/or supplier under their contract:

- 1. Pay the subcontractor and/or supplier for the proportionate share of the total payment received from the Owner attributable to the work performed by the subcontractor and/or supplier under that Contract; or
- 2. Notify the Owner and subcontractor and/or supplier, in writing, of his intention to withhold all or part of the subcontractor's and/or supplier's payment with the reason for nonpayment.

The Contractor will pay interest to the subcontractor and/or supplier on all amounts owed by the Contractor that remain unpaid after 7 days following receipt by the Contractor of payment from the Owner for work performed by the subcontractor and/or supplier under this contract, except for amounts withheld as allowed above. Interest shall accrue at the rate of 1 percent per month.

The Contractor shall include in each of its subcontracts a provision requiring each subcontractor and/or supplier to include or otherwise be subject to the same payment and interest requirements with respect to each lower-tier subcontractor and/or supplier. A Contractor's obligation to pay an interest charge to a subcontractor and/or supplier pursuant to the payment clause in this section may not be construed to be an obligation of the Owner's. A Contract modification may not be made for the purpose of providing reimbursement for such interest charge. A cost reimbursement claim may not include any amount for reimbursement for such interest charge.

10.01 Delete Article 17 Dispute Resolution and replace with the following:

This Agreement and all questions arising herewith shall be governed by and construed in accordance with the Laws of the Commonwealth of Virginia. The parties agree that the sole and exclusive jurisdiction for all disputes arising under this agreement shall be in the state and federal courts closest to Campbell County, Virginia.

End of Supplementary Conditions

DOCUMENT 00 43 13 – BID BOND (PENAL SUM FORM)

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



BIDDER (*Name and Address*):

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

OWNER (*Name and Address*):

Campbell County Utilities and Service Authority
Timothy Wagner, PE, Engineering Director
20644 Timberlake Road
Lynchburg, Virginia 24502

BID

Bid Due Date: March 12, 2026
Description: Martin Drive Regional WWPS Contract C

BOND

Bond Number: _____
Date: _____
Penal sum _____ \$ _____
(Words) (Figures)

Surety and Bidder, intending to be legally bound hereby, subject to the terms set forth below, do each cause this Bid Bond to be duly executed by an authorized officer, agent, or representative.

BIDDER _____ (Seal) **SURETY** _____ (Seal)
Bidder's Name and Corporate Seal Surety's Name and Corporate Seal

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

Print Name Print Name

Title Title

Attest: _____ Attest: _____
Signature Signature

Title Title

Bidder and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to pay to Owner upon default of Bidder the penal sum set forth on the face of this Bond. Payment of the penal sum is the extent of Bidder's and Surety's liability. Recovery of such penal sum under the terms of this Bond shall be Owner's sole and exclusive remedy upon default of Bidder.

1. Default of Bidder shall occur upon the failure of Bidder to deliver within the time required by the Bidding Documents (or any extension thereof agreed to in writing by Owner) the executed Agreement required by the Bidding Documents and any performance and payment bonds required by the Bidding Documents.

2. This obligation shall be null and void if:

2.1 Owner accepts Bidder's Bid and Bidder delivers within the time required by the Bidding Documents (or any extension thereof agreed to in writing by Owner) the executed Agreement required by the Bidding Documents and any performance and payment bonds required by the Bidding Documents, or

2.2 All Bids are rejected by Owner, or

2.3 Owner fails to issue a Notice of Award to Bidder within the time specified in the Bidding Documents (or any extension thereof agreed to in writing by Bidder and, if applicable, consented to by Surety when required by Paragraph 5 hereof).

3. Payment under this Bond will be due and payable upon default of Bidder and within 30 calendar days after receipt by Bidder and Surety of written notice of default from Owner, which notice will be given with reasonable promptness, identifying this Bond and the Project and including a statement of the amount due.

4. Surety waives notice of any and all defenses based on or arising out of any time extension to issue Notice of Award agreed to in writing by Owner and Bidder, provided that the total time for issuing Notice of Award including extensions shall not in the aggregate exceed 120 days from the Bid due date without Surety's written consent.

5. No suit or action shall be commenced under this Bond prior to 30 calendar days after the notice of default required in Paragraph 4 above is received by Bidder and Surety and in no case later than one year after the Bid due date.

6. Any suit or action under this Bond shall be commenced only in a court of competent jurisdiction located in the state in which the Project is located.

7. Notices required hereunder shall be in writing and sent to Bidder and Surety at their respective addresses shown on the face of this Bond. Such notices may be sent by personal delivery, commercial courier, or by United States Registered or Certified Mail, return receipt requested, postage pre-paid, and shall be deemed to be effective upon receipt by the party concerned.

8. Surety shall cause to be attached to this Bond a current and effective Power of Attorney evidencing the authority of the officer, agent, or representative who executed this Bond on behalf of Surety to execute, seal, and deliver such Bond and bind the Surety thereby.

9. This Bond is intended to conform to all applicable statutory requirements. Any applicable requirement of any applicable statute that has been omitted from this Bond shall be deemed to be included herein as if set forth at length. If any provision of this Bond conflicts with any applicable statute, then the provision of said statute shall govern and the remainder of this Bond that is not in conflict therewith shall

continue in full force and effect.

10. The term “Bid” as used herein includes a Bid, offer, or proposal as applicable.

END OF DOCUMENT 00 43 13 – BID BOND (PENAL SUM)

DOCUMENT 00 45 13 – BIDDER'S QUALIFICATIONS

All questions must be answered in full. Additional sheets for clarification of answers or additional information may be attached. This statement must be notarized.

1. Name, address, phone number of company.

2. Owner, principal officer, date and place organized.

3. General character of work performed.

4. Any work awarded failed to be completed or contracts defaulted on - where and why.

5. List of three most important recent contracts over \$30,000. State the Owner, Contact, phone number, work, appropriate cost, place, date started and date completed.
 - a.

cost: \$	Dates: From	to
----------	-------------	----

 - b.

cost: \$	Dates: From	to
----------	-------------	----

 - c.

cost: \$	Dates: From	to
----------	-------------	----

6. List the contracts upon which you are currently working. Include owner, location, approximate cost, and estimated date of completion.

- 14. Number of current full-time employees:
Number employees at highest level in past twelve months:
- 15. Are you on any list of debarred contractors maintained by the U.S. Department of Labor, the U.S. Department of Housing and Urban Development or the Virginia Department of Transportation?

Yes
No

- 16. List all contracts which have resulted in arbitration, litigation, or legal settlement of claims within the past two years.

The undersigned hereby authorizes and requests any person, firm or Corporation to furnish any information requested by _____ in verification of the recitals comprising this statement of contractor's qualifications:

Contractor: _____

By: _____

Title: _____

Date: _____

STATE OF _____

COUNTY OF _____

_____ being duly sworn deposes says that he is _____ of _____ and that the answers to the foregoing questions and all statements therein contained are true and correct.

SUBSCRIBED AND SWORN TO BEFORE ME THIS _____ DAY OF _____, _____

NOTARY PUBLIC _____

MY COMMISSION EXPIRES _____, _____

END OF DOCUMENT

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

THIS AGREEMENT is by and between The Campbell County Utilities and Service Authority (“Owner”) and _____ (“Contractor”).

Owner and Contractor hereby agree as follows:

ARTICLE 1 – WORK

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

ARTICLE 2 – THE PROJECT

2.01 The Project, of which the Work under the Contract Documents is a part, is generally described as follows: Contract C is work related to the installation of approximately 5,695 lf of gravity sewer, and other appurtenances. Project starts at manhole A8 and continues to manhole A27 & J4, however, manhole J4 cannot be installed until the Martin Drive WWPS is in operation. The project includes associated erosion and sediment control measures necessary to construct the project.

ARTICLE 3 – ENGINEER

3.01 The Project has been designed by Hurt & Proffitt.

3.02 The Owner has retained Hurt & Proffitt. (“Engineer”) to act as Owner’s representative, assume all duties and responsibilities, and have the rights and authority assigned to Engineer in the Contract Documents in connection with the completion of the Work in accordance with the Contract Documents.

ARTICLE 4 – CONTRACT TIMES

4.01 *Time of the Essence*

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

4.02 *Contract Times: Days*

A. The Work will be substantially completed within 270 days after the date when the Contract Times commence to run as provided in Paragraph 4.01 of the General Conditions, and completed and ready for final payment in accordance with Paragraph 15.06 of the General Conditions within 300 days after the date when the Contract Times commence to run.

4.03 *Liquidated Damages*

A. Contractor and Owner recognize that time is of the essence as stated in Paragraph 4.01 above and that Owner will suffer financial and other losses if the Work is not completed and Milestones not achieved within the times specified in Paragraph 4.02 above, plus any extensions thereof allowed in accordance with the Contract. The parties also recognize the

delays, expense, and difficulties involved in proving in a legal or arbitration proceeding the actual loss suffered by Owner if the Work is not completed on time. Accordingly, instead of requiring any such proof, Owner and Contractor agree that as liquidated damages for delay (but not as a penalty):

1. Substantial Completion: Contractor shall pay Owner \$500.00 for each day that expires after the time (as duly adjusted pursuant to the Contract) specified in Paragraph 4.02.A above for Substantial Completion until the Work is substantially complete.
2. Completion of Remaining Work: After Substantial Completion, if Contractor shall neglect, refuse, or fail to complete the remaining Work within the Contract Time (as duly adjusted pursuant to the Contract) for completion and readiness for final payment, Contractor shall pay Owner \$500.00 for each day that expires after such time until the Work is completed and ready for final payment.
3. Liquidated damages for failing to timely attain Substantial Completion and final completion are not additive and will not be imposed concurrently.

ARTICLE 5 – CONTRACT PRICE

5.01 Owner shall pay Contractor for completion of the Work in accordance with the Contract Documents the amounts that follow, subject to adjustment under the Contract:

- A. For all Unit Price Work, an amount equal to the sum of the extended prices (established for each separately identified item of Unit Price Work by multiplying the unit price times the actual quantity of that item):
- B.

Contract C Schedule of Values:

Sanitary Sewer					
Item #	Description	Quantity	Unit	Unit Price	Total
1	Sanitary Manhole - 6" Extended Base	28	EA		
2	Manhole Frame & Cover - Watertight	28	EA		
3	Manhole Vent	5	EA		
4	8" Gravity Sewer Line - Protecto 401 lined DIP	1,025	EA		
5	8" Gravity Sewer Line - SDR 35 PVC	4,670	LF		
6	18" Casing Bore & Jack – Farfields Drive	59	LF		
7	18" Casing Bore & Jack – Arrowhead Drive	56	LF		
8	18" Casing Bore & Jack – Whitestone Drive	50	LF		
9	18" Casing Open Cut – Lake Court Avenue	20	LF		

10	Stream Crossing	4	EA		
11	Service Lateral Main Connection	9	EA		
12	4" PVC Double Cleanout Assembly	6	EA		
13	6" PVC Double Cleanout Assembly	3	EA		
Other					
14	Abandon Existing Pump Station	1	LS		
15	Rock Excavation	50	CY		
16	Tree Removal	1	LS		
17	Seeding & Fine Grading	1	LS		
18	Traffic Control	1	LS		
19	Construction Stakeout	1	LS		
20	Mobilization/Demobilization (Max 5% of Bid)	1	LS		

The extended prices for Unit Price Work set forth as of the Effective Date of the Contract are based on estimated quantities. As provided in Paragraph 13.03 of the General Conditions, estimated quantities are not guaranteed, and determinations of actual quantities and classifications are to be made by Engineer.

- C. Total of Lump Sum Amount and Unit Price Work (subject to final Unit Price adjustment)

Contract C Base Bid, Lump Sum of

_____ Dollars (\$_____).

- D. For all Work, at the prices stated in Contractor's Bid, attached hereto as an exhibit.

ARTICLE 6 – PAYMENT PROCEDURES

6.01 *Submittal and Processing of Payments*

- A. Contractor shall submit Applications for Payment in accordance with Article 15 of the General Conditions. Applications for Payment will be processed by Engineer as provided in the General Conditions.

6.02 *Progress Payments; Retainage*

- A. Owner shall make progress payments on account of the Contract Price on the basis of Contractor's Applications for Payment on or about the 15th day of each month during performance of the Work as provided in Paragraph 6.02.A.1 below, provided that such Applications for Payment have been submitted in a timely manner and otherwise meet the requirements of the Contract. All such payments will be measured by the Schedule of

Values established as provided in the General Conditions (and in the case of Unit Price Work based on the number of units completed) or, in the event there is no Schedule of Values, as provided elsewhere in the Contract.

1. Prior to Substantial Completion, progress payments will be made in an amount equal to the percentage indicated below but, in each case, less the aggregate of payments previously made and less such amounts as Owner may withhold, including but not limited to liquidated damages, in accordance with the Contract
 - a. 95 percent of Work completed (with the balance being retainage). If the Work has been 50 percent completed as determined by Engineer, and if the character and progress of the Work have been satisfactory to Owner and Engineer, then as long as the character and progress of the Work remain satisfactory to Owner and Engineer, there will be no additional retainage; and
 - b. 5 percent of cost of materials and equipment not incorporated in the Work (with the balance being retainage).
- B. Upon Substantial Completion, Owner shall pay an amount sufficient to increase total payments to Contractor to 95 percent of the Work completed, less such amounts set off by Owner pursuant to Paragraph 15.01.E of the General Conditions, and less 5 percent of Engineer's estimate of the value of Work to be completed or corrected as shown on the punch list of items to be completed or corrected prior to final payment.

6.03 *Final Payment*

- A. Upon final completion and acceptance of the Work in accordance with Paragraph 15.06 of the General Conditions, Owner shall pay the remainder of the Contract Price as recommended by Engineer as provided in said Paragraph 15.06.

ARTICLE 7 – INTEREST

- 7.01 All amounts not paid when due shall bear interest at the rate of 1 percent per annum.

ARTICLE 8 – CONTRACTOR'S REPRESENTATIONS

- 8.01 In order to induce Owner to enter into this Contract, Contractor makes the following representations:
 - A. Contractor has examined and carefully studied the Contract Documents, and any data and reference items identified in the Contract Documents.
 - B. Contractor has visited the Site, conducted a thorough, alert visual examination of the Site and adjacent areas, and become familiar with and is satisfied as to the general, local, and Site conditions that may affect cost, progress, and performance of the Work.
 - C. Contractor is familiar with and is satisfied as to all Laws and Regulations that may affect cost, progress, and performance of the Work.
 - D. Contractor has carefully studied all: (1) reports of explorations and tests of subsurface conditions at or adjacent to the Site and all drawings of physical conditions relating to existing surface or subsurface structures at the Site that have been identified in the Supplementary Conditions, especially with respect to Technical Data in such reports and drawings, and (2) reports and drawings relating to Hazardous Environmental Conditions, if any, at or adjacent to the Site that have been identified in the Supplementary Conditions, especially with respect to Technical Data in such reports and drawings.

- E. Contractor has considered the information known to Contractor itself; information commonly known to contractors doing business in the locality of the Site; information and observations obtained from visits to the Site; the Contract Documents; and the Site-related reports and drawings identified in the Contract Documents, with respect to the effect of such information, observations, and documents on (1) the cost, progress, and performance of the Work; (2) the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor; and (3) Contractor's safety precautions and programs.
- F. Based on the information and observations referred to in the preceding paragraph, Contractor agrees that no further examinations, investigations, explorations, tests, studies, or data are necessary for the performance of the Work at the Contract Price, within the Contract Times, and in accordance with the other terms and conditions of the Contract.
- G. Contractor is aware of the general nature of work to be performed by Owner and others at the Site that relates to the Work as indicated in the Contract Documents.
- H. Contractor has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Contractor has discovered in the Contract Documents, and the written resolution thereof by Engineer is acceptable to Contractor.
- I. The Contract Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performance and furnishing of the Work.
- J. Contractor's entry into this Contract constitutes an incontrovertible representation by Contractor that without exception all prices in the Agreement are premised upon performing and furnishing the Work required by the Contract Documents.

ARTICLE 9 – CONTRACT DOCUMENTS

9.01 *Contents*

- A. The Contract Documents consist of the following:
 - 1. This Agreement (pages 1 to █, inclusive).
 - 2. Performance bond (pages █ to █, inclusive).
 - 3. Payment bond (pages █ to █, inclusive).
 - 4. Other bonds.
 - a. █ (pages █ to █, inclusive).
 - 5. General Conditions (pages █ to █, inclusive).
 - 6. Supplementary Conditions (pages █ to █, inclusive).
 - 7. Specifications as listed in the table of contents of the Project Manual.
 - 8. Drawings (not attached but incorporated by reference) consisting of █ sheets with each sheet bearing the following general title: █ [or] the Drawings listed on the attached sheet index.
 - 9. Addenda (numbers █ to █, inclusive).
 - 10. Exhibits to this Agreement (enumerated as follows):
 - a. Contractor's Bid (pages █ to █, inclusive).

11. The following which may be delivered or issued on or after the Effective Date of the Contract and are not attached hereto:
 - a. Notice to Proceed.
 - b. Work Change Directives.
 - c. Change Orders.
 - d. Field Orders.
- B. The documents listed in Paragraph 9.01.A are attached to this Agreement (except as expressly noted otherwise above).
- C. There are no Contract Documents other than those listed above in this Article 9.
- D. The Contract Documents may only be amended, modified, or supplemented as provided in the General Conditions.

ARTICLE 10 – MISCELLANEOUS

10.01 *Terms*

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

10.02 *Assignment of Contract*

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

10.03 *Successors and Assigns*

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

10.04 *Severability*

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

10.05 *Contractor's Certifications*

- A. Contractor certifies that it has not engaged in corrupt, fraudulent, collusive, or coercive practices in competing for or in executing the Contract. For the purposes of this Paragraph 10.05:

1. "corrupt practice" means the offering, giving, receiving, or soliciting of any thing of value likely to influence the action of a public official in the bidding process or in the Contract execution;
2. "fraudulent practice" means an intentional misrepresentation of facts made (a) to influence the bidding process or the execution of the Contract to the detriment of Owner, (b) to establish Bid or Contract prices at artificial non-competitive levels, or (c) to deprive Owner of the benefits of free and open competition;
3. "collusive practice" means a scheme or arrangement between two or more Bidders, with or without the knowledge of Owner, a purpose of which is to establish Bid prices at artificial, non-competitive levels; and
4. "coercive practice" means harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in the bidding process or affect the execution of the Contract.

10.06 *Other Provisions*

- A. Owner stipulates that if the General Conditions that are made a part of this Contract are based on EJCDC® C-700, Standard General Conditions for the Construction Contract, published by the Engineers Joint Contract Documents Committee®, and if Owner is the party that has furnished said General Conditions, then Owner has plainly shown all modifications to the standard wording of such published document to the Contractor, through a process such as highlighting or "track changes" (redline/strikeout), or in the Supplementary Conditions.

IN WITNESS WHEREOF, Owner and Contractor have signed this Agreement.

This Agreement will be effective on (which is the Effective Date of the Contract).

OWNER:

CONTRACTOR:

By: _____

By: _____

Title: _____

Title: _____

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

Attest: _____

Attest: _____

Title: _____

Title: _____

Address for giving notices:

Address for giving notices:

License No.: _____

(where applicable)

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

NOTE TO USER: Use in those states or other jurisdictions where applicable or required.

NOTICE OF AWARD

Date of Issuance:

Owner: Campbell County Utilities and Service Authority
Owner's Contract No.: 80-2304
Engineer: Hurt & Proffitt
Engineer's Project No.: 20230622
Project: Martin Drive Regional WWPS
Contract Name: Contract C

Bidder:

Bidder's Address:

TO BIDDER:

You are notified that Owner has accepted your Bid dated [_____] for the above Contract, and that you are the Successful Bidder and are awarded a Contract for:

The Martin Drive Regional WWPS Project Contract C.

The Contract Price of the awarded Contract is: \$ _____ (Unit Price Basis)

[6] unexecuted counterparts of the Agreement accompany this Notice of Award, and one copy of the Contract Documents accompanies this Notice of Award, or has been transmitted or made available to Bidder electronically.

a set of the Drawings will be delivered separately from the other Contract Documents.

You must comply with the following conditions precedent within 15 days of the date of receipt of this Notice of Award:

1. Deliver to Owner [6] counterparts of the Agreement, fully executed by Bidder.
2. Deliver with the executed Agreement(s) the Contract security [*e.g., performance and payment bonds*] and insurance documentation as specified in the Instructions to Bidders and General Conditions, Articles 2 and 6.
3. Other conditions precedent (if any):

Failure to comply with these conditions within the time specified will entitle Owner to consider you in default, annul this Notice of Award, and declare your Bid security forfeited.

Within ten days after you comply with the above conditions, Owner will return to you one fully executed counterpart of the Agreement, together with any additional copies of the Contract Documents as indicated in Paragraph 2.02 of the General Conditions.

Owner: Campbell County Utilities and Service Authority

Authorized Signature

By:

Title:

Copy: Engineer

NOTICE TO PROCEED

Owner: Campbell County Utilities and Service Authority Owner's Contract No.: 80-2304
Contractor: _____ Contractor's Project No.: _____
Engineer: Hurt & Proffitt Engineer's Project No.: 20230622
Project: Martin Drive Regional WWPS Contract Name: Contract C
Effective Date of Contract: _____

TO CONTRACTOR:

Owner hereby notifies Contractor that the Contract Times under the above Contract will commence to run on [_____, 2026]. [see Paragraph 4.01 of the General Conditions]

On that date, Contractor shall start performing its obligations under the Contract Documents. No Work shall be done at the Site prior to such date. In accordance with the Agreement, [the date of Substantial Completion is _____, and the date of readiness for final payment is _____] *or* [the number of days to achieve Substantial Completion is _____, and the number of days to achieve readiness for final payment is _____].

Before starting any Work at the Site, Contractor must comply with the following:

Owner: Campbell County Utilities and Service Authority

Authorized Signature

By:

Title:

Date Issued:

Copy: Engineer

DOCUMENT 00 61 13.13 – PERFORMANCE BOND



CONTRACTOR *(name and address)*

SURETY *(name and address of principal place of business):*

OWNER *(name and address):*

Campbell County Utilities and Service Authority
Timothy Wagner, PE, Engineering Director
20644 Timberlake Road
Lynchburg, VA 24502

CONSTRUCTION CONTRACT

Effective Date of the Agreement:
Amount:
Description: Martin Drive Regional WWPS Contract C

BOND

Bond Number:
Date *(not earlier than the Effective Date of the Agreement of the Construction Contract)*:
Amount:
Modifications to this Bond Form: one See Paragraph 16

Surety and Contractor, intending to be legally bound hereby, subject to the terms set forth below, do each cause this Performance Bond to be duly executed by an authorized officer, agent, or representative.

CONTRACTOR AS PRINCIPAL

SURETY

Contractor's Name and Corporate Seal *(seal)*

Surety's Name and Corporate Seal *(seal)*

By: _____
Signature

By: _____
Signature *(attach power of attorney)*

Print Name

Print Name

Title

Title

Attest: _____
Signature

Attest: _____
Signature

Title

Title

1. The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to the Owner for the performance of the Construction Contract, which is incorporated herein by reference.
2. If the Contractor performs the Construction Contract, the Surety and the Contractor shall have no obligation under this Bond, except when applicable to participate in a conference as provided in Paragraph 3.
3. If there is no Owner Default under the Construction Contract, the Surety's obligation under this Bond shall arise after:
 - 3.1 The Owner first provides notice to the Contractor and the Surety that the Owner is considering declaring a Contractor Default. Such notice shall indicate whether the Owner is requesting a conference among the Owner, Contractor, and Surety to discuss the Contractor's performance. If the Owner does not request a conference, the Surety may, within five (5) business days after receipt of the Owner's notice, request such a conference. If the Surety timely requests a conference, the Owner shall attend. Unless the Owner agrees otherwise, any conference requested under this Paragraph 3.1 shall be held within ten (10) business days of the Surety's receipt of the Owner's notice. If the Owner, the Contractor, and the Surety agree, the Contractor shall be allowed a reasonable time to perform the Construction Contract, but such an agreement shall not waive the Owner's right, if any, subsequently to declare a Contractor Default;
 - 3.2 The Owner declares a Contractor Default, terminates the Construction Contract and notifies the Surety; and
 - 3.3 The Owner has agreed to pay the Balance of the Contract Price in accordance with the terms of the Construction Contract to the Surety or to a contractor selected to perform the Construction Contract.
4. Failure on the part of the Owner to comply with the notice requirement in Paragraph 3.1 shall not constitute a failure to comply with a condition precedent to the Surety's obligations, or release the Surety from its obligations, except to the extent the Surety demonstrates actual prejudice.
5. When the Owner has satisfied the conditions of Paragraph 3, the Surety shall promptly and at the Surety's expense take one of the following actions:
 - 5.1 Arrange for the Contractor, with the consent of the Owner, to perform and complete the Construction Contract;
 - 5.2 Undertake to perform and complete the Construction Contract itself, through its agents or independent contractors;
 - 5.3 Obtain bids or negotiated proposals from qualified contractors acceptable to the Owner for a contract for performance and completion of the Construction Contract, arrange for a contract to be prepared for execution by the Owner and a contractor selected with the Owners concurrence, to be secured with performance and payment bonds executed by a qualified surety equivalent to the bonds issued on the Construction Contract, and pay to the Owner the amount of damages as described in Paragraph 7 in excess of the Balance of the Contract Price incurred by the Owner as a result of the Contractor Default; or
 - 5.4 Waive its right to perform and complete, arrange for completion, or obtain a new contractor, and with reasonable promptness under the circumstances:
 - 5.4.1 After investigation, determine the amount for which it may be liable to the Owner and, as soon as practicable after the amount is determined, make payment to the Owner; or
 - 5.4.2 Deny liability in whole or in part and notify the Owner, citing the reasons for denial.
6. If the Surety does not proceed as provided in Paragraph 5 with reasonable promptness, the Surety shall be deemed to be in default on this Bond seven days after receipt of an additional written notice from the Owner to the Surety demanding that the Surety perform its obligations under this Bond, and the Owner shall be entitled to enforce any remedy available to the Owner. If the Surety proceeds as provided in Paragraph 5.4, and the Owner refuses the payment or the Surety has denied liability, in whole or in part, without further notice the Owner shall be entitled to enforce any remedy available to the Owner.
7. If the Surety elects to act under Paragraph 5.1, 5.2, or 5.3, then the responsibilities of the Surety to the Owner shall not be greater than those of the Contractor under the Construction Contract, and the responsibilities of the Owner to the Surety shall not be greater than those of the Owner under the Construction Contract. Subject to the commitment by the Owner to pay the Balance of the Contract Price, the Surety is obligated, without duplication for:
 - 7.1 the responsibilities of the Contractor for correction of defective work and completion of the Construction Contract;
 - 7.2 additional legal, design professional, and delay costs resulting from the Contractor's Default, and resulting from the actions or failure to act of the Surety under Paragraph 5; and

- 7.3 liquidated damages, or if no liquidated damages are specified in the Construction Contract, actual damages caused by delayed performance or non-performance of the Contractor.
8. If the Surety elects to act under Paragraph 5.1, 5.3, or 5.4, the Surety's liability is limited to the amount of this Bond.
9. The Surety shall not be liable to the Owner or others for obligations of the Contractor that are unrelated to the Construction Contract, and the Balance of the Contract Price shall not be reduced or set off on account of any such unrelated obligations. No right of action shall accrue on this Bond to any person or entity other than the Owner or its heirs, executors, administrators, successors, and assigns.
10. The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders, and other obligations.
11. Any proceeding, legal or equitable, under this Bond may be instituted in any court of competent jurisdiction in the location in which the work or part of the work is located and shall be instituted within two years after a declaration of Contractor Default or within two years after the Contractor ceased working or within two years after the Surety refuses or fails to perform its obligations under this Bond, whichever occurs first. If the provisions of this paragraph are void or prohibited by law, the minimum periods of limitations available to sureties as a defense in the jurisdiction of the suit shall be applicable.
12. Notice to the Surety, the Owner, or the Contractor shall be mailed or delivered to the address shown on the page on which their signature appears.
13. When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted here from and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.
- #### 14. Definitions
- 14.1 Balance of the Contract Price: The total amount payable by the Owner to the Contractor under the Construction Contract after all proper adjustments have been made including allowance for the Contractor for any amounts received or to be received by the Owner in settlement of insurance or other claims for damages to which the Contractor is entitled, reduced by all valid and proper payments made to or on behalf of the Contractor under the Construction Contract.
- 14.2 Construction Contract: The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and changes made to the agreement and the Contract Documents.
- 14.3 Contractor Default: Failure of the Contractor, which has not been remedied or waived, to perform or otherwise to comply with a material term of the Construction Contract.
- 14.4 Owner Default: Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.
- 14.5 Contract Documents: All the documents that comprise the agreement between the Owner and Contractor.
15. If this Bond is issued for an agreement between a contractor and subcontractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.
16. Modifications to this Bond are as follows:

END OF DOCUMENT 00 61 13.13 – PERFORMANCE BOND

DOCUMENT 00 61 13.16 – PAYMENT BOND

CONTRACTOR *(name and address)*:

SURETY *(name and address of principal place of business)*:



OWNER *(name and address)*:

Campbell County Utilities and Service Authority
Timothy Wagner, PE, Engineering Director
20644 Timberlake Road
Lynchburg, VA 24502

CONSTRUCTION CONTRACT

Effective Date of the Agreement:
Amount:
Description: Martin Drive Regional WWPS Contract C

BOND

Bond Number:
Date *(not earlier than the Effective Date of the Agreement of the Construction Contract)*:
Amount:
Modifications to this Bond Form: None See Paragraph 18

Surety and Contractor, intending to be legally bound hereby, subject to the terms set forth below, do each cause this Payment Bond to be duly executed by an authorized officer, agent, or representative.

CONTRACTOR AS PRINCIPAL

SURETY

(seal)
Contractor’s Name and Corporate Seal

(seal)
Surety’s Name and Corporate Seal

By: _____
Signature

By: _____
Signature *(attach power of attorney)*

Print Name

Print Name

Title

Title

Attest: _____
Signature

Attest: _____
Signature

Title

Title

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

1. The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to the Owner to pay for labor, materials, and equipment furnished for use in the performance of the Construction Contract, which is incorporated herein by reference, subject to the following terms.
2. If the Contractor promptly makes payment of all sums due to Claimants, and defends, indemnifies, and holds harmless the Owner from claims, demands, liens, or suits by any person or entity seeking payment for labor, materials, or equipment furnished for use in the performance of the Construction Contract, then the Surety and the Contractor shall have no obligation under this Bond.
3. If there is no Owner Default under the Construction Contract, the Surety's obligation to the Owner under this Bond shall arise after the Owner has promptly notified the Contractor and the Surety (at the address described in Paragraph 13) of claims, demands, liens, or suits against the Owner or the Owner's property by any person or entity seeking payment for labor, materials, or equipment furnished for use in the performance of the Construction Contract, and tendered defense of such claims, demands, liens, or suits to the Contractor and the Surety.
4. When the Owner has satisfied the conditions in Paragraph 3, the Surety shall promptly and at the Surety's expense defend, indemnify, and hold harmless the Owner against a duly tendered claim, demand, lien, or suit.
5. The Surety's obligations to a Claimant under this Bond shall arise after the following:
 - 5.1 Claimants who do not have a direct contract with the Contractor,
 - 5.1.1 have furnished a written notice of non-payment to the Contractor, stating with substantial accuracy the amount claimed and the name of the party to whom the materials were, or equipment was, furnished or supplied or for whom the labor was done or performed, within ninety (90) days after having last performed labor or last furnished materials or equipment included in the Claim; and
 - 5.1.2 have sent a Claim to the Surety (at the address described in Paragraph 13).
 - 5.2 Claimants who are employed by or have a direct contract with the Contractor have sent a Claim to the Surety (at the address described in Paragraph 13).
6. If a notice of non-payment required by Paragraph 5.1.1 is given by the Owner to the Contractor that is sufficient to satisfy a Claimant's obligation to furnish a written notice of non-payment under Paragraph 5.1.1.
7. When a Claimant has satisfied the conditions of Paragraph 5.1 or 5.2, whichever is applicable, the Surety shall promptly and at the Surety's expense take the following actions:
 - 7.1 Send an answer to the Claimant, with a copy to the Owner, within sixty (60) days after receipt of the Claim, stating the amounts that are undisputed and the basis for challenging any amounts that are disputed; and
 - 7.2 Pay or arrange for payment of any undisputed amounts.
 - 7.3 The Surety's failure to discharge its obligations under Paragraph 7.1 or 7.2 shall not be deemed to constitute a waiver of defenses the Surety or Contractor may have or acquire as to a Claim, except as to undisputed amounts for which the Surety and Claimant have reached agreement. If, however, the Surety fails to discharge its obligations under Paragraph 7.1 or 7.2, the Surety shall indemnify the Claimant for the reasonable attorney's fees the Claimant incurs thereafter to recover any sums found to be due and owing to the Claimant.
8. The Surety's total obligation shall not exceed the amount of this Bond, plus the amount of reasonable attorney's fees provided under Paragraph 7.3, and the amount of this Bond shall be credited for any payments made in good faith by the Surety.
9. Amounts owed by the Owner to the Contractor under the Construction Contract shall be used for the performance of the Construction Contract and to satisfy claims, if any, under any construction performance bond. By the Contractor furnishing and the Owner accepting this Bond, they agree that all funds earned by the Contractor in the performance of the Construction Contract are dedicated to satisfy obligations of the Contractor and Surety under this Bond, subject to the Owner's priority to use the funds for the completion of the work.
10. The Surety shall not be liable to the Owner, Claimants, or others for obligations of the Contractor that are unrelated to the Construction Contract. The Owner shall not be liable for the payment of any costs or expenses of any Claimant under this Bond, and shall have under this Bond no obligation to make payments to or give notice on behalf of Claimants, or otherwise have any obligations to Claimants under this Bond.
11. The Surety hereby waives notice of any change, including changes of time, to the Construction

Contract or to related subcontracts, purchase orders, and other obligations.

12. No suit or action shall be commenced by a Claimant under this Bond other than in a court of competent jurisdiction in the state in which the project that is the subject of the Construction Contract is located or after the expiration of one year from the date (1) on which the Claimant sent a Claim to the Surety pursuant to Paragraph 5.1.2 or 5.2, or (2) on which the last labor or service was performed by anyone or the last materials or equipment were furnished by anyone under the Construction Contract, whichever of (1) or (2) first occurs. If the provisions of this paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.
13. Notice and Claims to the Surety, the Owner, or the Contractor shall be mailed or delivered to the address shown on the page on which their signature appears. Actual receipt of notice or Claims, however accomplished, shall be sufficient compliance as of the date received.
14. When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.
15. Upon requests by any person or entity appearing to be a potential beneficiary of this Bond, the Contractor and Owner shall promptly furnish a copy of this Bond or shall permit a copy to be made.

16. **Definitions**

- 16.1 **Claim:** A written statement by the Claimant including at a minimum:
 1. The name of the Claimant;
 2. The name of the person for whom the labor was done, or materials or equipment furnished;
 3. A copy of the agreement or purchase order pursuant to which labor, materials, or equipment was furnished for use in the performance of the Construction Contract;
 4. A brief description of the labor, materials, or equipment furnished;

5. The date on which the Claimant last performed labor or last furnished materials or equipment for use in the performance of the Construction Contract;
6. The total amount earned by the Claimant for labor, materials, or equipment furnished as of the date of the Claim;
7. The total amount of previous payments received by the Claimant; and
8. The total amount due and unpaid to the Claimant for labor, materials, or equipment furnished as of the date of the Claim.

16.2 **Claimant:** An individual or entity having a direct contract with the Contractor or with a subcontractor of the Contractor to furnish labor, materials, or equipment for use in the performance of the Construction Contract. The term Claimant also includes any individual or entity that has rightfully asserted a claim under an applicable mechanic’s lien or similar statute against the real property upon which the Project is located. The intent of this Bond shall be to include without limitation in the terms of “labor, materials, or equipment” that part of the water, gas, power, light, heat, oil, gasoline, telephone service, or rental equipment used in the Construction Contract, architectural and engineering services required for performance of the work of the Contractor and the Contractor’s subcontractors, and all other items for which a mechanic’s lien may be asserted in the jurisdiction where the labor, materials, or equipment were furnished.

16.3 **Construction Contract:** The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and all changes made to the agreement and the Contract Documents.

16.4 **Owner Default:** Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.

16.5 **Contract Documents:** All the documents that comprise the agreement between the Owner and Contractor.

17. If this Bond is issued for an agreement between a contractor and subcontractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

18. Modifications to this Bond are as follows:

END OF DOCUMENT 00 61 13.16 – PAYMENT BOND



Contractor's Application for Payment No.

	Application Period:	Application Date:
To (Owner): Campbell County Utilities and Service Authority	From (Contractor):	Via (Engineer): Hurt & Proffitt
Project: Martin Drive Regional WWPS	Contract: Contract C	
Owner's Contract No.: 80-2304	Contractor's Project No.:	Engineer's Project No.: 20230622

**Application For Payment
Change Order Summary**

Approved Change Orders	Number	Additions	Deductions	
				1. ORIGINAL CONTRACT PRICE..... \$ _____
				2. Net change by Change Orders..... \$ _____
				3. Current Contract Price (Line 1 ± 2)..... \$ _____
				4. TOTAL COMPLETED AND STORED TO DATE (Column F total on Progress Estimates)..... \$ _____
				5. RETAINAGE:
				a. X _____ Work Completed..... \$ _____
				b. X _____ Stored Material..... \$ _____
				c. Total Retainage (Line 5.a + Line 5.b)..... \$ _____
				6. AMOUNT ELIGIBLE TO DATE (Line 4 - Line 5.c)..... \$ _____
				7. LESS PREVIOUS PAYMENTS (Line 6 from prior Application)..... \$ _____
				8. AMOUNT DUE THIS APPLICATION..... \$ _____
				9. BALANCE TO FINISH, PLUS RETAINAGE (Column G total on Progress Estimates + Line 5.c above)..... \$ _____
TOTALS				
NET CHANGE BY CHANGE ORDERS				

Contractor's Certification	
The undersigned Contractor certifies, to the best of its knowledge, the following:	
(1) All previous progress payments received from Owner on account of Work done under the Contract have been applied on account to discharge Contractor's legitimate obligations incurred in connection with the Work covered by prior Applications for Payment;	
(2) Title to all Work, materials and equipment incorporated in said Work, or otherwise listed in or covered by this Application for Payment, will pass to Owner at time of payment free and clear of all Liens, security interests, and encumbrances (except such as are covered by a bond acceptable to Owner indemnifying Owner against any such Liens, security interest, or encumbrances); and	
(3) All the Work covered by this Application for Payment is in accordance with the Contract Documents and is not defective.	
Contractor Signature	
By: _____	Date: _____

Payment of:	\$ _____	
	(Line 8 or other - attach explanation of the other amount)	
is recommended by:	_____	_____
	(Engineer)	(Date)
Payment of:	\$ _____	
	(Line 8 or other - attach explanation of the other amount)	
is approved by:	_____	_____
	(Owner)	(Date)
Approved by:	_____	_____
	Funding or Financing Entity (if applicable)	(Date)

Date of Issuance:	Effective Date:
Owner: Campbell County Utilities and Service Authority	Owner's Contract No.: 80-2304
Contractor:	Contractor's Project No.:
Engineer: Hurt & Proffitt	Engineer's Project No.: 20230622
Project: Martin Drive Regional WWPS	Contract Name: Contract C

The Contract is modified as follows upon execution of this Change Order:

Description:

Attachments: *[List documents supporting change]*

CHANGE IN CONTRACT PRICE	CHANGE IN CONTRACT TIMES <i>[note changes in Milestones if applicable]</i>
Original Contract Price: \$ _____	Original Contract Times: Substantial Completion: _____ Ready for Final Payment: _____ days or dates
[Increase] [Decrease] from previously approved Change Orders No. ___ to No. ___: \$ _____	[Increase] [Decrease] from previously approved Change Orders No. ___ to No. ___: Substantial Completion: _____ Ready for Final Payment: _____ days
Contract Price prior to this Change Order: \$ _____	Contract Times prior to this Change Order: Substantial Completion: _____ Ready for Final Payment: _____ days or dates
[Increase] [Decrease] of this Change Order: \$ _____	[Increase] [Decrease] of this Change Order: Substantial Completion: _____ Ready for Final Payment: _____ days or dates
Contract Price incorporating this Change Order: \$ _____	Contract Times with all approved Change Orders: Substantial Completion: _____ Ready for Final Payment: _____ days or dates

RECOMMENDED:	ACCEPTED:	ACCEPTED:
By: _____ Engineer (if required)	By: _____ Owner (Authorized Signature)	By: _____ Contractor (Authorized Signature)
Title: _____	Title: _____	Title: _____
Date: _____	Date: _____	Date: _____

Approved by Funding Agency (if applicable)

By: _____ Date: _____
Title: _____

CERTIFICATE OF SUBSTANTIAL COMPLETION

Owner:	Campbell County Utilities and Service Authority	Owner's Contract No.:	80-2304
Contractor:		Contractor's Project No.:	
Engineer:	Hurt & Proffitt	Engineer's Project No.:	20230622
Project:	Martin Drive Regional WWPS	Contract Name:	Contract C

This [preliminary] [final] Certificate of Substantial Completion applies to:

All Work The following specified portions of the Work:

Date of Substantial Completion

The Work to which this Certificate applies has been inspected by authorized representatives of Owner, Contractor, and Engineer, and found to be substantially complete. The Date of Substantial Completion of the Work or portion thereof designated above is hereby established, subject to the provisions of the Contract pertaining to Substantial Completion. The date of Substantial Completion in the final Certificate of Substantial Completion marks the commencement of the contractual correction period and applicable warranties required by the Contract.

A punch list of items to be completed or corrected is attached to this Certificate. This list may not be all-inclusive, and the failure to include any items on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract.

The responsibilities between Owner and Contractor for security, operation, safety, maintenance, heat, utilities, insurance, and warranties upon Owner's use or occupancy of the Work shall be as provided in the Contract, except as amended as follows: *[Note: Amendments of contractual responsibilities recorded in this Certificate should be the product of mutual agreement of Owner and Contractor; see Paragraph 15.03.D of the General Conditions.]*

Amendments to Owner's responsibilities: None
 As follows

Amendments to Contractor's responsibilities: None
 As follows:

The following documents are attached to and made a part of this Certificate: *[punch list; others]*

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

EXECUTED BY ENGINEER:		RECEIVED:		RECEIVED:	
By: _____	By: _____	By: _____	By: _____	By: _____	By: _____
(Authorized signature)		Owner (Authorized Signature)		Contractor (Authorized Signature)	
Title: _____	Title: _____	Title: _____	Title: _____	Title: _____	Title: _____
Date: _____	Date: _____	Date: _____	Date: _____	Date: _____	Date: _____

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



Endorsed 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

TABLE OF CONTENTS

	Page
Article 1 – Definitions and Terminology	1
1.01 Defined Terms	1
1.02 Terminology	5
Article 2 – Preliminary Matters.....	6
2.01 Delivery of Bonds and Evidence of Insurance	6
2.02 Copies of Documents	6
2.03 Before Starting Construction	6
2.04 Preconstruction Conference; Designation of Authorized Representatives	7
2.05 Initial Acceptance of Schedules	7
2.06 Electronic Transmittals.....	7
Article 3 – Documents: Intent, Requirements, Reuse	8
3.01 Intent.....	8
3.02 Reference Standards.....	8
3.03 Reporting and Resolving Discrepancies	8
3.04 Requirements of the Contract Documents	9
3.05 Reuse of Documents	10
Article 4 – Commencement and Progress of the Work.....	10
4.01 Commencement of Contract Times; Notice to Proceed	10
4.02 Starting the Work.....	10
4.03 Reference Points	10
4.04 Progress Schedule	10
4.05 Delays in Contractor’s Progress	11
Article 5 – Availability of Lands; Subsurface and Physical Conditions; Hazardous Environmental Conditions	12
5.01 Availability of Lands	12
5.02 Use of Site and Other Areas	12
5.03 Subsurface and Physical Conditions.....	13
5.04 Differing Subsurface or Physical Conditions	14
5.05 Underground Facilities	15

5.06	Hazardous Environmental Conditions at Site	17
Article 6 – Bonds and Insurance		19
6.01	Performance, Payment, and Other Bonds	19
6.02	Insurance—General Provisions	19
6.03	Contractor’s Insurance	20
6.04	Owner’s Liability Insurance	23
6.05	Property Insurance	23
6.06	Waiver of Rights	25
6.07	Receipt and Application of Property Insurance Proceeds	25
Article 7 – Contractor’s Responsibilities		26
7.01	Supervision and Superintendence	26
7.02	Labor; Working Hours	26
7.03	Services, Materials, and Equipment.....	26
7.04	“Or Equals”	27
7.05	Substitutes	28
7.06	Concerning Subcontractors, Suppliers, and Others	29
7.07	Patent Fees and Royalties	31
7.08	Permits	31
7.09	Taxes	32
7.10	Laws and Regulations.....	32
7.11	Record Documents.....	32
7.12	Safety and Protection.....	32
7.13	Safety Representative	33
7.14	Hazard Communication Programs	33
7.15	Emergencies	34
7.16	Shop Drawings, Samples, and Other Submittals.....	34
7.17	Contractor’s General Warranty and Guarantee.....	36
7.18	Indemnification	37
7.19	Delegation of Professional Design Services	37
Article 8 – Other Work at the Site		38
8.01	Other Work	38
8.02	Coordination	39
8.03	Legal Relationships.....	39

Article 9 – Owner’s Responsibilities.....	40
9.01 Communications to Contractor.....	40
9.02 Replacement of Engineer	40
9.03 Furnish Data	40
9.04 Pay When Due.....	40
9.05 Lands and Easements; Reports, Tests, and Drawings	40
9.06 Insurance.....	40
9.07 Change Orders.....	40
9.08 Inspections, Tests, and Approvals.....	41
9.09 Limitations on Owner’s Responsibilities	41
9.10 Undisclosed Hazardous Environmental Condition.....	41
9.11 Evidence of Financial Arrangements.....	41
9.12 Safety Programs	41
Article 10 – Engineer’s Status During Construction.....	41
10.01 Owner’s Representative.....	41
10.02 Visits to Site.....	41
10.03 Project Representative.....	42
10.04 Rejecting Defective Work.....	42
10.05 Shop Drawings, Change Orders and Payments.....	42
10.06 Determinations for Unit Price Work	42
10.07 Decisions on Requirements of Contract Documents and Acceptability of Work	42
10.08 Limitations on Engineer’s Authority and Responsibilities.....	42
10.09 Compliance with Safety Program.....	43
Article 11 – Amending the Contract Documents; Changes in the Work	43
11.01 Amending and Supplementing Contract Documents	43
11.02 Owner-Authorized Changes in the Work	44
11.03 Unauthorized Changes in the Work	44
11.04 Change of Contract Price	44
11.05 Change of Contract Times	45
11.06 Change Proposals	45
11.07 Execution of Change Orders.....	46
11.08 Notification to Surety.....	47
Article 12 – Claims.....	47

12.01	Claims	47
Article 13 –	Cost of the Work; Allowances; Unit Price Work.....	48
13.01	Cost of the Work	48
13.02	Allowances	50
13.03	Unit Price Work	51
Article 14 –	Tests and Inspections; Correction, Removal or Acceptance of Defective Work.....	52
14.01	Access to Work.....	52
14.02	Tests, Inspections, and Approvals.....	52
14.03	Defective Work.....	53
14.04	Acceptance of Defective Work.....	53
14.05	Uncovering Work	53
14.06	Owner May Stop the Work	54
14.07	Owner May Correct Defective Work.....	54
Article 15 –	Payments to Contractor; Set-Offs; Completion; Correction Period	55
15.01	Progress Payments.....	55
15.02	Contractor’s Warranty of Title	58
15.03	Substantial Completion.....	58
15.04	Partial Use or Occupancy	59
15.05	Final Inspection	59
15.06	Final Payment.....	59
15.07	Waiver of Claims	61
15.08	Correction Period	61
Article 16 –	Suspension of Work and Termination	62
16.01	Owner May Suspend Work	62
16.02	Owner May Terminate for Cause	62
16.03	Owner May Terminate For Convenience	63
16.04	Contractor May Stop Work or Terminate	63
Article 17 –	Final Resolution of Disputes	64
17.01	Methods and Procedures.....	64
Article 18 –	Miscellaneous	64
18.01	Giving Notice	64
18.02	Computation of Times.....	64
18.03	Cumulative Remedies	64

18.04	Limitation of Damages	65
18.05	No Waiver	65
18.06	Survival of Obligations	65
18.07	Controlling Law	65
18.08	Headings.....	65

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. §§5101 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.I 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 considered 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 for whom the Owner is responsible 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 11.04.C.2.a and 11.04.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 additional 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 B

CONSTRUCTION MATERIALS

TABLE OF CONTENTS

SECTION – B

SECTION B-2 - WASTEWATER RELATED

- 2.01 Gravity Pipe and Fittings.
 - A. Polyvinylchloride (Main Line Pipe Material).
 - B. Polyvinylchloride (4 Inch and 6 Inch Diameter Service Lateral Pipe Material).
 - C. Ductile Iron (Main Line Pipe Material).
- 2.02 Precast Concrete Manholes.
- 2.03 Manhole Frames and Covers.
- 2.04 Manhole Vents.
- 2.05 Structure Penetrations.
- 2.06 Service Laterals.
- 2.07 Cleanout Frame and Cover.
- 2.08 Sewer Service Saddles.
- 2.09 Pressure Pipe and Fittings.
 - A. Polyvinylchloride.
 - B. High Density Polyethylene (HDPE).
 - C. Ductile Iron.
 - D. Restraint Devices.
- 2.10 Casing Pipe.
 - A. Sewer Casing Pipe. (Sewer Mains 3-inch and greater).
 - B. Pipe Support Spacers.
- 2.11 Valve boxes.
- 2.12 Valve Stem Extensions.
- 2.13 Valve Box Adaptor.
- 2.14 Plug Valves.
- 2.15 Air Release and Vacuum Valves.
- 2.16 Tracer Wire.
- 2.17 Marking Tape.
- 2.18 Witness Posts.

SECTION B-2 - WASTEWATER RELATED

2.01 Gravity Pipe and Fittings.

Pipe size, type, joint, and class shall be detailed on the Drawings. The following are general descriptions.

A. Polyvinylchloride (Main Line Pipe Material).

Polyvinylchloride pipe and fittings for gravity sewers with nominal diameters of between 6 and 15 inches, inclusive, shall be manufactured in accordance with ASTM Designation D3034 and shall meet the requirements for SDR 35. Pipe and fittings for gravity sewers with nominal diameters between 18 and 36 inches, inclusive, shall be manufactured in accordance with ASTM Designation F679 and shall meet the requirements for pipe stiffness 46 (PS 46). The assembly of gravity sewer joints for internal or external pressures of less than 25 feet of head shall be in accordance with ASTM Designation D3212 and shall consist of an integral wall section with a solid cross section rubber gasket manufactured in accordance with ASTM Designation F477. PVC pipe shall be installed on Standard Bedding as shown in the Standard Details.

B. Polyvinylchloride (4 Inch and 6 Inch Diameter Service Lateral Pipe Material).

Polyvinylchloride pipe shall be SDR 26.

C. Ductile Iron (Main Line Pipe Material).

Ductile iron pipe shall be centrifugally cast and manufactured in accordance with AWWA/ANSI C151/A21.51 Specification, shall be at least Thickness Class 51 and shall be used at sewer depths greater than 15 feet or in special circumstances. Ductile iron pipe for gravity sewers shall be cement mortar lined with Type II Portland cement and shall be coated inside and outside with bituminous material of either coal tar or asphalt base in accordance with AWWA/ANSI C104/A21.4 Specification. Mechanical joints and push-on joints shall be manufactured in accordance with AWWA/ANSI Specification C111/A21.11.

Ductile iron pipe and fittings shall be lined with Protecto 401, or equal, in accordance with ASTM Designation A746. Ductile iron pipe and fittings shall be coated on the exterior with bituminous material of either coal tar or asphalt base in accordance with AWWA/ANSI Specification C151/A21.51.

Fittings for ductile iron pipe shall be compact style ductile iron fittings manufactured in accordance with AWWA/ANSI C153/A21.53 Specification wall thickness shall be Thickness Class 54. All fittings shall be bituminous coated inside and out.

2.02 Precast Concrete Manholes.

Precast concrete manholes shall be constructed to meet requirements of ASTM C478 and in accordance with the Standard Details. The walls of precast concrete manholes shall have a minimum thickness of 5 inches. Manhole sections shall be tongue and groove and shall be joined

with an “O” ring rubber gasket conforming to ASTM C-443 and butyl mastic sealant. Holes for the required sewers shall be made in the manhole sections during the manufacturing operation to the diameters required and shall be provided with flexible connections comprised of rubber boots and stainless steel straps, similar to Kor-N-Seal, A-Lok Products, Press-Seal Corporation, or approved equal and meet requirements of ASTM C923.

The joints and/or joining surfaces of the manholes shall be sealed with a butyl rubber based tape. The butyl component of the tape shall consist of 50% (min.) butyl rubber, shall contain 2% or less volatile matter, and shall be .050 inch thick. The backing component shall be high-density polyethylene film. A release paper may be utilized. The tape width shall be 6-inches wide. The tape shall be overlapped at least twice its width. The tape shall not be stretched during application. Primer and/or adhesive as recommended by the tape supplier shall be employed for adverse, critical, or other applications. Testing of joints and compliance with construction requirements shall be conducted in strict conformance with the requirements of the sealant supplier.

All precast units shall be constructed of 4000 PSI concrete and reinforced with welded wire fabric conforming to ASTM standards. Detailed shop drawings showing the reinforcing and design calculations shall be stamped by a Professional Engineer registered in the Commonwealth of Virginia. Manholes shall be carefully made and shall have no honeycomb or other deteriorated surfaces. All surfaces shall be smooth. Manholes shall not have steps.

2.03 Manhole Frames and Covers.

Frames and covers for manholes shall be best quality gray iron cast in accordance with ASTM A48 for the service conditions shown on the Standard Details. Castings shall be sound, true to form and thickness, sand blast cleaned, and machined on all bearing surfaces. Castings shall receive one coat of black asphaltum paint prior to delivery to the job site. For manhole frames and covers set flush with final grade, the frames shall be set in butyl mastic sealant. For manhole frames and covers set above grade, the manhole frame shall be set in butyl mastic sealant and bolted to the manhole with two ½ inch diameter stainless steel epoxied anchor bolts, two ½ inch diameter stainless steel wedge anchors, or two ½ inch diameter stainless steel stud anchors which extend no more than two inches above the top of the frame flange when installed. Watertight manhole frames and covers shall be attached to the top of the manhole with four bolts in addition to the above requirements and be equipped with a manhole chimney seal sized to fit the field application. Manhole chimney seals shall be Cretex or approved equal.

Manhole covers for air/vacuum release manholes shall have two 1-inch diameter holes drilled in the cover 180 degrees apart.

2.04 Manhole Vents.

Manhole vents, where required, shall be fabricated of ductile iron pipe and fittings as specified in paragraph 2.01.C with bronze insect screen.

2.05 Structure Penetrations.

Where existing manholes or similar structures are core drilled radially, flexible connections comprised of rubber boots and stainless steel straps, such as Kor-N-Seal, A-Lok Products, Press-Seal Corporation, or approved equal shall be furnished. At non-radial penetration locations, Link-

Seal devices in steel sleeves shall be installed to seal the structure against infiltration. Where the slopes of the incoming and outgoing sewers and laterals exceed 12 percent, the manhole openings shall match the slope of the incoming or outgoing sewer or lateral.

2.06 Service Laterals.

All 4-inch and 6-inch service lateral pipe and fittings shall be PVC SDR 26 and as specified in paragraph 2.01.2 except the service stub-out and cap shall be PVC Schedule 40 as shown on the Standard Detail.

2.07 Cleanout Frame and Cover.

A cleanout frame and cover shall be furnished at each service location. Cleanout frame and cover shall be PCO-1*MOD, Capitol Foundry or approved equal.

2.08 Sewer Service Saddles.

Where service laterals are connected to existing sewers, service saddles shall be utilized. Sewer service saddles shall be ductile iron in accordance with ASTM A536 and shall be Style CB as manufactured by Romac Industries.

2.09 Pressure Pipe and Fittings.

A. Polyvinylchloride.

Where polyvinylchloride pipe is designated for use in 4-inch through 12-inch force mains, such pipe shall be manufactured in accordance with AWWA Specification C900 to cast iron pipe outside diameter dimensions. Class 150 pipe shall meet the requirements of DR 18 and Class 200 pipe shall meet the requirements of DR 14. Joints shall consist of an integral wall section with solid cross section rubber gasket conforming to ASTM Designation F-477. Fittings shall be all bell, mechanical joint, manufactured as specified for ductile iron. For sizes less than 4-inch, pipe shall be Yelomine by Aquamine Corporation or equal. PVC pipe used for sanitary sewer force mains shall be green. Standard bedding, tracer wire, and locator warning tape shall be furnished for PVC pipe as shown in the Standard Details.

B. High Density Polyethylene (HDPE).

HDPE pipe for force mains shall be manufactured from a PE 3408 high density resin compound meeting the specifications of ASTM D3350 with a cell classification of PE:345434C and meeting Type III, Class C, Category 5, Grade P34 per ASTM D1238. HDPE pipe shall comply with AWWA Specification C-901 for pipe less than 4 inches in diameter and AWWA Specification C-906 for pipe 4 inches or greater in diameter. HDPE pipe 4 inches or greater shall be ductile iron pipe size (DIPS). The pipe shall contain no recycled materials except that generated in the manufacturer's own plant from resin of the same specification from the same raw material. Pipe and accessories shall be 200 psi at 73.4 degrees F meeting the requirements of Standard Dimension Ratio (SDR) 11 as a minimum strength.

Butt fusion fittings shall be PE3408 HDPE, Cell Classification of 345464C as determined by ASTM D3350 and manufactured to ASTM D3261. Molded and fabricated fittings shall have

the same pressure rating as the pipe unless otherwise specified on the drawings. Fabricated fittings are to be manufactured using a Data Logger. Temperature, fusion pressure, and a graphic representation of the fusion cycle shall be part of the quality control records.

Electrofusion fittings shall be PE3408 HDPE, Cell Classification of 345464C as determined by ASTM D3350 and manufactured to ASTM F1055. Electrofusion fittings shall have the same pressure rating as the pipe unless otherwise specified on the drawings.

Flanged and mechanical joint adaptors shall be PE3408 HDPE, Cell Classification of 345464C as determined by ASTM D3350 and manufactured to ASTM D3261. Electrofusion fittings shall have the same pressure rating as the pipe unless otherwise specified on the drawings.

HDPE pipe for force mains shall be color coded green. The color coding shall be permanently co-extruded striped on the pipe outside surface as part of the pipe's manufacturing process.

C. Ductile Iron.

Ductile iron pipe for force mains shall be Thickness Class 51, manufactured in accordance with ANSI/AWWA C151/A21.51 Specification, and shall be cement-mortar lined inside in accordance with ANSI/AWWA C104/A21.4 Specification. Cement for the mortar shall be Type II Portland cement. The standard seal coating of bituminous material shall be applied. The exterior coating of bituminous material shall be applied in accordance with the AWWA/ANSI C104/A21.4 Specification. Ductile iron pipe with flanged joints shall be manufactured in accordance with AWWA/ANSI C115/A21.15.

Ductile iron pipe and fittings used to convey wastewater shall be lined with Protecto 401, or equal, in accordance with ASTM Designation A746. Ductile iron pipe and fittings shall be coated on the exterior with bituminous material of either coal tar or asphalt base in accordance with AWWA/ANSI Specification C151/A21.51.

Fittings for ductile iron pipe shall be compact style ductile iron fittings manufactured in accordance with AWWA/ANSI C153/A21.53 Specification wall thickness shall be Thickness Class 54. All fittings shall be designed with special interior linings such as Protecto 401, or equal, in accordance with ASTM Designation A746 and coated on the outside with bituminous material.

D. Restraint Devices.

Any change in direction will require an appropriate restraint device or method.

1. Mechanical Joint Restraints.

Where mechanical joint restraints are required, but not limited to, valves, tees, bends, and emergency pump connections, the following devices shall be used, or approved equal:

- a. Ford Uniflange Series 1400.
- b. Romac RomaGrip Mechanical Joint Restraint.
- c. EBAA Iron Meg-A-Lug.

- d. Star Pipe Products Stargrip Series 3000.
- e. Tyler Union Series 2000.

2. Mechanical Joint Adaptors.

Mechanical joint adaptors shall meet the ductile iron and working pressure specifications of AWWA compact fittings, ANSI/AWWA C153/A21.53 and C110/A21.10 — American National Standard for Ductile Iron Compact Fittings, 3-Inch Through 36-Inch (76mm Through 914mm) for Water Service. Mechanical joint (MJ) valves and fittings shall be connected using a bolt-through positive restraint mechanism manufactured of U. S. A. ductile iron conforming to ASTM A536, 65-45-12. The positive restraint device shall connect the valves and/or fittings at a linear distance not to exceed three (3) inches and without attachment to pipe. The device shall come complete with all accessories, including standard styrene butadiene rubber (SBR) MJ gaskets conforming to the latest revision of AWWA C111/ASTM F-477 and weathering steel (Corten) bolts conforming to AWWA C111/A21.11 and ASTM A242. Nuts for 3 through 12-inch sizes shall be SAE Grade 5 steel with black oxide coating. Nuts for 14-inch and larger adaptors shall be heavy hex Corten steel conforming to ASTM A242. Sizes 3-12-inch of the bolt-through MJ positive restraining device shall be supplied with an NSF 61 asphaltic seal coating in accordance with ANSI/AWWA C104/A21.4. Sizes 14-36-inch shall be supplied with NSF 61, 7-mil. fusion bonded epoxy conforming to AWWA C116/A21.16-09 as well as the coating, surface preparation and application requirements of ANSI/AWWA C550. For sewer installations, the device shall be supplied with 40-mil Protecto 401 epoxy. The device shall be used with standard mechanical joint fittings (AWWA C110 or C153) and valves. The device shall be Infact Corporation FOSTER ADAPTOR or approved equal.

1. Push-On Joint Restraints.

When push-on joint restraints are required the following devices shall be used:

- a. Gripper Gasket

2. Restrained Joint Ductile Iron Pipe.

Ductile iron pipe shall be restrained in casing pipe, special stream crossings, and/or other locations as required. Restrained joints will vary from manufacturer to manufacturer. Application of restraint will be one of the determining factors as to type of joint restraint required. The following manufacturers are approved for joint restraint pipe.

- a. U.S. Pipe
- b. American Ductile Iron Pipe
- c. McWane
- d. Griffin Pipe Products Co.

3. Pipe Restraining Systems.

A pipe restraining system, where required, will be approved on a case-by-case basis. The

following manufacturers of these restraining systems are as follows, or approved equal:

- a. Romac Industries, Inc.
- b. Ford Meter Box Company
- c. Smith-Blair, Inc.
- d. EBAA Iron, Inc.
- e. Star Pipe Products

4. Thrust Blocks & Bulkhead Anchor.

Blocks and anchors shall be in accordance with the standard detail, bearing on undisturbed earth. Thrust blocking shall be made of concrete having a compressive strength of not less than 3,000 PSI after 28 days. The system shall not be pressure tested until at least 14 days after the thrust blocks are poured.

5. Threaded Rod Applications.

All threaded rods used for restraints shall be stainless steel (S.S.) 304. Mild alloy steel or plated steel will not be allowed. All nuts and washers shall be S.S. 304. To facilitate the restraining of pipe and mechanical joints fittings, "Ductile Lugs" (ASTM A536) shall be for all threaded rod applications. Eye bolts are not allowed.

2.10 Casing Pipe.

A. Sewer Casing Pipe. (Sewer Mains 3-inch and greater).

Steel casing pipe for boring or jacking under highways and railroads shall meet requirements of ASTM A 139, Grade B or ASTM A53 Standard Weight Class and shall have beveled edges suitable for welding or be threaded. Nominal pipe diameter and wall thickness shall be as indicated on drawings. No protective coating or lining will be required. Steel casing pipe shall be spiral welded.

B. Pipe Support Spacers.

Pipe support spacers for use in casing pipe shall be steel and primed and then coated with an anti-corrosion finish as manufactured by Spider Manufacturing, Inc. or approved equal and shall be furnished in accordance with Standard Details. Pipe end seals shall be 1/8-inch thick neoprene and shall be fastened to the casing and carrier pipes with stainless steel pipe clamps. Pipe end seals shall be manufactured by Spider Manufacturing, Inc., or approved equal.

2.11 Valve boxes.

Valve boxes shall be cast iron screw type with adjustable extension pieces and flared base to fit the operating mechanism of the valve and shall be bituminous coated. The least diameter of the shaft shall be 5.25 inches. The head shall be round and shall have the word "sewer" cast upon it. Each valve shall be protected by a valve box.

The following valve boxes are approved:

- A. Capitol Foundry Part Nos. 562S* or 664S*, depending on depth.
- B. ProSelect PSVB562SW or PSVB664SW, depending on depth.

2.12 Valve Stem Extensions.

Where valves are installed at depths greater than 5 feet, valve stem extensions shall be furnished. Valves stem extensions shall be compatible to the valve operator utilized and contain centering plates.

2.13 Valve Box Adaptor.

All valve boxes shall be installed upon the valve with the use of a valve box adaptor (types A-H) as manufactured by Adaptor Inc. or an approved equal. The adaptor shall be installed in lieu of hardwood, brick, or other types of blocking and shall be incidental to the valve and box installation.

2.14 Plug Valves.

Valves shall be of the non-lubricated, eccentric type with resilient-faced plugs and screwed, flanged, or mechanical joint ends as shown on the Drawings. Port areas of 4-inch through 20-inch valves shall be at least 30 percent of full pipe area. Bodies shall be semi-steel with raised seats. Seats in 3 inch and larger valves shall have a welded-in overlay of high nickel content on all surfaces contacting the plug face. Valves through 20 inches shall have permanently lubricated, stainless steel bearings in the upper and lower plug stem journals.

All valves shall be of the bolted bonnet design. All 4 inch and larger valves shall be designed so that they can be repacked without removing the bonnet and the packing shall be adjustable. All exposed nuts, bolts, springs, and washers shall be stainless steel 304. Flanged valves through 12 inches shall have face-to-face dimensions of standard gate valves. A valve whose exterior is susceptible to attack by weather or contact with partially treated sewage shall receive one coat of primer on the exterior.

Resilient plug facings shall be compatible with raw sewage and sludge. Plug facings shall provide drip tight shut-off regardless of flow direction.

Manual valves shall have gear actuators and tee wrenches, as indicated on the Drawings. All gearing shall be enclosed in a semi-steel housing and be suitable for running in a lubricant with seals provided on all shafts to prevent entry of dirt and water into the actuator. The actuator shaft and the quadrant shall be supported on permanently lubricated bronze bearings. Actuators shall clearly indicate valve position and an adjustable stop shall be provided to set closing torque.

Valves for buried service shall have seals on all shafts and gaskets on the valve and actuator covers to prevent the entry of water. Actuators mounting brackets for buried service shall be totally enclosed and shall have gasket seals. All exposed nuts, bolts, springs, and washers shall be stainless steel 304. Valves shall have two coats asphalt varnish on exterior.

Valves shall be PEC Eccentric Plug Valves as manufactured by DeZurik Corporation or approved equal.

2.15 Air Release and Vacuum Valves.

Combination air valves shall be capable of withstanding 150 psi working pressure, have reinforced nylon body and cover, foamed polypropylene float, stainless steel 316 stem, nut, washers, spring, and ball valves, and Buna-N O-rings. Combination air valves shall have a rolling seal assembly that allows air to vent from the system during filling and normal operation and allows air to enter the system during draining. The valves shall be as shown on the Standard Details. Acceptable combination air valves are:

- A. A.R.I. D-025 where pressure does not exceed 100 psi.
- B. A.R.I. D-025L where pressure does not exceed 200 psi.

2.16 Tracer Wire.

Tracer wire for open trench installation shall be a 12 AWG solid conductor of soft-drawn 21% IACS, copper clad steel, utilizing a AISI 1006 or 1010 low carbon steel core, with a minimum break load of 282 lbs. (55,000 psi). Conductor shall be rated for direct burial use at 30 volts and RoHS compliant. The insulation shall be 30 mil high-density, high molecular weight polyethylene (HDPE insulation). Approved tracer wire for open trench installation includes:

- A. Pro-Trace HF-CCS PE30.
- B. Copperhead Superflex.

Tracer wire for directional drilling and boring installation shall be a 12 AWG solid conductor of soft-drawn 21% IACS, copper clad steel, utilizing a AISI 1055 high carbon steel core, with a minimum break load of 1150 lbs. (200,000 psi). Conductor shall be rated for direct burial use at 30 volts and RoHS compliant. The insulation shall be 45 mil high-density, high molecular weight polyethylene (HDPE insulation). Approved tracer wire for directional drilling and boring installation includes:

- A. Pro-Trace HDD-CCS PE45.
- B. DURAtace CCS HDPE 45.
- C. Copperhead SoloShot Extra High Strength Tracer Wire.

As an alternative to the trace wires listed above, tracer wire for open trench or directional drilling and boring installation may be a 19 AWG tin coated solid copper conductor, with a resistivity of 16.85 OHMS per MFT, a tensile strength of 38,500 psi nominal, a break strength of 38.95 lbs. nominal, and an elongation of 30%. The conductor insulation shall be polyethylene with a nominal thickness of 0.006-inches, a maximum voltage of 300 volts insulated, and a dielectric constant of 2.29 @ 1 MHZ. The core material shall be woven polyester and water blocking polyester yarns. The outer jacket shall be high-density polyethylene. Approved alternate tracer wire for directional drilling and boring installation includes:

- A. Trace-Safe RT Series.

All mainline tracer wires must be interconnected in intersections, at mainline tees and mainline crosses. At tees, the three wires shall be joined using a single 3-way lockable connector. At crosses, the four wires shall be joined using a 4-way connector. Use of two 3-way connectors

with a short jumper wire between them is an acceptable alternative.

Direct bury wire connectors – shall include 3-way lockable connectors and mainline to lateral lug connectors specifically manufactured for use in underground trace wire installation. Connectors shall be dielectric silicon filled to seal out moisture and corrosion and shall be installed in a manner to prevent any uninsulated wire exposure. Approved connectors include:

- A. 3M DBY-6
- B. Copperhead SnakeBite Locking Connector

Non locking friction fit, twist-on or taped connectors are prohibited.

Tracer wire must be wrapped or taped to the pipe or tubing. Strip insulation from each end a minimum of 12-inches, where connections will be made.

For services, wrap and secure the bare stripped wire to the meter box's compression fitting and to the corporation stop compression fitting. The tracer wire shall make a complete and traceable circuit.

Trace wire installation shall be performed in such a manner that allows proper access for connection of line tracing equipment, proper locating of wire without loss or deterioration of low frequency (512Hz) signal for distances in excess of 1,000 linear feet, and without distortion of signal caused by multiple wires being installed in close proximity to one another.

Trace wire systems shall be installed as a single continuous wire, except where using approved connectors. No looping or coiling of wire is allowed. All new trace wire installations shall be located using typical low frequency (512Hz) line tracing equipment, witnessed by the Contractor, Engineer and Owner as applicable, prior to acceptance of ownership.

This verification shall be performed upon completion of rough grading and again prior to final acceptance of the project.

Continuity testing in lieu of actual line tracing shall not be accepted.

2.17 Marking Tape.

Underground marking tape shall be a 2-inch wide detectable marking tape, with a minimum 5.0 mil overall thickness. Tape shall be manufactured using a 0.8 mil clear virgin polypropylene film, reverse printed and laminated to a solid 0.35 mil solid aluminum foil core, and then laminated to a 3.75 mil clear Virginia polyethylene film. Tape shall be printed "CAUTION BURIED SEWER LINE BELOW" and meet the APWA Color-Code standard for identification of buried utilities. Acceptable marking tapes are:

- A. Pro-Line Safety Products.
- B. Presco.
- C. Mutual Industries, Inc.

2.18 Witness Posts.

Witness posts for off road water lines shall be impact resistant, three rail design, fiberglass composite markers. They shall be labeled “CAUTION SEWER PIPELINE BEFORE DIGGING CALL CAMPBELL CO UTILITIES + SERVICE AUTHORITY (434) 239-8654 48 HOURS BEFORE DIGGING CALL 811 OR (800) 552-7001”. Acceptable witness post manufacturers are:

A. Carsonite Composites.

SECTION C-1 - GENERAL REQUIREMENTS

1.01 Summary of Work.

1. Work covered consists of providing all work indicated on Drawings or required by the Contract Documents approved for Project.
2. The Contractor shall restrict his activities to take place during the week from Monday through Friday. Work shall not take place on Saturday, Sunday, or Campbell County Utilities and Service Authority holidays without prior written consent from the Owner.
3. Where portions of the Project are near overhead high voltage lines, the Contractor shall meet the requirements of the Virginia Overhead High Voltage Line Safety Act. Costs involved in meeting these requirements shall be the responsibility of the Contractor.
4. The Contractor shall comply with the Virginia Underground Utility Protection Act at no additional cost to the Owner.
5. The Contractor shall comply with the Occupational Safety and Health Act at no additional cost to the Owner.
6. Traffic Control. When working within Virginia Department of Transportation right-of-way, the Contractor shall comply with the requirements of the Virginia Department of Transportation, the Virginia Work Area Protection Manual, the Virginia Department of Transportation Land Use Permit issued for the Project, and the Maintenance of Traffic (MOT) Plan developed for the Project. When working within easements on private property, the Contractor shall comply with all maintenance of traffic issues contained within the easement agreements, other agreements between the Owner and the private property owner, and other agreements between the Contractor and the private property owner.
7. Erosion & Sediment Control Measures. The Contractor shall comply with the Sediment and Control Plan developed for the Project, the Virginia Erosion and Sediment Control Manual, and the Virginia Sediment and Erosion Control Law. The Contractor shall install additional erosion and sediment control measures as required and as directed by the Owner.
8. Permits. The Contractor shall obtain all permits required for the Project, unless already obtained by the Owner. These may include, but not be limited to the Campbell County Building Permit, the Campbell County Land Use Permit, the VDOT Land Use Permit, and a Campbell County Business License. It is the Contractor's duty during the bid period to ask the Owner what permits have been obtained or are in the process of being obtained.

1.02 Payment.

1. Applications for Payment.
 - (1) Application for Payment shall be EJCDC Document C-620, entitled "Contractor's Application for Payment". Each application for payment by the Contractor, excluding the first, shall be accompanied by a "Contractor's Affidavit of Payment of Debts and Claims," AIA Document G706 and "Contractor's Affidavit of Release of Liens," AIA Document G706A. Payment for stored material delivered but not incorporated in the work will be the invoiced amount only. Material must be stored in a bonded or insured location approved by the Owner. Submit applicable invoices with Application for Payment.

- (2) For each Application for Payment that is approved, the Owner shall pay to the Contractor 95 percent of the total amount due and the Owner shall retain 5 percent of the amount due until final completion and acceptance of all work covered by the Contract.

2. Change Order Procedures.

- (1) No amount, in part or in whole, of a Change Order shall be included in a requisition for payment by the Contractor until the Change Order has been executed and copies of the Change Order have been distributed to the Owner and Contractor.
- (2) Work Change Directive. A Work Change Directive is a device which enables the Owner to promptly order changes in the work which may involve changes in cost or contract time, or both pending preparation and execution of a formal Change Order.
- (3) Request for Change Order Proposal. The Owner may request the Contractor to submit a Change Order proposal for changes in contract work. The Contractor shall submit the proposal in accordance with Contract requirements within a reasonable time. The Owner may issue to the Contractor a Proceed Order authorizing the required changes for an additional amount not to exceed, or a deduction of not less than the amount shown in the Proceed Order. If the Contractor is not in agreement with the amount stipulated in the Proceed Order, he shall, within a reasonable time after the issue date of the order, submit an equitable proposal and develop with the Owner a mutually acceptable price for the required change in work.
- (4) Change Order Proposal. Without further request and within a reasonable time from the issue date of a proceed order, the Contractor shall submit a written Change Order proposal covering the work authorized in the Proceed Order so that a Change Order may be prepared for execution.

1.03 Measurement and Payment Definitions.

1. Standard Payment Items.

- (1) Price per horizontal linear foot for all size free bores and/or directional bores shall include furnishing all materials, equipment, and labor required to bore or push a hole under a driveway or like obstruction and restoring disturbed area to original or better conditions. This price shall include the setup cost for excavation of boring and receiving pits and installation or removal of boring machines. The cost and installation of the pipe shall be included in this item.
- (2) Price per horizontal linear foot for each size and wall thickness steel casing pipe bored and jacked shall include furnishing all materials, equipment, and labor required to bore or jack a hole under pavement, or like obstruction and installation of the casing pipe through the bore, and restore disturbed area to original or better conditions. Price also includes each size restrained joint pipe, and pipe supports, required to be installed through the casing pipe. Price also includes all materials, equipment, and labor to seal the ends of the casing pipe after the carrier pipe has been installed. Price shall include setup costs required to excavate boring and receiving pits and to install and remove boring equipment.
- (3) Price per horizontal linear foot for each material, size, and wall thickness pipe horizontally directionally drilled (HDD) shall include furnishing all materials, equipment, and labor required to install an HDD and restore disturbed area to original or better conditions. Price

also includes each material, size, and wall thickness restrained joint pipe through the bore. Price shall include setup costs required to excavate, backfill, and restore boring and receiving pits.

- (4) Price per ton for grouted Class I dry riprap shall include all materials, equipment, and labor required to install riprap at locations designated on the Drawings and as directed by the Owner.
- (4) Price per ton for ungrouted Class I dry riprap shall include all materials, equipment, and labor required to install the riprap at the locations designated on the Drawings and as directed by the Owner.
- (5) Price per cubic yard for select borrow shall include all material, equipment, and labor required to remove unsuitable material for backfill and furnish, haul, place, compact, and grade select borrow approved by the Owner. The select borrow shall be used in the locations designated on the Drawings and/or as directed by the Owner.
- (6) Price per ton of aggregate fill shall include removal and disposal of unsuitable material and replacement with aggregate fill material as directed by the Owner.
- (7) Mobilization shall include all activities necessary to mobilize in order to carry out construction activities. No more than 50 percent of the mobilization cost will be paid in the first pay request by the Contractor under this item. Any additional monies will be paid on a pro-rated basis over the remaining months of the Contract.
- (9) Replacement of Plant Mix Pavement in Streets and Driveways: Price per linear foot of pipe line trench for the replacement of state highways and driveways surfaced with plant mix pavement in accordance with the conditions existing prior to construction.

2. Water Line Payment Items.

- (1) Pipe. Price per horizontal linear foot for each size and type of pipe, complete in place as shown on the Drawings shall include all pipe, fittings, corporation stops, service saddles, all types of joint restraints, and all materials, equipment, and labor to excavate, provide bedding, install pipe, required compaction tests, backfill the water line, pressure tests, flushing, disinfecting, and restoring disturbed area to original or better conditions. Price includes tracer wire and marking tape. Price includes all clearing and grubbing, seeding and fine grading, concrete encasement, and also includes all erosion control measures and devices including, but not limited to, silt fence, straw bale barrier, drop inlet silt traps, riprap, and miscellaneous stone. Price includes relocation, repair, and/or replacement of all above ground obstructions along the water line alignment including but not limited to fence, landscaping, signs, mailboxes, curbs, asphalt pavement or reinforced concrete pavement and/or structures, and miscellaneous items. Price includes relocation, repair, and/or replacement of all below ground improvements along the alignment including, but not limited to, all underground utilities, vaults, and miscellaneous items. Price shall be based on horizontal linear feet between stations shown on the Drawings and not actual pipe length.
- (2) Valves. Price for each size and type of valve with stem extension (if required), concrete collar (if required), valve box adaptor, and valve box shall include furnishing all materials, equipment, and labor to install, test, disinfect each valve and restore disturbed area to like or better conditions. Valves included in blowoff assemblies, vaults, and fire hydrant assemblies shall not be included in this payment item.

- (3) Service Connections. Price for each type of service connection (near side or far side) as shown on Standard Details, complete in place. The price shall include the yoke box with adaptor, locator tracer wire, corporation stops, service saddles, taps in water line, and restoration of disturbed area to like or better condition. The pipe shall include the bore pit, bore, PVC casing pipe, installation of service pipe in casing pipe, and restoration of bore pit for far side service connections. The cost of the service pipe is included in this payment item.
- (4) Fire Hydrant Assembly. Price for each fire hydrant assembly shall include furnishing all materials, equipment, and labor to install a fire hydrant assembly including hydrant, gate valve, valve box, pipe, fittings, restraints, stone, testing and disinfection to connect hydrant assembly to the water line. The price shall include all excavation and backfill for the entire fire hydrant assembly and piping, and restoring disturbed area to like or better conditions.
- (5) Sampling Station. Price for each sampling station shall include all materials, equipment, and labor to install a sampling station including sampling station, valve, valve box, pipe, fittings, corporation stop, bedding stone, testing, and disinfection to connect the sampling station to the water line. The price shall also include excavation and backfill for the entire sampling station assembly, and restoring disturbed area to like or better conditions.
- (6) Air Release Assembly. Price for each size and type air release valve assembly shall include furnishing all materials, equipment, and labor to install a corporation stop, brass nipple(s), air release valve assembly, and discharge piping with threaded brass insect screen on a water line. Price shall include the concrete manhole and manhole frame and cover that will enclose the air release valve assembly. Price shall also include excavation, bedding, stone, backfill for the concrete manhole, and restoring disturbed area to like or better conditions.
- (7) Flushing Hydrant. Price for a flushing hydrant assembly shall include furnishing and installing all material, equipment, and labor to install flushing hydrant assembly including flushing hydrant, meter box, brass nipple, frame and cover, and stone bedding. Price shall include all excavation and backfill from the main water line to the flushing hydrant assembly and restoring disturbed area to like or better conditions.
- (8) Automatic Flushing Assembly. Price for automatic flushing valve assembly shall include furnishing and installing all material, equipment, and labor to install flushing valve assembly, including connection to main and piping to the flushing unit, excavation, backfill, discharge piping from unit to outlet point, and check valve at end of discharge piping as shown on the Drawings.
- (9) Main Line Flushing Assembly. Price for main line flushing assembly shall include furnishing and installing all material, equipment, and labor to install main line flushing assembly, including connection to main, piping, fittings, mechanical joint restraints, gate valve and box, check valve, filter fabric, riprap, excavation, backfill, compaction, and restoration as shown on the Drawings.
- (10) Wet Tap. Price for a wet tap shall include furnishing and installing all material, equipment, and labor to install a wet tap, including the tapping sleeve and tapping valve, valve box, excavation, backfill, compaction, and restoration as shown on the Drawings.
- (11) Bulkhead Anchor. Price for bulkhead anchors shall include furnishing and installing all material, equipment, and labor to install bulkhead anchors, including excavation, installation

of mechanical joint restraint where required or stainless steel threaded rod where required, forming, concrete, backfill, compaction, and restoration as shown on the Drawings.

- (12) Type F Horizontal Anchor. Price for type F horizontal anchor shall include furnishing and installing all material, equipment, and labor to install type F horizontal anchor, including excavation, concrete, 6 mil polyethylene sheeting, backfill, compaction, and restoration as shown on the Drawings.
- (13) Abandonment of Existing Waterlines. Price for abandonment of existing waterlines shall include all labor, material, and equipment to close the existing valves, dewater the existing waterlines, cut the existing waterlines, remove the cut portions of pipe and appurtenances, and plug or cap the existing waterline where designated by the drawings or where directed by the Engineer.
- (14) Abandonment of Existing Water Services and Removal of Existing Meters Boxes. This bid item shall include all labor, material, and equipment to excavate to the corporation stop, close the corporation stop, cut and crimp the service line, cut the service lines at the meter box, remove the meter box, and backfill and restore the excavated areas. All meter boxes removed shall be delivered to the Authority's inventory storage facility at 20644 Timberlake Road, Lynchburg, Virginia, unless directed otherwise by the Engineer.

3. Sewer Line Payment Items.

- (1) Gravity Sewer. Price per linear foot for each size and type gravity sanitary sewer, complete in place, and shall include furnishing all material, equipment, and labor to excavate, provide bedding, install the pipe, backfill to subgrade if under paved area or backfill to grade if not under paved area, and test the sewer line. Price includes tracer wire and marking tape. Price includes all clearing and grubbing, seeding and fine grading, concrete encasement, and also includes all erosion control measures and devices including but not limited to silt fence, straw bale barrier, drop inlet silt traps, riprap, and miscellaneous stone. Price includes relocation, repair, and/or replacement of all above ground obstructions along the sewer alignment including but not limited to fence, landscaping, signs, mailboxes, curbs, asphalt pavement or reinforced concrete pavement and/or structures and miscellaneous items. Price includes relocation, repair, and/or replacement of all below ground improvements along the sewer alignment including but not limited to all underground utilities, vaults, and miscellaneous items.
- (2) Force Main. Price per linear foot for each size and type force main, complete in place, and shall include furnishing all material, equipment, and labor to excavate, provide bedding, install the pipe, backfill to subgrade if under paved area or backfill to grade if not under paved area, and test the force main. Price includes all required fittings and joint restraints, tracer wire, and marking tape along the entire length of force mains, and above ground force main sewer indicator posts (one every 500 feet along the entire length of force mains). Price includes all clearing and grubbing, seeding and fine grading, concrete encasement, and also includes all erosion control measures and devices including but not limited to silt fence, straw bale barrier, drop inlet silt traps, riprap, and miscellaneous stone. Price includes relocation, repair, and/or replacement of all above ground obstructions along the sewer alignment including but not limited to fence, landscaping, signs, mailboxes, curbs, asphalt pavement or reinforced concrete pavement and/or structures, and miscellaneous items. Price includes relocation, repair, and/or replacement of all below ground improvements along the sewer alignment including but not limited to all underground utilities, vaults, and miscellaneous items.

- (3) Manhole. Price per vertical foot for each size sanitary sewer manhole measured from invert to bottom of casting shall include furnishing all material, equipment, and labor to excavate, provide bedding, install and test the new manholes, and backfill to subgrade if in paved area or backfill to grade if not in paved area.
- (4) Inside Drop Manhole. Price per vertical foot for each size sanitary sewer manhole with inside drop connection measured from invert to bottom of casting shall include furnishing all material, equipment, and labor to excavate, provide bedding, install and test the new inside drop manholes, and backfill to subgrade if in paved area or backfill to grade if not in paved area.
- (5) Manhole Frame and Cover. Price for each manhole frame and cover shall include furnishing all material, equipment, and labor to install the manhole frame and cover.
- (6) Waterproof Manhole Frame and Cover. Price for each waterproof manhole frame and cover shall include furnishing all material, equipment, and labor to install the manhole frame and cover.
- (7) Service Lateral. Price per linear foot for each size sanitary sewer service lateral complete in place shall include furnishing and installing all material, equipment, and labor to install the service lateral and backfill. The price shall also include the service saddle on the main sewer line, bedding, pipe, fittings, adapters, and testing.
- (8) Cleanout Assembly. Price for each size cleanout assembly complete in place and shall include wyes, 45-degree bends, clean-out plugs, adapters, service stub-out, and plug. Price includes vertical cleanout riser pipes complete in place.
- (9) Air Release/Vacuum Assembly. Price for each sewage air release and vacuum valve assembly shall include furnishing all material, fittings, valves, equipment, and labor to install air release and vacuum valve. Price shall include the concrete manhole and manhole frame and cover that will enclose the air release and vacuum valve assembly. Price shall also include excavation, bedding, and backfill for the concrete manhole.
- (10) Valves. Price for each size and type of valve with stem extension, adapter, and valve box shall include furnishing all materials, equipment, and labor to install and test each valve and valve box, and restore disturbed area to like or better conditions.
- (11) Special Design Manholes or Vaults. Lump sum price for special design manholes or vaults in accordance with Drawings and specifications, complete in place.
- (12) Abandonment of Existing Sewer lines. Price for abandonment of existing sewer lines shall include all labor, material, and equipment to cut the existing sewer lines, remove the cut portions of pipe, and plug the existing sewer line with concrete where designated by the drawings or where directed by the Engineer.

1.04 Coordination. Phases of the construction which involve the temporary interruption of essential services shall be scheduled in consultation with the Owner or Owner's representative and shall not be of longer duration than essential to accomplish the purpose of such interruptions. Liaison in this matter shall be required before beginning work.

1.05 Field Engineering. Reference points shall be provided on the Drawings from which the Contractor shall lay out the work. The Contractor shall stake out the alignment of the actual centerline using offset stakes. The Contractor shall protect and preserve all reference points and offset stakes and replace same at no additional cost if they are destroyed. All sanitary sewer stakeout work shall be done by a Surveyor licensed

to do business in the Commonwealth of Virginia. The cost of the Surveyor shall be distributed among the various bid items and will not be paid for separately.

1.06 Project Meetings.

1. Preconstruction Conference with the Contractor shall be held before beginning any work.
2. Monthly construction progress meeting shall be held at a time and place designated by the Owner.

1.07 Submittals.

1. Construction Schedules. Submit a detailed construction schedule prior to the Preconstruction Conference. Revise the schedule before each progress meeting.
2. Disbursement of Funds Schedule. At the Preconstruction Conference, submit a disbursement of funds schedule detailing the Contractor's anticipated monthly pay request amounts for the entire project time. Revise the schedule before each progress meeting.
3. At the Preconstruction Conference, submit the following, if required:
 - (1) A detailed written construction operations plan providing a description of how bypass pumping operations shall be performed.
 - (2) A plan for blasting operations.
 - (3) A plan for temporary stream crossings for access to construction areas.
 - (4) A copy of the detailed erosion and sedimentation control plan.
 - (5) A copy of the completed registration statement sent to DEQ and the Stormwater Pollution Prevention Plan that has been prepared in accordance with Virginia Pollutant Discharge Elimination System General Permit for control of stormwater discharges from construction activities.
 - (6) A Maintenance of Traffic (MOT) plan, approved by VDOT, showing how traffic will be managed in all streets affected by the project work.
 - (7) A schedule of values.
4. Shop Drawings or Product Data. Within 10 days of Notice to Proceed, provide a submittal schedule. A submittal shall be required for each item of material to be used for construction.
 - (1) Submit a minimum of four copies of all shop drawings or product data. Electronic submittal of shop drawings is permissible, but the shop drawings must have the Contractor's approval stamp on them, otherwise they will be returned without Owner or Engineer review.
 - (2) The Owner shall retain two copies. The Engineer shall retain one copy and the remaining copy will be returned to the Contractor. Should the Contractor need more than one paper copy of the approved shop drawings, the extra paper copies shall be submitted with the shop drawing package.
 - (3) All shop drawings shall be approved by the Contractor and any subcontractors prior to being submitted, certifying that the materials or item is provided in accordance with Contract Documents.

- (4) Failure to comply with these requirements will result in the submittal being returned unprocessed.
5. Material Schedule. Within 20 days after effective date of the agreement, submit for approval a schedule listing manufacturer of the items of equipment and materials proposed for the construction. Following approval of the schedule, no changes in material or equipment from those listed will be allowed except in unusual or extenuating circumstances. When such circumstances arise, the Contractor shall request, in writing, approval of the proposed change stating the circumstances necessitating such a change. The intent of this schedule is to name the manufacturers of material specified by a product standard and to designate which manufacturer will be used when more than one has been named for an item in the specifications. The schedule shall not be interpreted as allowing any change from base bid items or those substitute items offered with the bid and accepted by the Owner.
6. Contractor shall update Record Drawings and present them at each progress meeting for review and approval. Failure to maintain an up-to-date set of Record Drawings shall be grounds for withholding partial or complete payment of the Contractor's monthly pay request.

1.08 Construction Facilities and Temporary Controls.

1. Temporary Utilities.

- (1) Temporary Sanitary Facilities. Contractor shall provide and maintain in a neat and sanitary condition such accommodations for the use of his employees as will comply with laws and regulations.
- (2) Temporary Electricity and Water. The Contractor shall make all necessary arrangements for obtaining electric power and water for construction purposes. No separate payment for these items for construction purposes or testing will be made.

2. Pollution Control.

- (1) Dust Control. Ensure that dust is held to an absolute minimum during all portions of the work through the application of moisture and dust suppression agents as required.
- (2) The Contractor is responsible for managing construction practices in accordance with his approved erosion control and stormwater pollution prevention plans, and shall install and maintain all measures necessary to maintain compliance with applicable stormwater management and erosion control regulations.

3. Project Identification. One clear and legible project sign shall be provided on the Project by the Contractor as soon as work commences, and the work forces are mobilized. Project sign shall be approved by the Owner. The location of sign shall be as determined by the Owner. The sign shall contain the following information and meet the following requirements:

- (1) Dimensions shall not be less than 4 feet by 8 feet.
- (2) Lettering shall not be less than as shown on Standard Detail.
- (3) It shall list Contractor's name, Contractor's representative, emergency phone number, and local phone number.
- (4) It shall list the name of the Project and project number.

- (5) “Campbell County Utilities and Service Authority” and phone number.
- (6) The construction cost of the Project and funding source(s). Example: 50% Developer funding and 50% CCUSA funding.
- (7) It shall list Engineer's company.
- (8) The sign shall be constructed of a sturdy and durable material.
- (9) Sign or signs shall be placed in such a manner as to be clearly visible to the public.

The Contractor shall maintain this sign for the duration of the Contract and dispose of it after completion. The Contractor shall replace deteriorated signs as directed by the Owner. There shall be no separate payment for this item.

- 4. Field Offices and Sheds. Provide and maintain a weathertight, heated, and properly lighted temporary field office, if required by the Owner. Wood or kerosene stove shall not be used for heating. Field office shall provide 100 square feet for use by the inspector. The space shall be equipped with a 3-foot by 5-foot plan table, plan chair, a 15-inch wide four-drawer metal filing cabinet, a plan rack, one chair, and reasonable lighting furnished by the Contractor.

- 5. Traffic Control.

- (1) This work shall consist of maintenance and protection of pedestrian and vehicular traffic around all areas of construction. The Contractor shall submit a detailed Maintenance of Traffic (MOT) plan to VDOT for approval. This plan shall specifically address traffic control for all streets affected by the Project and must be approved prior to starting construction. All traffic control devices indicated on the layouts or deemed necessary are to be furnished by the Contractor. All traffic control devices provided by the Contractor shall conform to the MUTCD requirements such as warning lights, barricades, delineators, frames for signs, cones, poles, drums, flagmen, and project signs.
- (2) The Contractor shall erect, maintain, and remove all traffic control devices.
- (3) The Contractor shall furnish, install, and maintain amber warning lights at all locations necessary for the control and protection of vehicular traffic. Warning lights placed at or on warning signs shall be flashing lights. Warning lights used at locations of work area shall be steady-burn lights. Amber warning lights shall be battery powered lights conforming to the Institute of Transportation Engineers (ITE) Standard for Flashing and Steady-Burn Barricade Warning Lights.
- (4) The Contractor shall maintain local resident and business access on all streets during construction of all improvements on this Project.

- 1.09 Materials and Equipment.

- 1. Quality. Material and equipment incorporated into the work.

- (1) Conform to applicable specifications and standards.
- (2) Comply with size, make, type, and quality specified, or as specifically approved in writing by the Owner.

- (3) Manufactured and Fabricated Products
 - a. Design, fabricate, and assemble in accordance with the best engineering and shop practices.
 - b. Manufacture like parts of duplicate units to standard sizes and gages, to be interchangeable.
 - c. Two or more items of the same kind shall be identical, by the same manufacturer.
 - d. Products shall be suitable for service conditions.
 - e. Equipment capacities, sizes, and dimensions shown or specified shall be adhered to unless variations are specifically approved in writing.
- (4) Do not use material or equipment for any purpose other than that for which it is designed or is specified.
- (5) Except as specifically indicated or specified, materials and equipment removed from existing structures shall not be used in the completed work.
- (6) For material and equipment specifically indicated or specified to be reused in the work:
 - a. Use special care in removal, handling, storage, and reinstallation to assure proper function in the completed work.
 - b. Arrange for transportation, storage, and handling of products, which require off-site storage, restoration, or renovation. Pay all costs for such work.
- (7) Manufacturer's Instructions
 - a. Installation of work shall comply with manufacturer's printed instructions.
 - b. Maintain one set of complete instructions at the job site during installation and until completion.
 - c. Handle, install, connect, clean, condition, and adjust products in accordance with such instructions and in conformity with specified requirements.
 - d. Do not proceed with work without clear instructions.
 - e. Do not omit any preparatory step or installation procedure unless specifically modified or exempted by Contract Documents and the manufacturer.

2. Transportation and Handling.

- (1) Arrange deliveries of products in accordance with construction schedules. Coordinate to avoid conflict with work and conditions at the site.
 - a. Deliver products in undamaged condition, in manufacturer's original containers or packaging, with identifying labels intact and legible.

- b. Immediately on delivery, inspect shipments to assure compliance with requirements of Contract Documents and approved submittals, and that products are properly protected and undamaged.
 - (2) Provide equipment and personnel to handle products by methods to prevent soiling or damage to products or packaging.
- 3. Storage and Protection.
 - (1) Store products in accordance with manufacturer's instructions, with seals and labels intact and legible.
 - a. Store products subject to damage by the elements in weathertight enclosures.
 - b. Maintain temperature and humidity within the ranges required by manufacturer's instructions.
 - (2) Exterior Storage.
 - a. Store fabricated products above the ground, on blocking or skids; prevent soiling or staining; cover products which are subject to deterioration with impervious sheet coverings; and provide adequate ventilation to avoid condensation.
 - b. Store loose granular materials in a well-drained area on solid surfaces to prevent mixing with foreign matter.
 - (3) Arrange storage in a manner to provide easy access for inspection. Make periodic inspections of stored products to assure that products are maintained under specified conditions and free from damage or deterioration.
 - (4) Protection after Installation. Provide substantial coverings or barriers as necessary to protect installed products from damage from traffic and subsequent construction operations. Remove when no longer needed. Contractor is responsible for the condition of installed products until accepted by the Owner.
- 4. Project Substitutions.
 - (1) Substitutions. The Contractor may offer with his bid, substitute items of equipment and materials to those of specified manufacturers called for in Part B - Construction Materials, provided that, if approved:
 - a. No major changes in the construction or design intent of the Project would be required. Changes required to accommodate substituted items shall be made by the Contractor at no additional cost or time delay.
 - b. Features of quality, capacity, construction, performance, appearance, size, arrangement, and general utility including economy of operation of substitutes offered, either parallel or exceed those of specified products.
 - c. The provisions of Article 6.19 of the General Conditions and any other guarantees, if required by the specification sections, shall apply in full force and effect to the performance of such substitute products approved for incorporation into the work.

- (2) Technical data covering the proposed substitution shall be furnished with the bid when possible, and not later than 10 days after bid submission.
 - (3) If the substitute item is not approved in writing, the Contractor shall provide the item from a specified manufacturer.
- 1.10 The Contractor shall give his personal superintendence to the work and shall assign a specific project superintendent, experienced with utility work, to the Project. This superintendent shall be present on the work site at all times during progress, any absences shall be coordinated with the inspector and satisfactory coverage provided to ensure adequate superintendence of work. The project superintendent shall be fully competent and have full authority to act for the Contractor, and evidence of competency satisfactory to the Owner shall be provided.
- 1.11 The Contractor shall have posted in a conspicuous spot with his equipment and on the work site, signage, or stickers identifying the Contractor's equipment and listing an emergency 24-hour phone number.
- 1.12 The Contractor shall designate a responsible member of their organization at the site whose duty shall be the prevention of accidents.
- 1.13 Contract closeout shall include the following:
 1. Punch List. Correct all punch list items.
 2. Cleaning. Clean up all debris; remove stains, spots, marks, and dirt; remove paint spots and smears from all surfaces; and clean appurtenances.
 3. Project Record Documents.
 - (1) Provide one complete set of Drawings recording all changes to the work to indicate actual installation. The Contractor is to note changes in legible red letters at least 1/8 inch high. The Contractor will be responsible for accurately recording the lengths of installed pipe and vertical heights of cleanouts and manholes as they are installed. The Contractor shall note the structure number, lot address, and the distance to the nearest manhole on the Drawings for all sanitary services installed. For all new water services, the structure number, lot address, and the distance along the main line to the nearest main line valve shall be noted on the Drawings. This information will be reviewed at each progress meeting and will be used as a basis for pay requests. The end of project record survey by a Licensed Surveyor shall record the northing, easting, and rim elevation coordinates of all manholes and cleanouts, deflections to upstream manholes, and the invert elevations of all pipes in newly installed manholes. The Licensed Surveyor shall use this electronic information to calculate manhole-to-manhole lengths and slopes for all newly installed pipes. The Contractor's Record Drawing submittal shall include a digital and hardcopy printout of this record survey and calculated information in tabular format – including the Licensed Surveyor's feature code legend, a digital copy of the Licensed Surveyor's original record survey information in the latest edition of AutoCAD Civil 3D, and a final copy of the Contractor's redlined Drawings noting all as installed conditions.
 - (2) These records are a specific contract requirement, and final payment will not be made until the Record Drawings have been submitted in an acceptable form.
 4. Guarantees, Warranties, and Bonds. Submit all required guarantees, warranties, and bonds.
 5. List of Manufacturers and Suppliers. At the conclusion of the Project, the Contractor shall submit a complete list of subcontractors, manufacturers, and suppliers who participated in the construction or

who furnished materials or equipment. The address of each firm shall be included, together with types of materials or work performed.

6. Affidavit of Payment of Debts and Claims. Submit using AIA Document G706.
7. Affidavit of Release of Liens. Submit using AIA Document G706A.
8. Consent of Surety to Final Payment, if retainage is in escrow account.

SECTION C-2 - SITE PREPARATION

- 2.01 Description. This section applies to all work on this project.
- 2.02 Provide barricades, coverings, or other types of protection necessary to prevent damage to existing improvements not indicated to be removed, and improvements on adjoining properties.
1. Restore all improvements damaged by this work to their original condition, and acceptable to the Owner or other parties or authorities having jurisdiction, unless indicated otherwise. Damages caused by Contractor accident, negligence, error, carelessness, or which could have been reasonably avoided without undue impact to construction methods shall be repaired at Contractor expense.
- 2.03 Protect existing trees and other vegetation indicated to remain in place against cutting, breaking, or skinning of roots; skinning and bruising of bark; smothering of trees by stockpiling construction materials or excavated materials within drip line; excess foot or vehicular traffic; or parking of vehicles within drip line. Provide temporary fences, barricades, or guards as required to protect trees and vegetation to be left standing. Trees and vegetation which are wounded or stressed due to failure to adhere to the above standards of care shall be restored, removed, or replaced at Contractor expense at the direction of the Owner.
- 2.04 Store and use explosives in accordance with Federal, state, and local regulations. The Contractor shall be responsible for and shall satisfactorily correct all damage resulting from use of explosives.
- 2.05 Construction operations in public streets shall be confined to as small a space as is practicable and shall be subject at all times to the approval of the Owner and VDOT. Unless otherwise directed, the Contractor shall perform the proposed construction as follows:
1. Not over 300 feet of ditch shall be open at any one time, and not more than one intersection blocked. Not more than 15 feet of ditch shall remain open over night and then only when required to expose end of pipe that will be extended the next working day, and it shall be properly barricaded or equipment parked over it.
 2. If, in the opinion of the Owner, the material taken from the ditch is not suitable for backfilling, it shall be removed, and an acceptable material used for backfilling trenches.
 3. Calcium chloride shall be used to settle dust whenever necessary and required by the Owner.
 4. All loose material shall be swept from hard surface immediately behind the backfilling.
 5. Contractor shall maintain trenches for a period of 12 months from the completion of work.
 6. All walks, driveways, and lawns shall be maintained and restored to their original condition by the applicant and maintained for a period of 12 months from the completion of work.
- 2.06 Land Disturbing and Construction Limits Criteria for Sewer and Water Line Construction.
1. General Requirements Applying to All Areas.
 - (1) Contractor shall plan construction to minimize disturbance to properties adjacent to the sewer and water lines. Contractor shall flag the proposed limits of construction and mark all trees proposed to be cut for review and approval by the Owner prior to any clearing being performed. The Contractor shall use appropriately sized equipment for utility installation, to limit impacts to minimum necessary for utility installation.

- (2) The Owner reserves the right to limit the width of land to be disturbed and to designate on the Drawings or in the field certain areas or items within this width to be protected from damage.
- (3) The Contractor shall be responsible for damages to area or items designated to be protected. Repairs to, replacement of, or reparations for areas or items damaged shall be made to the satisfaction of the Owner before acceptance of the completed project.
- (4) In developed areas, brush, laps, roots, and stumps from trees shall be removed from the site. In undeveloped areas, the Contractor will be allowed to leave stumps undisturbed provided the tree is cut within 6 inches of the finish grade, stumps shall be removed when they are located within drainage swales.
- (5) All buildings or structures located along the line shall be protected by the Contractor. Hand trenching, shoring, or other methods may be required.
- (6) Any fences disturbed by the Contractor shall be repaired with new materials to a condition equal to or better than their original condition or to the satisfaction of the Owner.
- (7) Contractor shall limit width of disturbed area through garden and lawn areas to a width absolutely necessary for construction. Prior to construction, topsoil and turf shall be stripped from areas of garden or lawn to be disturbed by Contractor for a depth of 6 inches and stockpiled near garden. After backfilling pipe, topsoil shall be loosely spread over all disturbed areas to a depth of at least 6 inches, and turf reinstated.
- (8) Contractor shall obtain written permission from property owners for use of any access roads other than ones located within rights-of-way. Written permission shall contain conditions for use and restoration agreements between property owner and Contractor. The Contractor is responsible for obtaining and complying with all relevant local, state, and Federal permits associated with work on private property.
- (9) All areas disturbed shall be restored to a condition equal to or better than their original condition and shall be graded to drain.
- (10) The Contractor shall replace or repair all damaged or destroyed hedge rows or property corners. Property corners removed during construction shall be replaced by a Surveyor licensed to practice in Virginia.

2. Specific Requirements Applying to Developed Subdivisions and Lots.

- (1) All trees located beyond 7.5 feet of the centerline shall be protected by the Contractor unless the Contractor obtains written authorization from the Owner to remove them. The Owner reserves the right to designate other trees located closer to the centerline for protection where possible.
- (2) All shrubs, hedges, or other ornamental plantings located along the line shall be protected or moved and replanted by the Contractor.
- (3) Wells or springs located within 50 feet and septic systems within 10 feet of the centerline shall be protected by the Contractor.
- (4) Contractor shall grub only brush, roots, and stumps of removed trees. Damage to lawns shall be kept to an absolute minimum necessary for construction.

- (5) Excavated or blasted rock shall be removed from the site unless otherwise ordered by the Owner.
- (6) Restoration and fine grading shall follow within 1 week from the time an area is disturbed or within 500 feet from the immediate work site, whichever occurs first. Seeding shall follow as ordered by the Owner.

3. Specific Requirements Applying to Undeveloped Areas.

- (1) All trees 12 inches in diameter or larger located beyond 7.5 feet of the centerline shall be protected unless Contractor obtains written authorization from Owner to remove them. Owner reserves the right to designate select trees located closer to centerline for protection where possible.
- (2) In areas where animals are kept, Contractor shall notify property owner prior to commencing work and keep Owner advised of progress of work. Fences shall be kept secure at all times and animals protected from open ditches, machinery, blasting, and other hazards.
- (3) All areas shall be grubbed and cleared of stumps and roots.
- (4) Restoration and fine grading shall follow within 1 week from the time an area is disturbed or within 1,000 feet from the immediate work site, whichever occurs first. Seeding shall follow as ordered by the Owner.
- (5) When working in wooded areas, the Contractor may construct small brush piles for birds and wildlife instead of hauling off or mulching the brush. The brush piles shall not contain stumps, large limbs, rocks, brick, block, dirt, broken pavement, broken concrete, paper, yard waste, or scrap metal. The brush pile shall be constructed only on Authority owned easements, right-of-ways, or with specific written land owner permission.

4. Construction Limits.

- (1) Contractor shall not disturb any areas outside the following limits specified in this section without express written permission from the Owner.
- (2) No "clear cutting" of timber shall be permitted within the construction limits. Contractor shall make select cutting of trees, taking smallest trees first, that are mandatory for the construction of the utility line. Owner's decision shall be final on determination of which trees are to be cut.
- (3) The following widths measured from the centerline of the sewer and water lines shall be considered the maximum allowable working area and be referred to as "construction limit."

Pipe Size	Distance from C/L	Total Allowable Width
12-inch or smaller	15 feet	30 feet
15-inch to 18-inch	20 feet	40 feet
24-inch and up	25 feet	50 feet

All areas outside these construction limits shall be protected by the Contractor unless written variations are granted by the Owner.

2.07 Demolition.

1. Manholes to be abandoned shall have the frames and covers removed and the top masonry removed 2 feet below surrounding grade. The remaining portion of the manholes shall be cleared of organic material, all pipes plugged with Portland cement grout, the bottom broken to permit drainage, and backfilled with VDOT No. 57 stone. The frame and covers from all existing manholes to be abandoned or removed shall be salvaged.
 2. All abandoned valve boxes shall be removed to 6 inches below the surface and backfilled with like surface material. When abandoning existing lines, the line shall be abandoned at its source and all water control devices closed and a 1-foot segment of the line shall be removed at the water control device.
 3. Remove pipe at locations shown on the Drawings or where necessary for construction of the new line. Plug pipes at each end and at manholes. Salvaged pipe shall be transported as directed by the Owner. All unsalvageable pipe shall become property of the Contractor and shall be promptly removed from the site. The Contractor shall be responsible for off loading salvaged pipe and scheduling delivery 24 hours in advance.
- 2.08 Clean up debris resulting from site clearing operations continuously with the progress of the work.
- 2.09 Remove promptly all salvageable material that becomes property of the Contractor and is not to be reused in construction. Sale of material on the site is prohibited.
- 2.10 All waste material and debris from the project shall be taken to the Region 2000 Service Authority landfill or other landfill approved by the County. The material shall be broken or cut into pieces which can be easily compacted by the landfill equipment. The Contractor shall be responsible for all tipping fees assessed at any landfill.
- 2.11 Remove debris from site in such a manner as to prevent spillage. Keep pavement and area adjacent to site clean and free from mud, dirt, and debris at all times.

SECTION C-3 - TRENCHING AND BACKFILLING

- 3.01 Description. This section specifies all trenching and backfilling work on the Project.
- 3.02 Storage and use of explosives shall be in accordance with this project manual and the National Fire Protection Association's NFPA 495, Explosive Materials Code, Latest Edition, and the requirements of the storage and use permit issued to the Contractor by the Fire Marshall. In the event of a discrepancy, the more stringent requirements govern.
- 3.03 Compaction Tests. In the course of backfilling trenches for utility installations, constructing embankments for roadways, and placing aggregate base, the Contractor shall perform and include in his bid the cost of "field density determinations" or compaction tests every 1,000 feet of pipeline or a minimum of one per project. The Owner has the right to call for additional tests and will pay for the additional tests. Compaction tests will be called for by the Owner, the location of the tests will be determined by the Owner, and the Contractor shall cooperate fully. Field density determinations shall be performed in accordance with AASHTO T191, T205, or T214, modified to include material sizes used in the laboratory determination of density; with nuclear field density testing device; or by other approved methods. When the nuclear field density testing device is used, density determinations for the material will be related to the density of the same material tested in accordance with VTM-1, VTM-10, or VTM-12 and a control strip will not be required. When the test results indicate that the density is less than the percent specified, the Contractor shall excavate and re-compact the areas which have failed at no expense to the Owner. Whenever a test fails to meet the required density, the Contractor shall pay for retesting the areas after corrective action has been taken.
- 3.04 Underground Utilities.
1. The location of all underground utilities shown on the Drawings are approximate and the Contractor shall be responsible for their exact location. Excavation to confirm elevations of existing sanitary lines may be required prior to laying new sanitary sewers to confirm depths of existing sewer lines, particularly on dead end line segments where terminal elevations are unknown.
 2. Locate existing utilities, culverts, and structures, above or below ground, before any excavation starts. Coordinate work with utility companies. Protect, maintain in service, and prevent damage to utilities not designated to be removed. When utilities are encountered and are not shown on Drawings or when locations differ from those shown on Drawings, notify the Owner for instructions before proceeding. The Contractor shall repair at his own expense any damage to existing utilities, including service connections.
- 3.05 All excavation shall be unclassified regardless of the material encountered.
- 3.06 Unauthorized excavation consists of removal of materials beyond indicated subgrade elevations or side dimensions, without specific approval of the Owner. Unauthorized excavation shall be replaced at Contractor's expense.
- 3.07 Where unauthorized excavations have been carried beyond points required, restore these areas to the elevations and dimensions shown on the Drawings with material approved by the Owner. Compact and restore as specified at Contractor's expense.
- 3.08 Where soft, yielding, or otherwise unsatisfactory material is encountered in the trench bottom, the Contractor shall remove the material to such depth as determined by the Owner and replace with #57 or #68 coarse aggregate fill. Removal of unsatisfactory material from the trench bottom and replacement with aggregate fill will be paid as aggregate fill material.
- 3.09 Where removal of unsatisfactory material is due to fault or negligence of the Contractor, by inadequate shoring or bracing, dewatering, material storage, or other failure to meet specified requirements, work shall be performed at no additional cost to the Owner.

3.10 Excavation.

1. Crusher run aggregate, or asphalt millings shall be spread on pavement before stockpiling excavated material on the pavement. The crusher run aggregate shall be considered incidental to the installation of the various utilities, sidewalks, curb and gutter, driveway entrances, etc., and will not be measured for separate payment.
2. Excavate trenches below bottom of pipe for pipe bedding fill for plastic pipe or where trench bottom is rock in accordance with Standard Details.
3. Pavement, curb, gutter, and sidewalk material excavated along the trench shall not be used as backfill material.
4. Rock that has been removed from the trench by blasting or with rock excavation equipment shall not be used as backfill material unless it is less than 5 inches in diameter. Rock that is not suitable for backfill shall be replaced with earth fill.
5. Keep excavations free of water while work is being performed.
6. Where underground streams or springs are found, provide temporary drainage and notify the Owner.
7. Remove from project site and dispose of material unsatisfactory for reuse, including all trash and excess material which cannot be reused continuously with the progress of the work. Keep all pavements and area adjacent to work clean and free from mud, dirt, and debris at all times.
8. Remove shoring and all form materials.
9. Where rock is encountered so that a manhole, vault, or other structure will bear on rock, it shall be used to support the foundation. Where only a part of the foundation will bear on rock, at least 8 inches of compacted aggregate fill shall be provided below bottom of footings.

3.11 Pipe Bedding.

1. Bedding for pipe shall be coarse aggregate fill, #57 or #68 stone.
2. Place required 6-inches of pipe bedding where trench bottom is rock. Bedding to be placed to crown of all plastic piping in accordance with Standard Details.
3. Compact pipe bedding by tamping or rodding to prevent settlement.
4. Excavate bell holes in the bedding to insure that the pipe barrel is fully supported by the bedding.

3.12 Compaction.

1. Compact each layer of fill or backfill to not less than the following percentages of the maximum density at optimum moisture content as determined by ASTM D 698 (AASHTO T-99).
 - (1) 100 percent, within 5 percent of optimum moisture content, beneath and within 25 feet of buildings structures, and drainage appurtenances, including those shown for future construction and for top 6 inches within VDOT right of way.
 - (2) 95 percent beneath pavements, walks, and road shoulders, including those shown for future construction and between ditch to ditch and sidewalk to sidewalk in VDOT right of way

- (3) 90 percent in other areas
2. Compact soil materials using equipment suitable for materials to be compacted and work area locations. Use power-driven hand tampers for compacting materials adjacent to structures. Trench backfill shall be compacted in lifts to achieve uniform density. Compacted lifts shall not exceed 6 inches in height under pavement and structures. Moisture content shall be monitored during construction to ensure maintenance of optimum moisture levels.

3.13 Backfill.

1. Obtain the particular backfill material required from excavation stockpiles, borrow areas, or other approved sources.
2. Backfill trench to a compacted depth of 1 foot over the pipe with clean earth fill. Backfill shall be placed by hand uniformly on each side of the pipe and compacted in layers not exceeding 6 inches. Do not backfill on muddy or frozen soil, or with muddy or frozen soil.
3. Backfill trench from 1 foot above the pipe to grade with earth fill free of stones or other material larger than 5 inches or 1/2 the layer thickness in any dimension, whichever is smaller. Layers shall not exceed 12 inches, except that under road shoulders and under existing or future paved areas and structures, layers shall not exceed 8 inches. Backfill shall be compacted to the density specified for the areas in which it is located except that minimum compaction in any area shall be to the density of the adjacent soil.
4. Excavate depressions caused by removal of stumps or other clearing operations to firm subgrade, fill with clean earth fill, and compact as specified.
5. Place backfill materials evenly adjacent to structures. Take care to prevent wedging action of the backfill against structures by carrying the material uniformly around the structure to approximately the same elevation in each lift.
6. Compact each layer of backfill to the required density.
7. Replace topsoil and/or provide new topsoil to at least 6 inches or the original depth whichever is greater in areas to be seeded.
8. Aggregate fill placed under manholes or other structures shall be compacted with two passes of vibratory plate or vibratory roller.

3.14 Grading.

1. Uniformly grade all areas within the limits designated on the Drawings, including adjacent transition areas. Finish surfaces within specified tolerances with uniform levels or slopes between points where elevations are shown and existing grades.
2. Finish all surfaces free from irregular changes, rocks, or debris.
3. Finish subgrade areas to receive topsoil to within 0.1 foot of required subgrade elevations.
4. Shape subgrade under walks to line, grade, and cross-section to within 0.10 foot of required subgrade elevations.
5. Shape subgrade under pavement to line, grade, and cross-section to within 1/2-inch of required subgrade elevations.

6. Protect newly graded areas from traffic and erosion. Repair and reestablish grade in settled, eroded, or rutted areas to the specified tolerances.
7. Where compacted areas are disturbed by subsequent construction or adverse weather, scarify the surface, reshape, and compact to the required density. Use hand tamper for recompaction over underground utilities.

3.15 Utilities to be Abandoned or Removed.

1. When underground utilities are to be abandoned in place, plug, cap, or seal with concrete at the "construction limits" or at points shown.
2. Remove underground utilities indicated on the Drawings to be removed, and backfill resulting excavation with suitable material compacted as specified. Plug, cap, or seal utilities with concrete at the construction limits or at points shown.
3. The cost of removing existing manholes and pipe to allow the installation of new sanitary sewer shall be included in the Contractor's unit prices for sanitary sewer pipe.

3.16 Erosion Control.

1. No more than 300 feet of trench shall be open at any one time.
2. No disturbed area shall be denuded for more than 7 calendar days.
3. Permanent or temporary soil stabilization shall be applied to denuded areas within 7 days after final grade is reached on any portion of the line. Soil stabilization shall also be applied within 7 days to denuded areas which may not be at final grade but will remain dormant (undisturbed) for longer than 15 days. Soil stabilization practices include vegetative establishment, mulching, and early application of gravel base on areas to be paved.
4. Comply with all local requirements and with the Virginia Erosion and Sediment Control Regulations as administered by the Virginia Soil and Water Conservation Board to control erosion and sedimentation.
5. Install silt fences around soil stockpiles and excavations.
6. All applicable erosion and siltation control measures shall be taken prior to grading.
7. Protect and maintain storm sewer inlets with inlet protection devices.
8. Inspect all erosion and sediment control devices at the close of each work day and after each rainstorm. Make necessary repairs or clean up immediately to maintain the effectiveness of the device.
9. Where consistent with job safety requirements, easement conditions, and construction methods, place all excavated material on the uphill side of the trench. When the soil is placed on the downhill side of the trench, divert maximum drainage toward the trench.
10. Water discharged from dewatering activities shall not be discharged directly to any stream or water body. Comply with state minimum standard and Specification 3.26, Dewatering Structure, of the Virginia Erosion and Sediment Control Handbook, 1992 Edition. When working adjacent to or within a water body, comply with state minimum standard and Specification 3.27, Turbidity Curtain, of the Virginia Erosion and Sediment Control Handbook, 1992 Edition.

11. Comply with practices outlined in the project Stormwater Pollution Prevention Plan prepared in accordance with VPDES permit requirements.
 12. The Contractor must have a person on-site while working in VDOT right of ways that possesses the Virginia Department of Conservation and Recreation's E & S Contractor's Certifications.
- 3.17 Riprap shall be installed in accordance with Section 414 "Riprap" of the VDOT Road and Bridge Specifications. Geotextile fabric shall be placed under all riprap.
- 3.18 Protect graded areas from the action of the elements. Settlement or other damage that occurs prior to acceptance of the work shall be repaired and grades satisfactorily reestablished.
- 3.19 Repair after Cleanup. Upon completion of construction work and after spoils and debris have been removed, regrade any areas disturbed by the operations. Remove all temporary erosion controls upon final stabilization as directed by the Owner.
- 3.20 Blasting.
1. The Contractor shall provide a blast warning signal system. The blast warning signal system shall consist of one or more air horns located at the blast site. The air horn(s) shall be audible a minimum of 1 mile from the blast site. The signals shall be one long horn 5 minutes prior to the blast, one short horn 1 minute prior to the blast, and one long horn after the blast to signal all clear. The Contractor shall erect two clear and legible blast warning signal signs at locations determined by the Owner. The signs shall list the blast warning signal system, the Contractor superintendent's name and telephone number, and the Owner inspector's name and telephone number.
 2. The Contractor shall establish test pits at up to two representative locations along utility alignments and up to three locations adjacent to railroad right-of-ways to determine if the rock is "ripable" with a Caterpillar 225 Excavator or equivalent and the feasibility of rock excavation by "hoe ramming." if these procedures do not offer reasonable production for rock excavation, then blasting will be allowed unless otherwise indicated. Reasonable production for rock excavation by "hoe ramming" will be defined as 5 or more cubic yards per hour.
 3. The blasting shall be performed by a qualified Contractor. Qualifications, proposed procedures, and schedule shall be submitted for approval at least 2 weeks prior to commencing any blasting operations.
 4. The Contractor shall notify in writing all property owners within 250 feet of the proposed blast at least 1 week prior to the proposed blast and verbally on the day of the scheduled blast.
 5. Blasting shall be limited to mid-morning hours on days of clear-to-partly cloudy skies with increasing surface temperature and light wind. Blasting will not be allowed after 3:30 p.m. Blasting will not be allowed on overcast, low ceiling days. The Contractor shall provide monitoring equipment to monitor all blasting. A copy of the monitor record shall be given to the Owner daily.
 6. The use of unconfined explosives shall be prohibited.
 7. The maximum allowable peak particle velocity shall be 1.25 inches per second for all structures located 0 to 300 feet from the blasting site, the maximum allowable peak particle velocity shall be 1.00 inch per second for all structures located 301 to 5,000 feet from the blasting site. The maximum allowable peak particle velocity shall be 0.75 inch per second for all structures located 5,001 feet and beyond from the blasting site.
 8. To minimize vibration, minimum scaled distance (SD) of 50 shall be used to determine maximum explosive weight per delay. A test blast shall be conducted to verify the scaled distance. The maximum explosive weight per delay shall not exceed the distance from the blast to the nearest

structure divided by 50 squared. Maximum explosive weight per delay may be revised pending outcome of test blast. Test blast monitoring shall be at the expense of the Owner. The recommendations indicated for blasting criteria in no way relieves the Contractor of his liability.

9. The peak overpressure or air blast shall not exceed the maximum limits specified in the following table:

Airblast Limits

Lower Frequency of Measuring System (HZ (plus or minus 3 DCB))		Measurement Level (DCB)
0.1 HZ or lower	Flat response	134 peak
2 HZ or lower	Flat response	133 peak
6 HZ or lower	Flat response	129 peak
C-weighted	Slow response	105 peak

10. Pre-blast meetings may be scheduled by the Owner to document hole depths and spacing, charge weight per delay, shot scheduling, and weather conditions. The Contractor shall obtain accurate measured distances from structures to center of blast area prior to determining the safe maximum charge-weight per delay and loading blast holes.
11. Pre-blast and post blast surveys will be performed by the Contractor. The written permission shall be submitted to the Owner prior to entering upon private property. The pre-blast and post blast surveys will include all occupied buildings within 250 feet of blasting areas. The pre-blast and post blast surveys performed by the Owner in no way relieve the Contractor of his liability.
12. The Owner reserves the right to monitor production blasting. In this event, the Contractor shall provide the Owner ample notice of scheduled blasts to allow set-up of monitoring equipment.
13. Prior to blasting operations, the Contractor shall lease for the Owner one seismograph and accessories. The seismograph shall be "Minimate Plus Base Unit" as manufactured by Instantel or an approved equal. The seismograph shall have 300-event capacity and four channels, internal triaxial sensor, installation spikes, linear microphone with stand, Blastmate III to PC connecting cable, operator manual, Blastware III compliance module and operator manual, and AC adaptor. Accessories shall be one fastening plate for precise leveling requirements including ceiling and wall installations; one standard transducer leveling plate with leveling feet and integrated spirit level which can be used with floor, wall, and ceiling installations; one external 12-volt DC battery power supply cable; and one 110-volt AC adaptor. The seismograph and accessories lease will not be paid as a bid item. The Contractor shall have the seismograph calibrated quarterly. Another seismograph shall be provided during the calibration process. The seismograph is in addition to Contractor's monitoring requirements stated above.

SECTION C-5 - WASTEWATER SYSTEM

- 5.01 Description. This section specifies all sanitary sewer work on this project.
- 5.02 Separation of Water Lines and Sanitary Sewers.
- A. Follow Virginia Department of Health standards for the separation of sanitary sewer and water distribution systems.
- B. Parallel Installation.
- (1) Normal Conditions. Sewer lines and manholes shall be constructed at least 10 feet horizontally from a water line whenever possible. The distance shall be measured edge-to-edge.
- (2) Unusual Conditions. When local conditions prevent a horizontal separation of at least 10 feet, then maximum horizontal separation shall be provided with vertical separation of bottom of water line at least 18 inches above top of sewer. Where this vertical separation cannot be obtained, the sewer shall be constructed of AWWA approved water pipe pressure-tested in place to 50 PSI without leakage prior to backfilling. The sewer manhole shall be of watertight construction and tested in place.
- C. Crossing.
- (1) Normal Conditions. Sewers crossing under water lines shall be laid to provide a separation of at least 18 inches between the bottom of the water line and the top of the sewer whenever possible.
- (2) Unusual Conditions. When local conditions prevent a vertical separation described in "Crossing, Normal Conditions," paragraph above, the following construction shall be used.
- a. Sewers passing over or under water lines shall be constructed of cast or ductile iron pipe with mechanical joints as described in "Parallel Installation, Unusual Conditions" paragraph above.
- b. Sewers passing over water lines shall be laid to provide:
- (1) Vertical separation of at least 18 inches between bottom of sewer and top of water line,
- (2) Adequate structural support for the sewers to prevent excessive deflection of the joints and settling on and breaking water line,
- (3) Maximum separation of water and sewer line joints.
- (4) Sanitary sewers or sewer manholes - no water pipes shall pass through or come in contact with any part of a sewer or sewer manhole.
- 5.03 Take all precautions necessary to insure that pipe, fittings, and related items are not damaged in unloading, handling, and placing in trench. Examine each piece of material just prior to installation to determine that no damage has occurred. Remove any damaged material from the site and replace with undamaged material.

1. Keep pipe clean. Exercise care to keep foreign material and dirt from entering pipe during storage, handling, and placing in trench. Close ends of in-place pipe at the end of any work period to prevent entry of animals and foreign material.
 2. Bed pipe as specified in Section 3 - Trenching and Backfilling.
 3. Do not lay pipe when weather or trench conditions are unsuitable.
- 5.04 Lay gravity sewers so as to maintain a true alignment and grade as indicated on Drawings. After completion, the pipe shall exhibit a full circle of light when lighted at one manhole and viewed from the next.
1. Commence laying gravity sewers at the lowest point on a section of line and lay pipe with the bell ends uphill. The Contractor shall verify depths of existing sewer, and locations of lateral ties as called for on project plans prior to initiating pipe laying operations to ensure adequate fall for all newly installed sewers.
 2. Pipe Joint. Prior to making pipe joints on gravity sewer lines, clean and dry all surfaces of joint pipe and jointing material. Use lubricants, primers, adhesives, and similar materials as recommended by the manufacturers. Place, fit, join, and adjust the jointing materials or factory fabricated joints as recommended by the manufacturer to obtain the degree of watertightness required. As soon as possible after the joint is made, place sufficient backfill material, as specified under Section 3 - Trenching and Backfilling, along each side of the pipe to resist forces that might tend to move the pipe off line and grade.
 3. Backfill as specified under Section 3 - Trenching and Backfilling. Place backfill over the pipe immediately after the pipe has been laid.
- 5.05 Lay pressure piping with bell ends facing the direction of laying. Where the grade is greater than 10 percent, pipe shall be laid with bell ends upgrade.
- 5.06 Join mechanical joint pipe as follows:
1. Thoroughly clean inside of the bell and 8 inches of the outside of the spigot end of the joining pipe to remove oil, grit, excess coating, and other foreign matter from the joint. Apply gasket lubricant. Slip cast-iron gland on spigot end with lip extension of gland toward end of pipe.
 2. Push the spigot end forward to seat in the bell. Then carefully press the gasket into the bell so that it is located evenly around the joint. Move the gland into position, insert bolts, and screw nuts up finger tight. Then tighten all nuts to torque listed below.

<u>Bolts Size - Inches</u>	<u>Torque Feet - Pounds</u>
5/8	40 - 60
3/4	60 - 90
1	70 - 100
1-1/4	90 - 120

3. Tighten nuts on alternate sides of the gland until pressure on the gland is equally distributed.
4. Join lock-type mechanical joint pipe according to manufacturer's recommendations.
5. Permissible deflection in mechanical joint pipe shall not be greater than listed in AWWA C600.
6. Permissible deflection in lock-type mechanical joint pipe shall be as recommended by manufacturer.

- 5.07 Join ductile iron push-on joint pipe as follows:
1. Thoroughly clean inside of the bell and 8 inches of the outside of the spigot end of the joining pipe to remove oil, grit, excess coating, and other foreign matter. Flex rubber gasket and insert in the gasket recess of the bell socket. Apply a thin film of gasket lubricant supplied by pipe manufacturer to either the gasket or the spigot end of the joining pipe.
 2. Start spigot end of pipe into socket with care. The joint shall then be completed by forcing the plain end to the bottom of the socket with a forked tool or jack type device. Field cut pipe shall have the end filed to match the manufactured spigot end.
 3. Join restrained push-on joints according to manufacturer's recommendations.
 4. Permissible deflection in push-on joint pipe shall not be greater than listed in AWWA C600.
 5. Permissible deflection in restrained push-on joint pipe shall be as recommended by manufacturer.
- 5.08 Join polyvinylchloride (PVC) pipe as recommended by the manufacturer using rubber ring gaskets in bell joints or solvent weld as applicable.
1. Install PVC gravity sewer pipe and fittings in accordance with ASTM D 2321 "Underground Installation of Flexible Thermoplastic Sewer Pipe" and in accordance with the manufacturer's recommendation. Refer to Standard Detail in these specifications for bedding and backfill information.
 2. Store PVC gravity sewer pipe in accordance with the manufacturer's recommendations on flat even surfaces and maintain racked on the pallets as delivered to the job site until such time as the trench is ready for placement of the pipe; i.e., PVC pipe shall not be strung out on the job site. Any pipe damaged as a result of improper storage shall not be installed.
- 5.09 Join pipe of different materials using approved adaptor coupling.
- 5.10 Construct manhole channel with smooth semicircular bottoms matching inside diameters of the connecting sewers. Change directions of flow with a smooth curve of as large a radius as the manhole size will permit. Change size and grade of channels gradually and evenly. Manhole benches shall be smooth and shall have slope between 2 and 4 inches per foot toward the channels.
- 5.11 Install marking tape and tracer wire according to Standard Details.
- 5.12 For sanitary sewer force mains, install sewer line location marker posts every 500 feet, at changes in direction, and at appurtenances along sewer force main. Install marker post as recommended by the manufacturer.
- 5.13 Setting of Valves and Valve Boxes:
1. Install valves with operator stems in the vertical plane through the pipe axis and perpendicular to the pipe axis. Locate valves where shown on Drawings. Thoroughly clean before installation. Check valves for satisfactory operation.
 2. Equip all underground valve operators with valve box adaptors and valve boxes. Set box in alignment with valve stem centered on valve nut. Set the valve box to prevent transmitting shock or stress to the valve. Set the box cover flush with the finished ground surface or pavement.
 3. All valve boxes and manhole frames and covers located between edge of pavement and ditch line shall be installed approximately 1 inch below the finished grade. When located in the pavement, they shall

be placed flush with the pavement surface unless otherwise directed by the Owner or noted on the plans.

- 5.14 Install combination air release/vacuum valve assembly at locations indicated on the Drawings and at all high points on the sanitary sewer force main. Installation shall be in accordance with the Standard Details.
- 5.15 Encase gravity sewers and sanitary sewer force mains crossing under highways and railroads in a larger pipe or conduit called a casing pipe. The casing pipe shall be of the diameter and wall thickness indicated on the Drawings. Joining of steel casing pipe shall meet requirements of AWWA C206 "Standard for Field Welding of Steel Water Pipe Joints." Install casing pipe by jacking or boring.
1. Installation under highways shall meet requirements of VDOT Road and Bridge Specifications and the VDOT Land Use Permit. Seal up casing pipe ends to protect against foreign matter. Prior to beginning work, notify VDOT. Installation under railroads shall be in accordance with AREMA and the utility crossing railroad permit. Prior to beginning work, notify the railroad.
 2. The Contractor shall determine for himself the existing conditions both above and below ground prior to installation. The Contractor shall be responsible for installing the casing pipe and the carrier pipe to the required lines and grades.
 3. The carrier pipe shall be centered within the casing pipe by the use of casing spacers. Placement intervals for casing spacers shall be as indicated on the Standard Detail or based on manufacturer's recommendation, whichever is more stringent.
 4. The seals at each end of the casing pipe shall be preformed flexible rubber seals with stainless steel bands.
- 5.16 Force main and pressure pipe tests shall be as follows:
1. Supply the pumps, water, calibrated gages and meters, and all the necessary apparatus. Notify the Owner at least 48 hours in advance of the test date and perform tests in the presence of the Owner.
 2. Hydrostatic Pressure Test: After the line has been backfilled, a hydrostatic pressure test shall be performed. Carefully fill the system with water at a velocity of approximately 1 foot per second while necessary measures are taken to eliminate all air. After the system has been filled, raise the pressure by pump to 150 PSIG or 1.5 times the working pressure, whichever is greater. Measure pressure at lowest point in system with gage compensated for elevation. Maintain this pressure for at least 2 hours. If pressure cannot be maintained, determine the cause, repair, and repeat the test until successful.
 3. A leakage test shall be conducted concurrent with the pressure test. Use calibrated meter to determine leakage. Leakage shall be defined as the quantity of water that must be supplied into the pipe to maintain working pressure, after all air in the pipe line has been expelled and the pipe has been filled with water. Leakage shall not exceed the quantity determined by the formula given below. If leakage exceeds that determined by formula, find and repair the leaks and repeat the test until successful. The formula is as follows:
 - (1) $L \text{ equals } SD \text{ (square root of } P)/148,000$

(2) Where:

- L equals allowable leakage in gallons/hour
- S equals length of pipeline tested in feet
- D equals nominal diameter of the pipe in inches
- P equals average test pressure during leakage test in PSIG

4. All visible leaks shall be repaired.
5. Contractor shall provide temporary air bleed off fittings.

5.17 Testing Gravity Sewer Lines and Manholes.

1. Manhole testing shall be done by vacuum testing. The test shall be made using an inflatable compression band, vacuum pump, and appurtenances specifically designed for vacuum testing manholes. Test procedures shall be in accordance with ASTM C 1244 except the more restrictive requirement in (3) as indicated below.
 - (1) Manhole acceptance shall be based upon a test after the manhole is backfilled and the cover frame castings are set in place. Test shall include assessment of frame seal to manhole riser.
 - (2) All lift holes shall be plugged with nonshrink grout and all pipes shall be plugged, taking care to securely brace the plugs and pipe. Plugs shall be tied to an immobile object.
 - (3) After the testing equipment is in place, a vacuum of 10 inches of HG shall be drawn on the manhole. The manhole will be considered to have passed the test if the vacuum does not drop more than 1 inch of HG within the times shown in Table I.
 - (4) If the manhole fails the initial test, the Contractor shall locate the leakage and make proper repairs, and retest until a satisfactory test result is obtained.
 - (5) After the manholes have been backfilled and the cover frame casting sealed in place, and prior to final acceptance of the project, any signs of leaks or weeping visible from the inside of the manhole shall be repaired and the manhole shall be retested.

Table I Vacuum Test for Manholes Based on ASTM C 1244					
Minimum times for various manhole diameters for pressure drop from 10 inches to 9 inches HG					
Manhole Diameter, Inches					
Depth (ft)	48	54	60	66	72
Time (seconds)					
6	15				
8	20	23	26	29	33
10	25	29	33	36	41
12	30	35	39	43	49
14	35	41	46	51	57
16	40	46	52	58	67
18	45	52	59	65	73
20	50	53	65	72	81

2. Test for leakage of installed gravity sewers by low pressure air test, exfiltration, or infiltration test as approved and to the satisfaction of the Owner. Tests shall be conducted on short sections of sewer line; i.e., between manholes. The Contractor shall provide all labor, material, tools, and equipment

necessary to make the tests. Equipment and methods used shall be acceptable to the Owner. Monitoring gages shall be subject to calibration if deemed necessary by the Owner. Sewer lines, regardless of size, that cross under streams shall be tested for and exhibit zero infiltration. If any part of the sewer line fails the leakage test, the problem shall be corrected by the Contractor.

Before final acceptance, all gravity sewers shall be televised and recorded at a velocity of no more than 6" per second at a minimum resolution of 480 x 640 pixels. Lateral connections shall be televised at a full stop position and at a 90 degree angle from the gravity sewer. The Contractor shall provide the Owner with the video inspection media for review. Televised inspection recordings shall include verbal audible narrative or textual description of beginning and ending manhole locations. The Contractor shall provide all labor, material, tools, and equipment necessary to make the inspection record.

3. Low pressure air tests may only be used on pipe diameters 12 inches or less and shall comply with ASTM F 1417.
 - (1) If the pipe to be tested is submerged in groundwater, the test pressure shall be increased 1.0 PSI for every 2.31 feet the groundwater level is above the invert of the sewer. To determine groundwater level, the Contractor shall install a 4-inch PVC pipe on the outside of the manhole from the base of the manhole to above ground level. The bottom of this pipe shall be placed in a minimum of 18 inches of pipe bedding material to allow groundwater to enter the bottom of the pipe. Immediately prior to the line test, the groundwater elevation shall be determined by measuring down to the surface of the water in the PVC pipe from ground level. The PVC pipe shall be cut off below grade and capped or filled after an acceptable test has been obtained.
 - (2) Other methods of determining groundwater level may be used subject to approval of the Owner.
 - (3) It is extremely important that the various plugs be installed and braced in such a way as to prevent blowouts. A force of 250 pounds (1120 N) is exerted on an 8-inch (200-millimeter) plug by an internal pipe pressure of 5 PSI (35 KPA). It should be realized that sudden expulsion of a poorly installed plug or of a plug that is partially deflated before the pipe pressure is released can be dangerous.
 - a. As a safety precaution, pressurizing equipment shall include a regulator or relief valve set at 10 PSI (70 KPA) to avoid over-pressurizing and damaging an otherwise acceptable line. No one shall be allowed in the manholes during testing. All plugs shall be secured with tethers to immobile objects to insure they are not flushed downstream as they are removed.
 - (4) Table. Air test table was prepared in accordance with ASTM F1417 (Plastic Pipe) formulas.
4. Safety and operation procedures recommended by the equipment manufacturer shall be reviewed and adhered to at all times.
5. Allowable leakage of pipe using infiltration or exfiltration tests shall be limited to 100 gallons per day per inch diameter per mile or 2,400 gallons per day, whichever is less. If groundwater is 4 feet above top of pipe, use infiltration test. If groundwater is less than 4 feet above top of pipe, fill pipe and upstream manhole to produce a minimum 4-foot head over the top of pipe, let stand for 12 hours, refill manhole to original level, and conduct exfiltration test for 1 hour.

Table II
Air Test Table PVC Gravity Sewer
Based on ASTM F1417

Minimum test time in minutes: seconds for pressure drop from 3.5 to 2.5 PSIG

Plastic Pipe diameter d (in)	Minimum time T (min:sec)	Length for minimum time L (ft)	Time for longer length (sec)	Minimum specified time (T) required for 1.0 PSIG pressure drop for size and length of PVC pipe indicated						
				100 ft	150 ft	200 ft	250 ft	300 ft	350 ft	400 ft
				Allowable leakage Q = 0.0015 cu.Ft./min. per sq.ft. of internal pipe surface area						
				$T = 0.085DK/Q$						
				$K=0.000419DL$ for $K > 1$, otherwise $K=1$						
				Specification time for length shown (min:sec)						
4	3:46	597	.380 1	3:46	3:46	3:46	3:46	3:46	3:46	3:46
6	5:40	398	.854 1	5:40	5:40	5:40	5:40	5:40	5:42	6:24
8	7:34	298	1.520 1	7:34	7:34	7:34	7:34	7:36	8:52	10:08
10	9:26	239	2.374 1	9:26	9:26	9:26	9:53	11:52	13:51	15:49
12	11:20	199	3.418 1	11:20	11:20	11:24	14:15	17:05	19:56	22:47

SECTION C-6 - SEEDING

- 6.01 Description. This section specifies all seeding work on this project.
- 6.02 Fertilizer shall meet requirements of Federal Specification O-F-241. Provide fertilizer that is complete, inorganic, uniform in composition, and suitable for application with approved equipment. Proportions of fertilizer nutrients shall be multiples of the following:

10 pounds of actual Nitrogen
 20 pounds of actual Phosphate
 10 pounds of actual Potash

- 6.03 Grass seed, tested within 6 months of sowing, shall have the following characteristics:

1. Permanent Seeding.

<u>Species</u>	Percentages (Minimum)		
	<u>Weight</u>	<u>Purity</u>	<u>Germination</u>
Kentucky 31 Tall Fescue	95	97	85
Improved Perennial Ryegrass	2.5	98	90
Kentucky Bluegrass	2.5	97	85

2. Temporary Seeding.

<u>Seeding Date</u>	<u>Species</u>	Percentages (Min.)		Seeding Rate	
		<u>Wgt.</u>	<u>Purity</u>	<u>Germ.</u>	<u>Pounds per acre</u>
Feb 15-Apr 30	Oats	100	98	85	100
May 1-Aug 31	Millet	100	98	80	50
Sept 1-Nov 15	Rye	100	96	85	110

3. Wetland Seeding.

Permanent Seed Mix shall be ERNST-865 VA Southern Piedmont FACW Mix.

- 6.04 Lime shall be ground agricultural grade limestone containing not less than 85 percent calcium and magnesium carbonates. Fineness shall be such that 100 percent will pass a No. 20 sieve, and not less than 50 percent will pass a No. 100 sieve. Burnt lime or hydrated lime may be substituted in equivalent carbonates, if requested.
- 6.05 Materials shall be delivered in unbroken containers, clearly marked by the manufacturer as to contents. Seed, limestone, and fertilizer shall be labeled as to proportions, analysis, and quality. Store all materials in a manner affording protection from damage by weather or vandalism.
- 6.06 Seed only when wind velocity is less than 15 miles per hour.
- 6.07 All soil areas disturbed by the Contractor during his construction operations shall be seeded. Whenever the disturbed area is part of a residential lawn, it shall be hand raked thus removing rocks and clodded dirt to the satisfaction of the Owner and the property owner. The Contractor shall reseed any areas where a sufficient stand of grass is not obtained as determined by the Owner.

- 6.08 Soil Tests. The Contractor shall collect a minimum of one soil sample for every 2 acres, or 2,500 linear feet along linear projects, of land to be seeded and send the samples to the Cooperative Extension Service Soil Testing Laboratory at Virginia Tech, or by a reputable commercial laboratory for analysis to determine the appropriate amounts of lime and fertilizer to be applied for the various vegetation to be established. Adjustments to the application rates of lime and fertilizer shall be made based on the results of the soils analysis.
- 6.08 Temporary Seeding.
1. Restore topsoil to original depth or 6 inches.
 2. Use in areas when final grading has not been completed or when permanent seeding cannot be done due to the specified permanent seeding dates, or project sequencing requires disturbing the area in a secondary phase of work.
 3. Apply fertilizer at a rate of 10 pounds of 10-10-10 per 1,000 square foot (450 pounds per acre) or equivalent. Never apply more than 1 pound of water soluble nitrogen per 1,000 square feet within a 30 day period.
 4. Apply lime at a rate determined by the soils analysis. If a soils analysis has not been performed apply lime at the rate of 90 pounds per 1,000 square feet (2 tons per acre).
 5. For loose soil, work lime and fertilizer into soil and then seed. For packed or hard soil, loosen top layer while working lime and fertilizer into soil and then seed at the rate required for the temporary seeding species.
- 6.09 Prepare soil for permanent seeding and hydroseeding by tillage of topsoil in place to loosen thoroughly and break up all clods to a depth of 6 inches. Remove all stumps and roots, coarse vegetation, stones larger than 1-1/2 inches, and all construction debris. Soil shall be worked by suitable agricultural equipment to a depth of not less than 4 inches. Rake to a uniform, smooth, and drainable surface.
1. Apply lime and fertilizer uniformly and mix well into top 4 inches of seed bed. Apply lime at the rate determined by the soils analysis. If a soils analysis has not been performed apply lime at the rate of 90 pounds per 1,000 square feet (2 tons per acre). Apply fertilizer at the rate determined by the soils analysis. If a soils analysis has not been performed apply 10-20-10 fertilizer the equivalent rate of 12 pounds per 1,000 square feet (500 pounds per acre). Rates should be adjusted for other grades of fertilizer. Use controlled release fertilizer and lime. Never apply more than 1 pound of water soluble nitrogen per 1,000 square feet within a 30 day period.
- 6.10 Sow permanent grass seed between dates of March 1 and April 15 or September 1 and October 15.
- 6.11 Sow seed by mechanical seeder as follows:
1. Broadcast at rate of 6 pounds of grass seed per 1,000 square feet in cross directions to ensure uniform distribution. Rake surface lightly and roll with appropriate type of lawn roller weighing maximum of 150 pounds per foot of width.
 2. Apply either Type I or Type II mulch.
 - (1) Type I Mulch. Apply uniformly at the following rates:
Straw - 70-90 pounds per 1,000 square feet

Wood Fiber - 25-50 pounds per 1,000 square feet

- (2) Anchor Type I mulch by the following methods:

Apply light tack coat of asphalt emulsion (10 gallons per 1,000 square feet).

In residential areas, apply a synthetic mulch binder at rate recommended by manufacturer.

On slopes steeper than 4 horizontal to 1 vertical, secure heavy jute mesh with staples over Type I mulch.

- (3) Type II Mulch (Hold/Gro, Curlex, or equal). Apply on slopes 3:1 or steeper and in areas of concentrated flow in accordance with manufacturer's instructions where shown on the Drawings.

6.12 Sow seed by hydroseeding as follows:

1. Mix lime, seed, fertilizer, and wood cellulose fiber in required amount of water to produce a homogeneous slurry. Hydroseeding mix shall incorporate a 16-45-7 seed starting fertilizer to promote germination at a rate of 35 pounds per acre. The above ingredients shall be added and mixed in the following order: lime at 15 pounds per acre, seed at 260 pounds per acre, fertilizer at 35 pounds per acre, and ample wood cellulose fiber to make a slurry. All ingredients are to be designed for use in hydroseeding operations. After thoroughly mixed, apply uniformly at the rate of 260 pounds of grass seed per acre, dry weight.
2. The above mixture shall be applied within 3.0 hours from the time of mixing.
3. All mixtures shall be constantly agitated from the time they are mixed until they are applied to the seed bed.
4. Immediately following the application of the seed slurry mix, make separate application of wood cellulose mulch at the rate of 1,500 pounds, dry weight, per acre.

6.13 Remove all soiling or staining of finished walks, drives, and parking areas resulting from seeding work. Maintain paved areas in clean condition.

6.14 Maintenance of Permanent Seeding.

1. Reseed and mulch areas which do not exhibit a uniform stand of grass within 6 weeks, provide additional topsoil as required.
2. In the event that growth is not established by final project inspection, continue the specified attention until stand is accepted by the Owner.
3. Correct or repair all undue settling as evidenced by complaints received within 1 year after Substantial Completion.

SECTION 017823 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Section “General Requirements” Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
 - 1. Operation and maintenance documentation directory.
 - 2. Emergency manuals.
 - 3. Operation manuals for systems, subsystems, and equipment.
 - 4. Product maintenance manuals.
 - 5. Systems and equipment maintenance manuals.
- B. Related Requirements:
 - 1. Section “General Requirements” for submitting copies of submittals for operation and maintenance manuals.

1.3 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.

1.4 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 on digital media acceptable 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. Two (2) paper copies. Include a complete operation and maintenance directory. Enclose title pages and directories in clear plastic sleeves.
- C. Initial Manual Submittal: Submit draft copy of each manual at least thirty (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 fifteen (15) 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 fifteen (15) days of receipt of Engineer's comments and prior to commencing demonstration and training.

PART 2 - PRODUCTS

2.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

- A. Directory: 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.
 4. Table of contents.
- 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. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.
- E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

2.2 REQUIREMENTS FOR EMERGENCY, 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.
 7. Names and contact information for major consultants to the Engineer that designed the systems contained in the manuals.
 8. Cross-reference to related systems in other operation and maintenance manuals.
- 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.
- 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.
- 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, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch (215-by-280-mm) paper; 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, and indicate Specification Section number on bottom of spine. 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. Supplementary Text: Prepared on 8-1/2-by-11-inch (215-by-280-mm) white bond paper.
5. 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 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. Gas leak.
 4. Water leak.
 5. Power failure.
 6. Water outage.
 7. System, subsystem, or equipment failure.
 8. 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.

2.4 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. Use designations for systems and equipment indicated on Contract Documents.
 - 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: Include the following:
 - 1. Product name and model number. Use designations for products indicated on Contract Documents.
 - 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: Include the following, as applicable:
 - 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.

- D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.
- E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

2.5 PRODUCT 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.
- B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. 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.
- C. Product Information: Include the following, as applicable:
 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.
- D. Maintenance Procedures: Include manufacturer's written recommendations and the following:
 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.
- E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.
- F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
 1. Include procedures to follow and required notifications for warranty claims.

2.6 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

- A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures,

maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.

- B. **Source Information:** List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. 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.
- C. **Manufacturers' Maintenance Documentation:** Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:
 - 1. Standard maintenance instructions and bulletins.
 - 2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
 - 3. Identification and nomenclature of parts and components.
 - 4. List of items recommended to be stocked as spare parts.
- D. **Maintenance Procedures:** Include the following information and items that detail essential maintenance procedures:
 - 1. Test and inspection instructions.
 - 2. Troubleshooting guide.
 - 3. Precautions against improper maintenance.
 - 4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
 - 5. Aligning, adjusting, and checking instructions.
 - 6. Demonstration and training video recording, if available.
- E. **Maintenance and Service Schedules:** 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.
 - 1. **Scheduled Maintenance and Service:** Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
 - 2. **Maintenance and Service Record:** Include manufacturers' forms for recording maintenance.
- F. **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.
- G. **Maintenance Service Contracts:** Include copies of maintenance agreements with name and telephone number of service agent.
- H. **Warranties and Bonds:** Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
 - 1. Include procedures to follow and required notifications for warranty claims.

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

- A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals.
- B. 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.
- C. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.
- D. 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.
- E. 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.
- F. 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.
 - 1. Do not use original project record documents as part of operation and maintenance manuals.
 - 2. Comply with requirements of newly prepared record Drawings in Section "General Requirements".
- G. Comply with Section "General Requirements" schedule for submitting operation and maintenance documentation.

END OF SECTION 017823

SECTION 017839 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Section "General Requirements" Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for project record documents, including the following:
 - 1. Record Drawings.
 - 2. Record Specifications.
 - 3. Record Product Data.
 - 4. Miscellaneous record submittals.
- B. Related Requirements:
 - 1. Section "General Requirements" for general closeout procedures.

1.3 CLOSEOUT SUBMITTALS

- A. Record Drawings: Comply with the following:
 - 1. Number of Copies: Submit copies of record Drawings as follows:
 - a. Initial Submittal:
 - 1) Submit one (1) paper-copy set(s) of marked-up record prints.
 - 2) Engineer will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.
 - b. Final Submittal:
 - 1) Submit one (1) paper-copy set(s) of marked-up record prints.
 - 2) Print each drawing, whether or not changes and additional information were recorded.
- B. Miscellaneous Record Submittals: See other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

- A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.
1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.
 - a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
 - b. Accurately record information in an acceptable drawing technique.
 - c. Record data as soon as possible after obtaining it.
 - d. Record and check the markup before enclosing concealed installations.
 2. Content: Types of items requiring marking include, but are not limited to, the following:
 - a. Dimensional changes to Drawings.
 - b. Revisions to details shown on Drawings.
 - c. Depths of foundations below first floor.
 - d. Locations and depths of underground utilities.
 - e. Revisions to routing of piping and conduits.
 - f. Revisions to electrical circuitry.
 - g. Actual equipment locations.
 - h. Locations of concealed internal utilities.
 - i. Changes made by Change Order or Work Change Directive.
 - j. Changes made following Engineer's written orders.
 - k. Details not on the original Contract Drawings.
 - l. Field records for variable and concealed conditions.
 - m. Record information on the Work that is shown only schematically.
 3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
 4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
 5. Mark important additional information that was either shown schematically or omitted from original Drawings.

2.2 RECORD SPECIFICATIONS

- A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.

2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
4. For each principal product, indicate whether record Product Data has been submitted in operation and maintenance manuals instead of submitted as record Product Data.
5. Note related Change Orders and record Drawings where applicable.

2.3 RECORD PRODUCT DATA

- A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
 3. Note related Change Orders and record Drawings where applicable.

2.4 MISCELLANEOUS RECORD SUBMITTALS

- A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

- A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.
- B. Maintenance of Record Documents and Samples: Store record documents and Samples in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Engineer's reference during normal working hours.

END OF SECTION 017839

SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Section "General Requirements" Sections, apply to this Section.

1.2 SUMMARY

- A. This Section specifies cast-in place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:
 - 1. Slabs-on-grade.
 - 2. Sidewalks.
 - 3. Footings.
 - 4. Foundation Walls.
 - 5. Curb and curb and gutter.
 - 6. Thrust blocking for pressure pipe.
 - 7. Miscellaneous indicated Work.
- B. Related Sections include the following:
 - 1. Section "Earth Moving" for drainage fill under slabs-on-grade.

1.3 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.

1.4 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.
 - 1. Indicate amounts of mixing water to be withheld for later addition at Project site.
- C. Welding certificates.
- D. Qualification Data: For Installer and manufacturer.

- E. 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. Include special reinforcement required for openings through concrete structures. Details shall be prepared in accordance with ACI 315 and CRSI Manual of Standard Practices.
- F. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.
 - 1. Location of construction joints is subject to approval of the Engineer.
- G. Formwork Shop Drawings: Prepared by or under the supervision of a qualified professional engineer detailing fabrication, assembly, and support of formwork.
 - 1. Shoring and Reshoring: Indicate proposed schedule and sequence of stripping formwork, shoring removal, and reshoring installation and removal.
- H. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:
 - 1. Aggregates.
- I. Material Certificates: For each of the following, signed by manufacturers:
 - 1. Cementitious materials.
 - 2. Admixtures.
 - 3. Form materials and form-release agents.
 - 4. Steel reinforcement and accessories.
 - 5. Waterstops.
 - 6. Curing compounds.
 - 7. Bonding agents.
 - 8. Repair materials.
- J. Field quality-control test and inspection reports.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.
- B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
 - 1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

- C. **Testing Agency Qualifications:** An independent agency qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.
 - 1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-01 or an equivalent certification program.
 - 2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.

- D. **Source Limitations:** Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from one source, and obtain admixtures through one source from a single manufacturer.

- E. **Welding:** Qualify procedures and personnel according to AWS D1.4, "Structural Welding Code--Reinforcing Steel."

- F. **ACI Publications:** Comply with the following unless modified by requirements in the Contract Documents:
 - 1. ACI 301, "Specification for Structural Concrete."
 - 2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

- G. **Concrete Testing Service:** Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

- H. **Batch Tickets:** Batch tickets shall be provided for each truck of concrete delivered to the job site. Tickets shall include the following information:
 - 1. Concrete Company
 - 2. Date
 - 3. Batch Number
 - 4. Mix Design Identifier
 - 5. Quantity of Batch
 - 6. Time the Cement was Injected Into the Mix
 - 7. Water Withheld at the Plant (if any)
 - 8. Water Added at Job (if any)
 - 9. Admixtures (Name & Quantities) Injected at Plant
 - 10. Time of Truck's Departure From the Plant
 - 11. Driver's Name

- I. **Batch Ticket Log:** A log of all batch tickets shall be kept by the Independent Testing Agency and provided to the Engineer following each concrete pour. Results of field testing shall also be recorded on the Batch Ticket Log.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. **Steel Reinforcement:** Deliver, store, and handle steel reinforcement to prevent bending and damage. Avoid damaging coatings on steel reinforcement.

- B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
 - 2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.2 FORM-FACING MATERIALS

- A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
 - 1. Plywood, metal, or other approved panel materials.
 - 2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
 - a. High-density overlay, Class 1 or better.
 - b. Medium-density overlay, Class 1 or better; mill-release agent treated and edge sealed.
 - c. Structural 1, B-B or better; mill oiled and edge sealed.
 - d. B-B (Concrete Form), Class 1 or better; mill oiled and edge sealed.
- 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. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.
- D. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.
- E. 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.
 - 1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
- F. 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.

1. Furnish units that will leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
2. Furnish ties that, when removed, will leave holes no larger than 1 inch in diameter in concrete surface.
3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

2.3 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.
- B. Galvanized Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed bars, ASTM A 767/A 767M, Class I zinc coated after fabrication and bending.
- C. Plain-Steel Wire: ASTM A 82, galvanized.
- D. Galvanized-Steel Welded Wire Reinforcement: ASTM A 185, plain, fabricated from galvanized steel wire into flat sheets.
- E. Spacing: The clear distance between parallel bars shall not be less than 1-1/3 times the maximum size of the coarse aggregate. All main reinforcement shall be spaced not less than 2 inches from any concrete surface unless authorized or indicated on the plans. Clearance between ground and rebar shall be a minimum of 3 inches. For stirrups, spacer rods and similar secondary reinforcement, this clearance may be reduced by the diameter of such rods.
- F. Splicing: Where splicing of bars is necessary, the minimum length of the splice shall be 30 diameters of the largest bar, unless shown to be otherwise on plans.
- G. Hooks & Bends: When a hook is indicated on the plans, it shall mean either a 180 degree turn plus an extension of at least 4 bar diameters, or a 90 degree turn plus an extension of at least 6 bar diameters.

2.4 REINFORCEMENT ACCESSORIES

- A. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60, plain-steel bars, cut bars true to length with ends square and free of burrs.
- B. Zinc Repair Material: ASTM A 780, zinc-based solder, paint containing zinc dust, or sprayed zinc.
- C. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
 1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.
 2. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.

3. For zinc-coated reinforcement, use galvanized wire or dielectric-polymer-coated wire bar supports.

2.5 CONCRETE MATERIALS

- A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
 1. Portland Cement: ASTM C 150, Type I. Supplement with the following:
 - a. Fly Ash: ASTM C 618, Class C.
 - b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.
 - B. Silica Fume: ASTM C 1240, amorphous silica.
 - C. Normal-Weight Aggregates: ASTM C 33, Class 3S coarse aggregate or better, graded. Provide aggregates from a single source.
 1. Maximum Coarse-Aggregate Size: 1-1/2 inches nominal.
 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
 - D. Water: ASTM C 94/C 94M and potable.

2.6 ADMIXTURES

- A. Air-Entraining Admixture: ASTM C 260.
- B. 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.
 1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
 2. Retarding Admixture: ASTM C 494/C 494M, Type B.
 3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
 4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
 5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
 6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.
- C. Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete and complying with ASTM C 494/C 494M, Type C.
 1. Available Products:
 - a. Boral Material Technologies, Inc.; Boral BCN.
 - b. Euclid Chemical Company (The); Eucon CIA.
 - c. Grace Construction Products, W. R. Grace & Co.; DCI.

- d. Master Builders, Inc.; Rheocrete CNI.
 - e. Sika Corporation; Sika CNI.
 - f. Or Approved Equal.
- D. Non-Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, non-set-accelerating, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete.
- 1. Available Products:
 - a. Axim Concrete Technologies; Catexol 1000CI.
 - b. Boral Material Technologies, Inc.; Boral BCN2.
 - c. Cortec Corporation; MCI 2000.
 - d. Grace Construction Products, W. R. Grace & Co.; DCI-S.
 - e. Master Builders, Inc.; Rheocrete 222+.
 - f. Sika Corporation; FerroGard-901.
 - g. Or Approved Equal.

2.7 WATERSTOPS

- A. Flexible Rubber Waterstops: CE CRD-C 513, for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.
- 1. Available Manufacturers:
 - a. Greenstreak.
 - b. Progress Unlimited, Inc.
 - c. Williams Products, Inc.
 - d. Or Approved Equal.
 - 2. Profile: Flat, dumbbell with center bulb.
 - 3. Dimensions: 4 inches by 3/16 inch thick; nontapered.
- B. Flexible PVC Waterstops: CE CRD-C 572, for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.
- 1. Available Manufacturers:
 - a. Bometals, Inc.
 - b. Greenstreak.
 - c. Meadows, W. R., Inc.
 - d. Murphy, Paul Plastics Co.
 - e. Progress Unlimited, Inc.
 - f. Tamms Industries, Inc.
 - g. Vinylex Corp.
 - h. Or Approved Equal.
 - 2. Profile: Flat, dumbbell with center bulb.
 - 3. Dimensions: 4 inches by 3/16 inch thick; nontapered.

2.8 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
1. Available Products:
 - a. Axim Concrete Technologies; Cimfilm.
 - b. Burke by Edoco; BurkeFilm.
 - c. ChemMasters; Spray-Film.
 - d. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; Aquafilm.
 - e. Dayton Superior Corporation; Sure Film.
 - f. Euclid Chemical Company (The); Eucobar.
 - g. Kaufman Products, Inc.; Vapor Aid.
 - h. Lambert Corporation; Lambco Skin.
 - i. L&M Construction Chemicals, Inc.; E-Con.
 - j. MBT Protection and Repair, Div. of ChemRex; Confilm.
 - k. Meadows, W. R., Inc.; Sealtight Evapre.
 - l. Metalcrete Industries; Waterhold.
 - m. Nox-Crete Products Group, Kinsman Corporation; Monofilm.
 - n. Sika Corporation, Inc.; SikaFilm.
 - o. Symons Corporation, a Dayton Superior Company; Finishing Aid.
 - p. Unitex; Pro-Film.
 - q. US Mix Products Company; US Spec Monofilm ER.
 - r. Vexcon Chemicals, Inc.; Certi-Vex EnvioAssist.
 - s. Or Approved Equal.
- B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.
- C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- D. Water: Potable.
- E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.
1. Available Products:
 - a. Anti-Hydro International, Inc.; AH Curing Compound #2 DR WB.
 - b. Burke by Edoco; Aqua Resin Cure.
 - c. ChemMasters; Safe-Cure Clear.
 - d. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; W.B. Resin Cure.
 - e. Dayton Superior Corporation; Day Chem Rez Cure (J-11-W).
 - f. Euclid Chemical Company (The); Kurez DR VOX.
 - g. Kaufman Products, Inc.; Thinfilm 420.
 - h. Lambert Corporation; Aqua Kure-Clear.
 - i. L&M Construction Chemicals, Inc.; L&M Cure R.

- j. Meadows, W. R., Inc.; 1100 Clear.
 - k. Nox-Crete Products Group, Kinsman Corporation; Resin Cure E.
 - l. Symons Corporation, a Dayton Superior Company; Resi-Chem Clear Cure.
 - m. Tamms Industries, Inc.; Horncure WB 30.
 - n. Unitex; Hydro Cure 309.
 - o. US Mix Products Company; US Spec Maxcure Resin Clear.
 - p. Vexcon Chemicals, Inc.; Certi-Vex Enviocure 100.
 - q. Or Approved Equal.
- F. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, nondissipating.
- 1. Available Products:
 - a. Anti-Hydro International, Inc.; AH Clear Cure WB.
 - b. Burke by Edoco; Spartan Cote WB II.
 - c. ChemMasters; Safe-Cure & Seal 20.
 - d. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; Cure and Seal WB.
 - e. Dayton Superior Corporation; Safe Cure and Seal (J-18).
 - f. Euclid Chemical Company (The); Aqua Cure VOX.
 - g. Kaufman Products, Inc.; Cure & Seal 309 Emulsion.
 - h. Lambert Corporation; Glazecote Sealer-20.
 - i. L&M Construction Chemicals, Inc.; Dress & Seal WB.
 - j. Meadows, W. R., Inc.; Vocomp-20.
 - k. Metalcrete Industries; Metcure.
 - l. Nox-Crete Products Group, Kinsman Corporation; Cure & Seal 150E.
 - m. Symons Corporation, a Dayton Superior Company; Cure & Seal 18 Percent E.
 - n. Tamms Industries, Inc.; Clearseal WB 150.
 - o. Unitex; Hydro Seal.
 - p. US Mix Products Company; US Spec Hydrasheen 15 percent
 - q. Vexcon Chemicals, Inc.; Starseal 309.
 - r. Or Approved Equal.
- G. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, 18 to 25 percent solids, nondissipating.
- 1. Available Products:
 - a. Burke by Edoco; Spartan Cote WB II 20 Percent.
 - b. ChemMasters; Safe-Cure Clear.
 - c. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; High Seal.
 - d. Dayton Superior Corporation; Safe Cure and Seal (J-19).
 - e. Euclid Chemical Company (The); Diamond Clear VOX.
 - f. Kaufman Products, Inc.; SureCure Emulsion.
 - g. Lambert Corporation; Glazecote Sealer-20.
 - h. L&M Construction Chemicals, Inc.; Dress & Seal WB.
 - i. MBT Protection and Repair, Div. of ChemRex; MasterKure-N-Seal VOC.
 - j. Meadows, W. R., Inc.; Vocomp-20.
 - k. Metalcrete Industries; Metcure 0800.

- l. Nox-Crete Products Group, Kinsman Corporation; Cure & Seal 200E.
 - m. Sonneborn, Div. of ChemRex; Kure-N-Seal.
 - n. Symons Corporation, a Dayton Superior Company; Cure & Seal 18 Percent E.
 - o. Tamms Industries, Inc.; Clearseal WB STD.
 - p. Unitex; Hydro Seal 18.
 - q. US Mix Products Company; US Spec Radiance UV-25
 - r. Vexcon Chemicals, Inc.; Starseal 0800.
 - s. Or Approved Equal.
- H. Clear, Solvent-Borne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.
1. Available Products:
 - a. Burke by Edoco; Cureseal 1315.
 - b. ChemMasters; Spray-Cure & Seal Plus.
 - c. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; Sealcure 1315.
 - d. Dayton Superior Corporation; Day-Chem Cure and Seal (J-22UV).
 - e. Euclid Chemical Company (The); Super Diamond Clear.
 - f. Kaufman Products, Inc.; Sure Cure 25.
 - g. Lambert Corporation; UV Super Seal.
 - h. L&M Construction Chemicals, Inc.; Lumiseal Plus.
 - i. Meadows, W. R., Inc.; CS-309/30.
 - j. Metalcrete Industries; Seal N Kure 0.
 - k. Sonneborn, Div. of ChemRex; Kure-N-Seal 5.
 - l. Tamms Industries, Inc.; LusterSeal 300.
 - m. Unitex; Solvent Seal 1315.
 - n. US Mix Products Company; US Spec CS-25
 - o. Vexcon Chemicals, Inc.; Certi-Vex AC 1315
 - p. Or Approved Equal.
- I. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.
1. Available Products:
 - a. Burke by Edoco; Cureseal 1315 WB.
 - b. ChemMasters; Polyseal WB.
 - c. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; Sealcure 1315 WB.
 - d. Euclid Chemical Company (The); Super Diamond Clear VOX.
 - e. Kaufman Products, Inc.; Sure Cure 25 Emulsion.
 - f. Lambert Corporation; UV Safe Seal.
 - g. L&M Construction Chemicals, Inc.; Lumiseal WB Plus.
 - h. Meadows, W. R., Inc.; Vocomp-30.
 - i. Metalcrete Industries; Metcure 30.
 - j. Symons Corporation, a Dayton Superior Company; Cure & Seal 31 Percent E.
 - k. Tamms Industries, Inc.; LusterSeal WB 300.
 - l. Unitex; Hydro Seal 25.
 - m. US Mix Products Company; US Spec Radiance UV-25.

- n. Vexcon Chemicals, Inc.; Vexcon Starseal 1315.
- o. Or Approved Equal.

2.9 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork.
- B. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
- C. Reglets: Fabricate reglets of not less than 0.0217-inch-thick, galvanized steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.
- D. Dovetail Anchor Slots: Hot-dip galvanized steel sheet, not less than 0.0336 inch thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

2.10 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
 - 1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.
- B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
 - 1. Fly Ash: 25 percent.
 - 2. Combined Fly Ash and Pozzolan: 25 percent.
 - 3. Ground Granulated Blast-Furnace Slag: 50 percent.
 - 4. Combined Fly Ash or Pozzolan and Ground Granulated Blast-Furnace Slag: 50 percent portland cement minimum, with fly ash or pozzolan not exceeding 25 percent.
 - 5. Silica Fume: 10 percent.
 - 6. Combined Fly Ash, Pozzolans, and Silica Fume: 35 percent with fly ash or pozzolans not exceeding 25 percent and silica fume not exceeding 10 percent.
 - 7. Combined Fly Ash or Pozzolans, Ground Granulated Blast-Furnace Slag, and Silica Fume: 50 percent with fly ash or pozzolans not exceeding 25 percent and silica fume not exceeding 10 percent.
- C. Limit water-soluble, chloride-ion content in hardened concrete to 0.06 percent by weight of cement.
- D. Admixtures: Use admixtures according to manufacturer's written instructions.
 - 1. Use water-reducing or plasticizing admixture in concrete, as required, for placement and workability.

2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.
4. Use corrosion-inhibiting admixture in concrete mixtures where indicated.

2.11 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 4000 psi at 28 days.
2. Minimum Cementitious Materials Content: 470 lb/cu. yd.
3. Slump Limit: 4 inches, plus or minus 1 inch.
4. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 1-inch nominal maximum aggregate size.

2.12 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.13 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, and furnish batch ticket information.

1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Mix concrete materials in appropriate drum-type batch machine mixer.

1. For mixer capacity of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
2. For mixer capacity larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd.
3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixture time, quantity, and amount of water added. Record approximate location of final deposit in structure.

PART 3 - EXECUTION

3.1 FORMWORK

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
- C. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:
 - 1. Class A, 1/8 inch for smooth-formed finished surfaces.
 - 2. Class B, 1/4 inch for rough-formed finished surfaces.
- D. Construct forms tight enough to prevent loss of concrete mortar.
- E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
 - 1. Install keyways, reglets, recesses, and the like, for easy removal.
 - 2. Do not use rust-stained steel form-facing material.
- F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.
- G. Chamfer exterior corners and edges of permanently exposed concrete.
- H. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.
- I. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- J. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- K. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."
2. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
3. Install dovetail anchor slots in concrete structures as indicated.

3.3 REMOVING AND REUSING FORMS

- A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete, if concrete is hard enough to not be damaged by form-removal operations and curing and protection operations are maintained.
 1. Leave formwork for slabs and other structural elements that supports weight of concrete in place until concrete has achieved at least 70 percent of its 28-day design compressive strength.
 2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.
- B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.
- C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved Engineer.

3.4 SHORES AND RESHORES

- A. Comply with ACI 318 and ACI 301 for design, installation, and removal of shoring and reshoring.
 1. Do not remove shoring or reshoring until measurement of slab tolerances is complete.
- B. In multistory construction, extend shoring or reshoring over a sufficient number of stories to distribute loads in such a manner that no floor or member will be excessively loaded or will induce tensile stress in concrete members without sufficient steel reinforcement.
- C. Plan sequence of removal of shores and reshore to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excessive stress or deflection.

3.5 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.
 1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.
- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
 - 1. Weld reinforcing bars according to AWS D1.4, where indicated.
- D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- E. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.
- F. Zinc-Coated Reinforcement: Repair cut and damaged zinc coatings with zinc repair material according to ASTM A 780. Use galvanized steel wire ties to fasten zinc-coated steel reinforcement.

3.6 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Engineer.
 - 1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
 - 2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
 - 3. Locate joints for slabs in the middle third of spans.
 - 4. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:
 - 1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
 - 2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.
- D. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.7 WATERSTOPS

- A. Flexible Waterstops: Install in construction joints and at other joints indicated to form a continuous diaphragm. Install in longest lengths practicable. Support and protect exposed waterstops during progress of the Work. Field fabricate joints in waterstops according to manufacturer's written instructions.

3.8 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.
- B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Engineer.
- C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.
 - 1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
- D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
 - 1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
 - 2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
 - 3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.
- E. Deposit and consolidate concrete for slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
 - 1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 - 2. Maintain reinforcement in position on chairs during concrete placement.
 - 3. Screed slab surfaces with a straightedge and strike off to correct elevations.
 - 4. Slope surfaces uniformly to drains where required.
 - 5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

- F. Cold-Weather Placement: Comply with ACI 306.1 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 deg 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.
- G. Hot-Weather Placement: Comply with ACI 301 and as follows:
1. Maintain concrete temperature below 90 deg 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.

3.9 FINISHING FORMED SURFACES

- A. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
1. Apply to concrete surfaces exposed to public view.
- B. Rubbed Finish: Apply the following to smooth-formed finished as-cast concrete where indicated:
1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
 2. Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix one part portland cement to one and one-half parts fine sand with a 1:1 mixture of bonding admixture and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.
 3. Cork-Floated Finish: Wet concrete surfaces and apply a stiff grout. Mix one part portland cement and one part fine sand with a 1:1 mixture of bonding agent and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Compress grout into voids by grinding surface. In a swirling motion, finish surface with a cork float.

- C. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.10 FINISHING SLABS

- A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch in 1 direction.
- C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.
 - 1. Apply float finish to surfaces to receive trowel finish.
- D. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
 - 1. Apply a trowel finish to surfaces exposed to view.
 - 2. Finish and measure surface so gap at any point between concrete surface and an unlevelled, freestanding, 10-foot- long straightedge resting on 2 high spots and placed anywhere on the surface does not exceed 1/4 inch.
- E. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.
 - 1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route.

3.11 MISCELLANEOUS CONCRETE ITEMS

- A. Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.
- B. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set expansion anchors for machines and equipment at correct elevations, complying with diagrams or templates from manufacturer furnishing machines and equipment.

3.12 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.
- D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.
- E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
 - 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
 - a. Water.
 - b. Continuous water-fog spray.
 - c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
 - 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
 - 3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
 - a. After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound will not interfere with bonding of floor covering used on Project.

3.13 JOINT FILLING

- A. Prepare, clean, and install joint filler according to manufacturer's written instructions.

1. Defer joint filling until concrete has aged at least one month(s). Do not fill joints until construction traffic has permanently ceased.
- B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.
- C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.14 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by Engineer. Remove and replace concrete that cannot be repaired and patched to Engineer's approval.
- B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.
- C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
 1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension in solid concrete, but not less than 1 inch in depth. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
 2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
 3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Engineer.
- D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
 1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
 2. After concrete has cured at least 14 days, correct high areas by grinding.
 3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
 4. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor

elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.

5. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
 6. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.
- E. Perform structural repairs of concrete, subject to Engineer's approval, using epoxy adhesive and patching mortar.
- F. Repair materials and installation not specified above may be used, subject to Engineer's approval.

3.15 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Contractor will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Inspections:
1. Steel reinforcement placement.
 2. Steel reinforcement welding.
 3. Verification of use of required design mixture.
 4. Concrete placement, including conveying and depositing.
 5. Curing procedures and maintenance of curing temperature.
 6. Verification of concrete strength before removal of shores and forms from slabs.
- C. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.
 2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
 3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.

4. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
 5. Compression Test Specimens: ASTM C 31/C 31M.
 - a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.
 - b. Cast and field cure two sets of two standard cylinder specimens for each composite sample.
 6. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.
 - a. Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days.
 - b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
 7. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
 8. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
 9. Test results shall be reported in writing to Engineer, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
 10. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Engineer but will not be used as sole basis for approval or rejection of concrete.
 11. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Engineer. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Engineer.
 12. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
 13. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.
- D. Measure slab flatness and levelness according to ASTM E 1155 within 24 hours of finishing.

END OF SECTION

SECTION 262420 - WASTEWATER PUMP STATION CONTROL PANEL

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The pumping station control panel shall be supplied containing soft start starters, HOA switches, pump run lights, etc. per specifications included below. Coordinate auxiliary contacts required with the SCADA system specifications. A minimum of 8 spare terminal strip contacts shall be provided to allow for expansion, repair or alterations. Pump controls shall be provided in accordance with the SCADA, Civil drawings and specifications.

1.2 QUALITY ASSURANCE

- A. All work shall comply with the applicable codes, standards, rules and regulations published by IEEE, ANSI, NEC, National Electric Safety Code and NEMA Standard IC-1 Industrial Control.

1.3 SUBMITTALS

- A. Shop drawings shall be submitted showing layout materials and components for PUMP station control panels, as specified within and on the drawings.

PART 2 - PRODUCTS

2.1 GENERAL

- A. The pump control panel shall be assembled and tested by the same manufacturer supplying the pumps to ensure suitability and assurance of experience in matching controls to motors and to ensure single source responsibility for the equipment.
- B. The pump supplier shall provide a duplex pump control panel for electrical power supply and automatic operation of the wastewater pumps. The control panel shall be located where indicated on the drawings. The control panel shall include, but not be limited to, NEMA rated solid state, soft start type motor starters with thermal overload protection for each pump and main disconnect switch, circuit breakers and Hand-Off-Automatic (HOA) selector switches, manual start pushbuttons, LED run lights for each pump indicating running or stopped condition. Run time meters, alarm horn and light, push to test buttons for alarm horn and light, automatic reset for next alarm, connections for SCADA system shall be provided in the SCADA panel. 120-volt control transformer for receptacle and lights shall be provided within pump control panel as specified herein.

- C. The duplex pump control panel shall be pre-wired and mounted in a NEMA 4X, 12-gauge, stainless steel free-standing cabinet enclosure as indicated on the drawings. The enclosure shall have an anti-condensation heater sized to prevent moisture accumulation in the enclosure. Pump supplier shall provide all wiring and conduit between pump control panel and pumps. The Contractor shall provide all electrical wiring, conduit, and other appurtenances from the control panel to the electrical power service. Size cable and conduit in accordance with National Electrical Code.
- D. Functional Description: The pump station shall consist of two submersible wastewater pumps and submersible pressure transducer with mercury float backup switches for low and high-high level alarms from local SCADA control panel.
- E. Automatic alternator shall alternate lead/lag pump sequencing from the SCADA panel.
- F. Each pump motor shall be furnished with seal leak detection probe, heat sensors, and warning system. If the seal becomes contaminated, the sensor shall initiate the "Seal Failure Alarm." Contacts for these alarms shall be wired to the SCADA panel.
- G. Each pump shall be furnished with an automatic oil level monitor. If the low oil level recommended by the manufacturer is reached, then a "Low Oil Level" alarm shall initiate, and the oil level switch shall turn off the pump motor. Contacts for these alarms shall be wired to the SCADA panel.
- H. Flashing red alarm light and alarm horn shall activate at the local control panel. Alarm signals are sent to a PLC in the SCADA cabinet which then relays the alarm via radio to the PLCs at the Rustburg WWTP. The SCADA alarms panel shall transmit a status alarm via the SCADA panel when any of the following conditions occur:
 - 1. Low Water Level
 - 2. High Water Level
 - 3. Seal Failure (for each pump)
 - 4. Low Oil Level (for each pump)
 - 5. High Temperature (for each pump)
- I. Alarm light shall be equipped with long life LED bulb in guarded enclosure. Horn shall emit 120-decibel alarm at 10-foot distance.
- J. The control panel shall have power on light, push to test button for light, light with automatic reset for next alarm, and the appropriate contacts to transmit a status alarm to the PLC Control Panel at the WWTP when the alarm conditions specified herein are activated.

- K. The control panel shall have one GFI 120-volt, 20-amp electrical convenience outlet.
- L. Pumps operation shall be controlled by submersible pressure transducer with float backup of low level and high-high level alarms and shall be wired to the SCADA control panel for interface with the pump starter panel.
- M. Sealed mercury float switches shall be constructed of chemical resistant polypropylene. Each float switch shall include eccentric lead weight, locked compression cable entry with flexible boot. Float switch lengths shall be as required to operate the pumps as indicated on the drawings. Mercury float switches shall be wired to the SCADA control panel for interface with the pump starter panel.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Pump starter control panel shall be installed where shown on the drawings.
- B. All work shall be in a neat and workmanlike manner by a certified Master Electrician holding a current competency card and registered with the Commonwealth of Virginia.
- C. Electrical work shall be coordinated so as not to interfere with or delay other construction operations.
- D. Perform all necessary cutting, sleeving, excavating and backfilling for the installation of the equipment and the restoration thereafter.
- E. Install all equipment and control devices furnished by equipment manufacturers With their equipment and complete wiring in accordance with manufacturer's recommendations and approved wiring diagrams. Any OWNER furnished equipment shall be connected by the CONTRACTOR.
- F. The ends of all conduits shall be carefully reamed free from burrs after threading and before installation. All cuts shall be made square. All joints shall be made up tight.
- G. Care shall be taken to see that all power conduit runs either from a permanent and continuous ground connection point, or a bond wire is provided within the conduit.
- H. The CONTRACTOR shall permanently and effectively ground service neutral and all raceways, devices, and utilize equipment in accordance with requirements of the National Electrical Code, and as shown on Drawings.

3.2 ELECTRICAL WORK - GENERAL

- A. See Specifications on drawings.

3.3 GROUNDING - SECONDARY VOLTAGE SYSTEM

- A. See Specifications on drawings.

3.4 PUMP CABLE CONNECTORS AND SEALS

- A. CGB Connectors packed with removable sealants shall be installed in a ventilated enclosure under the control panel in accordance with the lift station drawing.

3.5 START-UP

- A. The manufacturer shall provide all necessary instruments and special apparatus to conduct any test that may be required to insure that the system is operating as designed. A written start-up report is required and must be furnished to OWNER within 30 days of start-up.

3.6 GUARANTEE

- A. Submit a written guarantee to the OWNER that all electrical work and material furnished provided under this contract is free of defects for a period of one year after final acceptance of the job. There will be no additional charge to the OWNER to repair or replace any such work which is found to be defective within the guarantee period. Should a defect occur and the CONTRACTOR or his representative not be available for immediate repair, an interim repair by others may be made without violation of the guarantee

End of Section

SECTION 263213 - PACKAGED ENGINE GENERATOR

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes packaged engine-generator set for emergency power supply with the following features:

- 1. Diesel engine.
- 2. Unit-mounted cooling system.
- 3. Unit-mounted control and monitoring.
- 4. Outdoor sound attenuated enclosure.

- B. Related Equipment include the following:

- 1. Transfer switch shall be per specification section 263600 and installed per the construction drawings. Generator supplier shall provide all provisions, including sensors and relays to initiate automatic-starting and -stopping signals for engine-generator set.

1.3 SUBMITTALS

- A. Product Data: Include rated capacities, operating characteristics, and furnished specialties and accessories. In addition, include the following:

- 1. Thermal damage curve for generator.
- 2. Time-current characteristic curves for generator protective device.

- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

- 1. Dimensioned outline plan and elevation drawings of engine-generator set and other components specified.
- 2. Wiring Diagrams: Power, signal, and control wiring.

- C. Field quality-control test reports.

- D. Operation and Maintenance Data: For packaged engine generator to include in emergency, operation, and maintenance manuals. Include the following:

- 1. List of tools and replacement items recommended to be stored at Project for ready access. Include part and drawing numbers, current unit prices, and source of supply.

- E. Warranty: Special warranty specified in this Section.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer. Maintain, within 100 miles of Project site, a service center capable of providing training, parts, and emergency maintenance repairs.
- B. Source Limitations: Obtain packaged generator set and auxiliary components through one source from a single manufacturer.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- D. Comply with ASME B15.1.
- E. Comply with NFPA 37.
- F. Comply with NFPA 70.
- G. Comply with NFPA 110 requirements for Level 2 emergency power supply system.
- H. Comply with UL 2200.
- I. Engine Exhaust Emissions: Comply with applicable federal, state, and local government requirements.

1.5 PROJECT CONDITIONS

- A. Environmental Conditions: Engine-generator system shall withstand the following environmental conditions without mechanical or electrical damage or degradation of performance capability:
 - 1. Ambient Temperature: Minus 15 to plus 40 deg C.
 - 2. Relative Humidity: 0 to 95 percent.
 - 3. Altitude: Sea level to 1000 feet.
- B. Space Limitations: Available space is indicated on drawings. Provide unit that fits within the space and provides the proper clearances.

1.6 COORDINATION

- A. Coordinate size and location of concrete base for package engine generator. Provide stainless steel expansion anchor-bolts (minimum of 6) for anchoring generator to concrete base.

1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of packaged engine generators and associated auxiliary components that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Two (2) years from date of Substantial Completion.

1.8 MAINTENANCE SERVICE

- A. Initial Maintenance Service: Beginning at Substantial Completion, provide 12 months' full maintenance by skilled employees of manufacturer's designated service organization. Include quarterly exercising to check for proper starting, load transfer, and running under load. Include routine preventive maintenance as recommended by manufacturer and adjusting as required for proper operation. Provide parts and supplies same as those used in the manufacture and installation of original equipment.

1.9 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Fuses: One for every 10 of each type and rating, but no fewer than one of each.
 - 2. Indicator Lamps: Two for every six of each type used, but no fewer than two of each.
 - 3. Filters: One set each of lubricating oil, fuel, and combustion-air filters.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Carter/Caterpillar Standby Generator
 - 2. Cummins Power Generation; Industrial Business Group.
 - 3. Kohler.

2.2 ENGINE-GENERATOR SET

- A. Factory-assembled and -tested, engine-generator set.
- B. Mounting Frame: Maintain alignment of mounted components without depending on concrete foundation; and have lifting attachments.
- C. Capacities and Characteristics:
 - 1. Output Connections: As indicated.
 - 2. Nameplates: For each major system component to identify manufacturer's name and address, and model and serial number of components.
- D. Generator-Set Performance:
 - 1. Steady-State Voltage Operational Bandwidth: 3 percent of rated output voltage from no load to full load.
 - 2. Transient Voltage Performance: Not more than 20 percent variation for 50 percent step-load increase or decrease. Voltage shall recover and remain within the steady-state operating band within three seconds.
 - 3. Steady-State Frequency Operational Bandwidth: 0.5 percent of rated frequency from no load to full load.
 - 4. Steady-State Frequency Stability: When system is operating at any constant load within the rated load, there shall be no random speed variations outside the steady-state operational band and no hunting or surging of speed.

5. Transient Frequency Performance: Less than 5 percent variation for 50 percent step-load increase or decrease. Frequency shall recover and remain within the steady-state operating band within five seconds.
6. Output Waveform: At no load, harmonic content measured line to line or line to neutral shall not exceed 5 percent total and 3 percent for single harmonics. Telephone influence factor, determined according to NEMA MG 1, shall not exceed 50 percent.
7. Sustained Short-Circuit Current: For a 3-phase, bolted short circuit at system output terminals, system shall supply a minimum of 300 percent of rated full-load current for not less than 10 seconds and then clear the fault automatically, without damage to generator system components.

2.3 ENGINE

- A. Fuel: Fuel oil, Grade DF-2.
- B. Rated Engine Speed: 1800 rpm.
- C. Maximum Piston Speed for Four-Cycle Engines: 2250 fpm.
- D. Lubrication System: The following items are mounted on engine or skid:
 1. Filter and Strainer: Rated to remove 90 percent of particles 5 micrometers and smaller while passing full flow.
 2. Thermostatic Control Valve: Control flow in system to maintain optimum oil temperature. Unit shall be capable of full flow and is designed to be fail-safe.
 3. Crankcase Drain: Arranged for complete gravity drainage to an easily removable container with no disassembly and without use of pumps, siphons, special tools, or appliances.
- E. Engine Fuel System:
 1. Main Fuel Pump: Mounted on engine. Pump ensures adequate primary fuel flow under starting and load conditions.
 2. Relief-Bypass Valve: Automatically regulates pressure in fuel line and returns excess fuel to source.
- F. Coolant Jacket Heater: Electric-immersion type, factory installed in coolant jacket system.
- G. Governor: Electronic.
- H. Cooling System: Closed loop, liquid cooled, with radiator factory mounted on engine-generator-set mounting frame and integral engine-driven coolant pump.
 1. Coolant: Solution of 50 percent ethylene-glycol-based antifreeze and 50 percent water, with anticorrosion additives as recommended by engine manufacturer.
 2. Size of Radiator: Adequate to contain expansion of total system coolant from cold start to 110 percent load condition.
 3. Temperature Control: Self-contained, thermostatic-control valve modulates coolant flow automatically to maintain optimum constant coolant temperature as recommended by engine manufacturer.
 4. Coolant Hose: Flexible assembly with inside surface of nonporous rubber and outer covering of aging-, ultraviolet-, and abrasion-resistant fabric.

- a. Rating: 50-psig maximum working pressure with coolant at 180 deg F, and noncollapsible under vacuum.
 - b. End Fittings: Flanges or steel pipe nipples with clamps to suit piping and equipment connections.
5. Radiator to have vertical air discharge.
- I. Muffler/Silencer: Critical type, sized as recommended by engine manufacturer and selected with exhaust piping system to not exceed engine manufacturer's engine backpressure requirements.
- 1. Minimum sound attenuation of 25 dB at 500 Hz.
- J. Air-Intake Filter: Heavy-duty, engine-mounted air cleaner with replaceable dry-filter element and "blocked filter" indicator.
- K. Starting System: 12 Volt electric, with negative ground.
- 1. Components: Sized so they will not be damaged during a full engine-cranking cycle with ambient temperature at maximum specified in Part 1 "Project Conditions" Article.
 - 2. Cranking Motor: Heavy-duty unit that automatically engages and releases from engine flywheel without binding.
 - 3. Cranking Cycle: 60 seconds.
 - 4. Battery: Adequate capacity within ambient temperature range specified in Part 1 "Project Conditions" Article to provide specified cranking cycle at least three times without recharging.
 - 5. Battery Cable: Size as recommended by engine manufacturer. Include required interconnecting conductors and connection accessories.
 - 6. Battery-Charging Alternator: Factory mounted on engine with solid-state voltage regulation and 35-A minimum continuous rating.
 - 7. Battery Charger: Current-limiting, automatic-equalizing and float-charging type. Unit shall comply with UL 1236 and include the following features:
 - a. Operation: Equalizing-charging rate of 10 A shall be initiated automatically after battery has lost charge until an adjustable equalizing voltage is achieved at battery terminals. Unit shall then be automatically switched to a lower float-charging mode and shall continue to operate in that mode until battery is discharged again.
 - b. Automatic Temperature Compensation: Adjust float and equalize voltages for variations in ambient temperature from minus 40 deg C to plus 60 deg C to prevent overcharging at high temperatures and undercharging at low temperatures.
 - c. Automatic Voltage Regulation: Maintain constant output voltage regardless of input voltage variations up to plus or minus 10 percent.
 - d. Ammeter and Voltmeter: Flush mounted in door. Meters shall indicate charging rates.
 - e. Enclosure and Mounting: NEMA 250, Type 1, wall-mounted cabinet.
 - f. Powered by 120V, 20A, single-phase circuit.

2.4 FUEL OIL STORAGE

- A. Comply with NFPA 30.

- B. Base-Mounted Fuel Oil Tank: Comply with UL 142, freestanding, factory-fabricated fuel tank assembly, with the following features:
1. Containment: Integral rupture basin with a capacity of 150 percent of nominal capacity of tank.
 - a. Leak Detector: Locate in rupture basin and connect to SCADA system.
 2. Low-Level Alarm Sensor: Liquid-level device operates alarm contacts at 25 percent of normal fuel level to SCADA system.
 3. Piping Connections: Factory-installed fuel supply and return lines from tank to engine; local fuel fill, vent and tank drain line.
 4. Tank level indicator.
 5. Capacity: Fuel for a minimum of fifty (50) hours' continuous operation at 100 percent rated power output.
 6. Vandal-resistant fill cap.

2.5 CONTROL AND MONITORING

- A. Automatic Starting System Sequence of Operation: When mode-selector switch on the control and monitoring panel is in the automatic position, remote-control contacts in the automatic transfer switches initiate starting and stopping of generator set. When mode-selector switch is switched to the on position, generator set starts. The off position of same switch initiates generator-set shutdown. When generator set is running, specified system or equipment failures or derangements automatically shut down generator set and initiate alarms. Operation of a remote emergency-stop switch located on the power rack or the exterior of the pump station control building also shuts down generator set.
- B. Configuration: Operating and safety indications, protective devices, basic system controls, and engine gages shall be grouped in a common control and monitoring panel mounted on the generator set. Mounting method shall isolate the control panel from generator-set vibration.
- C. Indicating and Protective Devices and Controls:
1. AC voltmeter.
 2. AC ammeter.
 3. AC frequency meter.
 4. DC voltmeter (alternator battery charging).
 5. Engine-coolant temperature gage.
 6. Engine lubricating-oil pressure gage.
 7. Running-time meter.
 8. Ammeter-voltmeter, phase-selector switch(es).
 9. Generator-voltage adjusting rheostat.
 10. Start-stop switch.
 11. Overspeed shutdown device.
 12. Coolant high-temperature shutdown device.
 13. Coolant low-level shutdown device.
 14. Oil low-pressure shutdown device.
 15. Fuel tank derangement alarm.

- D. Supporting Items: Include sensors, transducers, terminals, relays, and other devices and include wiring required to support specified items. Locate sensors and other supporting items on engine or generator, unless otherwise indicated.

2.6 GENERATOR OVERCURRENT AND FAULT PROTECTION

- A. Generator Circuit Breaker: Molded-case, thermal-magnetic type; 100 percent rated; complying with NEMA AB 1 and UL 489.
 - 1. Tripping Characteristic: Designed specifically for generator protection.
 - 2. Trip Rating: Matched to generator rating.
 - 3. Shunt Trip: Connected to trip breaker when generator set is shut down by other protective devices.
 - 4. Mounting: Adjacent to or integrated with control and monitoring panel.

2.7 GENERATOR, EXCITER, AND VOLTAGE REGULATOR

- A. Comply with NEMA MG 1.
- B. Drive: Generator shaft shall be directly connected to engine shaft. Exciter shall be rotated integrally with generator rotor.
- C. Electrical Insulation: Class H or Class F.
- D. Stator-Winding Leads: Brought out to terminal box to permit future reconnection for other voltages if required.
- E. Construction shall prevent mechanical, electrical, and thermal damage due to vibration, overspeed up to 125 percent of rating, and heat during operation at 110 percent of rated capacity.
- F. Enclosure: Dripproof.
- G. Instrument Transformers: Mounted within generator enclosure.
- H. Voltage Regulator: Solid-state type, separate from exciter, providing performance as specified.
 - 1. Adjusting rheostat on control and monitoring panel shall provide plus or minus 5 percent adjustment of output-voltage operating band.
- I. Windings: Two-thirds pitch stator winding and fully linked amortisseur winding.
- J. Subtransient Reactance: 12 percent, maximum.

2.8 OUTDOOR GENERATOR-SET ENCLOSURE

Description: Vandal-resistant, sound attenuating, weatherproof ALUMINUM housing with a dBA rating of 77 dBA at 23 feet under 100% load to meet Campbell County Code requirements and wind resistant up to 100 mph. Multiple panels shall be lockable and provide adequate access to components requiring maintenance. Panels shall be removable by one person without tools. Instruments and control shall be mounted within enclosure.

- A. Engine Cooling Airflow through Enclosure: Maintain temperature rise of system components within required limits when unit operates at 110 percent of rated load for 2 hours with ambient temperature at top of range specified in system service conditions.

- 1. Louvers: Fixed-engine, cooling-air inlet and discharge. Storm-proof and drainable louvers prevent entry of rain and snow. Radiator discharge is through a vertical plenum.

- B. Convenience Outlets: Factory wired, GFCI. Arrange for external electrical connection.

2.9 VIBRATION ISOLATION DEVICES

- A. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic restraint or manufacturer's equivalent integral linear type.

- B. Provide 3/4" depth x 3" wide neoprene rubber strips the length of the generator under each side of the base tank between the concrete pad and the bottom of the tank.

2.10 FINISHES

- A. Outdoor Enclosures and Components: Manufacturer's standard finish over corrosion-resistant pretreatment and compatible primer.

2.11 SOURCE QUALITY CONTROL

- A. Prototype Testing: Factory test engine-generator set using same engine model, constructed of identical or equivalent components and equipped with identical or equivalent accessories.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas, equipment bases, and conditions, with Installer present, for compliance with requirements for installation and other conditions affecting packaged engine-generator performance.

- B. Examine roughing-in of piping systems and electrical connections. Verify actual locations of connections before packaged engine-generator installation.

- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with packaged engine-generator manufacturers' written installation and alignment instructions and with NFPA 110.

- B. Install packaged engine generator to provide access, without removing connections or accessories, for periodic maintenance.

- C. Electrical Wiring: Install electrical devices furnished by equipment manufacturers but not specified to be factory mounted.

3.3 CONNECTIONS

- A. Ground equipment according to specifications on the drawings.
- B. Connect wiring according to specifications on the drawings.
- C. Use liquid-tight flexible metal conduit for final electrical connections to generator.

3.4 IDENTIFICATION

- A. Identify system components according to Division 26 Section "Common Work Results for Electrical."

3.5 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- B. Tests and Inspections:
 - 1. Perform tests recommended by manufacturer and each electrical test and visual and mechanical inspection (except those indicated to be optional) for "AC Generators and for Emergency Systems" specified in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - 2. NFPA 110 Acceptance Tests: Perform single-step full-load pickup test using a 100% rated load bank.
 - 3. Battery Tests: Equalize charging of battery cells according to manufacturer's written instructions. Record individual cell voltages.
 - a. Measure charging voltage and voltages between available battery terminals for full-charging and float-charging conditions. Check electrolyte level and specific gravity under both conditions.
 - b. Test for contact integrity of all connectors. Perform an integrity load test and a capacity load test for the battery.
 - c. Verify acceptance of charge for each element of the battery after discharge.
 - d. Verify that measurements are within manufacturer's specifications.
 - 4. Battery-Charger Tests: Verify specified rates of charge for both equalizing and float-charging conditions.
 - 5. System Integrity Tests: Methodically verify proper installation, connection, and integrity of each element of engine-generator system before and during system operation. Check for air, exhaust, and fluid leaks.
 - 6. Voltage and Frequency Transient Stability Tests: Use recording oscilloscope to measure voltage and frequency transients for 50 and 100 percent step-load increases and decreases and verify that performance is as specified.
 - 7. Harmonic-Content Tests: Measure harmonic content of output voltage under 25 percent and at 100 percent of rated linear load. Verify that harmonic content is within specified limits.

8. Noise Level Tests: Measure A-weighted level of noise emanating from generator-set installation, including engine exhaust and cooling-air intake and discharge, at four locations, and compare measured levels with required values.
 - C. Coordinate tests with tests for transfer switches and run them concurrently.
 - D. Test instruments shall have been calibrated within the last 12 months, traceable to standards of NIST, and adequate for making positive observation of test results. Make calibration records available for examination on request.
 - E. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - F. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - G. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - H. Remove and replace malfunctioning units and retest / reinspect as specified above.
 - I. Retest: Correct deficiencies identified by tests and observations and retest until specified requirements are met.
 - J. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation resistances, time delays, and other values and observations. Attach a label or tag to each tested component indicating satisfactory completion of tests.
- 3.6 DEMONSTRATION
- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain packaged engine generators.
 - B. Coordinate training with that required for automatic transfer switch.
 - C. Provide two (2) hours of training for generator.
- 3.7 FUELING
- A. Provide all fuel for testing and commissioning. Leave generator tank full at end of substantial completion and testing.

END OF SECTION 263213

SECTION 263600 - TRANSFER SWITCHES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes transfer switches rated 600 V and less, including the following:
 - 1. Automatic transfer switches.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, weights, operating characteristics, furnished specialties, and accessories.
- B. Shop Drawings: Dimensioned plans, elevations, sections, and details showing minimum clearances, conductor entry provisions, gutter space, installed features and devices, and material lists for each switch specified.
 - 1. Single-Line Diagram: Show connections between transfer switch, power sources, and load.
- C. Field quality-control test reports.
- D. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals. Include the following:
 - 1. Features and operating sequences, both automatic and manual.
 - 2. List of all factory settings of relays; provide relay-setting and calibration instructions, including software, where applicable.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Maintain a service center capable of providing training, parts, and emergency maintenance repairs within a response period of less than eight hours from time of notification.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with NEMA ICS 1.
- D. Comply with NFPA 70.
- E. Comply with NFPA 110.
- F. Comply with UL 1008 unless requirements of these Specifications are stricter.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Contactor Transfer Switches:
 - a. Caterpillar
 - b. Emerson; ASCO Power Technologies, LP,
 - c. Kohler.
 - d. Onan/Cummins Power Generation; Industrial Business Group.

2.2 GENERAL TRANSFER-SWITCH PRODUCT REQUIREMENTS

- A. Indicated Current Ratings: Apply as defined in UL 1008 for continuous loading and total system transfer, including tungsten filament lamp loads not exceeding 30 percent of switch ampere rating, unless otherwise indicated.
- B. Tested Fault-Current Closing and Withstand Ratings: Adequate for duty imposed by protective devices at installation locations in Project under the fault conditions indicated, based on testing according to UL 1008.
- C. Solid-State Controls: Repetitive accuracy of all settings shall be plus or minus 2 percent or better over an operating temperature range of minus 20 to plus 70 deg C.
- D. Resistance to Damage by Voltage Transients: Components shall meet or exceed voltage-surge withstand capability requirements when tested according to IEEE C62.41. Components shall meet or exceed voltage-impulse withstand test of NEMA ICS 1.
- E. Switch Characteristics: Designed for continuous-duty repetitive transfer of full-rated current between active power sources.
1. Limitation: Switches using molded-case switches or circuit breakers or insulated-case circuit-breaker components are not acceptable.
 2. Switch Action: Double throw; mechanically held in both directions.
 3. Contacts: Silver composition or silver alloy for load-current switching. Conventional automatic transfer-switch units, rated 225 A and higher, shall have separate arcing contacts.
- F. Neutral Terminal: Solid and fully rated, unless otherwise indicated to be switched.
- G. Factory Wiring: Train and bundle factory wiring and label, consistent with Shop Drawings, either by color-code or by numbered or lettered wire and cable tape markers at terminations. Color-coding and wire and cable tape markers are specified in Division 26 Section "Common Work Results for Electrical."
1. Designated Terminals: Pressure type, suitable for types and sizes of field wiring indicated.
 2. Power-Terminal Arrangement and Field-Wiring Space: Suitable for top, side, or bottom entrance of feeder conductors as indicated.
 3. Control Wiring: Equipped with lugs suitable for connection to terminal strips.

- H. Enclosures: NEMA 4X, complying with NEMA ICS 6 and UL 508, unless otherwise indicated.

2.3 AUTOMATIC TRANSFER SWITCHES

- A. Comply with Level 2 equipment according to NFPA 110.
- B. Electrical Operation: Accomplish by a nonfused, momentarily energized solenoid or electric-motor-operated mechanism, mechanically and electrically interlocked in both directions.
- C. Switching Arrangement: Double-throw type, incapable of pauses or intermediate position stops during normal functioning, unless otherwise indicated.
- D. Manual Switch Operation: Unloaded. Control circuit automatically disconnects from electrical operator during manual operation.
- E. In-Phase Monitor: Factory-wired, internal relay controls transfer so it occurs only when the two sources are synchronized in phase. Relay compares phase relationship and frequency difference between normal and emergency sources and initiates transfer when both sources are within 15 electrical degrees, and only if transfer can be completed within 60 electrical degrees. Transfer is initiated only if both sources are within 2 Hz of nominal frequency and 70 percent or more of nominal voltage.
- F. Automatic Transfer-Switch Features:
 - 1. Undervoltage Sensing for Each Phase of Normal Source: Sense low phase-to-ground voltage on each phase. Pickup voltage shall be adjustable from 85 to 100 percent of nominal, and dropout voltage is adjustable from 75 to 98 percent of pickup value. Factory set for pickup at 90 percent and dropout at 85 percent.
 - 2. Adjustable Time Delay: For override of normal-source voltage sensing to delay transfer and engine start signals. Adjustable from zero to six seconds, and factory set for one second.
 - 3. Voltage/Frequency Lockout Relay: Prevent premature transfer to generator. Pickup voltage shall be adjustable from 85 to 100 percent of nominal. Factory set for pickup at 90 percent. Pickup frequency shall be adjustable from 90 to 100 percent of nominal. Factory set for pickup at 95 percent.
 - 4. Time Delay for Retransfer to Normal Source: Adjustable from 0 to 30 minutes, and factory set for 10 minutes to automatically defeat delay on loss of voltage or sustained undervoltage of emergency source, provided normal supply has been restored.
 - 5. Test Switch: Simulate normal-source failure.
 - 6. Switch-Position Pilot Lights: Indicate source to which load is connected.
 - 7. Source-Available Indicating Lights: Supervise sources via transfer-switch normal- and emergency-source sensing circuits.
 - a. Normal Power Supervision: Green light with nameplate engraved "Normal Source Available."
 - b. Emergency Power Supervision: Red light with nameplate engraved "Emergency Source Available."
 - 8. Unassigned Auxiliary Contacts: Two normally open, single-pole, double-throw contacts for each switch position, rated 10 A at 240-V ac.
 - 9. Transfer Override Switch: Overrides automatic retransfer control so automatic transfer switch will remain connected to emergency power source regardless of condition of normal source. Pilot light indicates override status.

10. Engine Starting Contacts: One isolated and normally closed, and one isolated and normally open; rated 10 A at 32-V dc minimum.
11. Engine Shutdown Contacts: Time delay adjustable from zero to five minutes, and factory set for five minutes. Contacts shall initiate shutdown at remote engine-generator controls after retransfer of load to normal source.
12. Engine-Generator Exerciser: Solid-state, programmable-time switch starts engine generator and transfers load to it from normal source for a preset time, then retransfers and shuts down engine after a preset cool-down period. Initiates exercise cycle at preset intervals adjustable from 7 to 30 days. Running periods are adjustable from 10 to 30 minutes. Factory settings are for 7-day exercise cycle, 20-minute running period, and 5-minute cool-down period. Exerciser features include the following:
 - a. Exerciser Transfer Selector Switch: Permits selection of exercise with and without load transfer.
 - b. Push-button programming control with digital display of settings.
 - c. Integral battery operation of time switch when normal control power is not available.

2.4 SOURCE QUALITY CONTROL

- A. Factory test and inspect components, assembled switches, and associated equipment. Ensure proper operation. Check transfer time and voltage, frequency, and time-delay settings for compliance with specified requirements. Perform dielectric strength test complying with NEMA ICS 1.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Identify components according to specifications on the drawings.
- B. Set field-adjustable intervals and delays, relays, and engine exerciser clock.

3.2 CONNECTIONS

- A. Wiring to Remote Components: Match type and number of cables and conductors to control and communication requirements of transfer switches as recommended by manufacturer. Increase raceway sizes at no additional cost to Owner if necessary, to accommodate required wiring.
- B. Ground equipment according to Division 26 Section "Common Work Results for Electrical."
- C. Connect wiring according to Division 26 Section "Common Work Results for Electrical."

3.3 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installation, including connections, and to assist in testing.
 2. After installing equipment and after electrical circuitry has been energized, test for compliance with requirements.
 3. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

4. Measure insulation resistance phase-to-phase and phase-to-ground with insulation-resistance tester. Include external annunciation and control circuits. Use test voltages and procedure recommended by manufacturer. Comply with manufacturer's specified minimum resistance.
 - a. Check for electrical continuity of circuits and for short circuits.
 - b. Inspect for physical damage, proper installation and connection, and integrity of barriers, covers, and safety features.
 - c. Verify that manual transfer warnings are properly placed.
 - d. Perform manual transfer operation.
 5. After energizing circuits, demonstrate interlocking sequence and operational function for each switch at least three times.
 - a. Simulate power failures of normal source to automatic transfer switches and of emergency source with normal source available.
 - b. Simulate loss of phase-to-ground voltage for each phase of normal source.
 - c. Verify time-delay settings.
 - d. Verify pickup and dropout voltages by data readout or inspection of control settings.
 - e. Test bypass/isolation unit functional modes and related automatic transfer-switch operations.
 - f. Verify proper sequence and correct timing of automatic engine starting, transfer time delay, retransfer time delay on restoration of normal power, and engine cool-down and shutdown.
- B. Coordinate tests with tests of generator and run them concurrently.
 - C. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation and contact resistances and time delays. Attach a label or tag to each tested component indicating satisfactory completion of tests.
 - D. Remove and replace malfunctioning units and retest as specified above.
- 3.4 DEMONSTRATION
- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain transfer switches and related equipment as specified below.
 - B. Coordinate this training with that for generator equipment.
 - C. Provide two (2) hours of automatic transfer switch training.

END OF SECTION 263600

SECTION 311000 - SITE CLEARING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Section “General Requirements” Sections, apply to this Section.

1.2 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, and abandoning site utilities in place.
- 7. Temporary erosion- and sedimentation-control measures.

- B. Related Sections:

- 1. Section “Construction Facilities and Temporary Controls” for temporary utility services, construction and support facilities, security and protection facilities, and temporary erosion- and sedimentation-control measures.

1.3 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.
- D. 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 (50 mm) in diameter; and free of subsoil and weeds, roots, toxic materials, or other nonsoil materials.
- E. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction, and indicated on Drawings.

- F. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction, and defined by a circle concentric with each tree with a radius 1.5 times the diameter of the drip line unless otherwise indicated.
- G. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.4 MATERIAL OWNERSHIP

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

1.5 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 or videotape.
 - 2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plants designated to remain.
- B. Record Drawings: Identifying and accurately showing locations of capped utilities and other subsurface structural, electrical, and mechanical conditions.

1.6 QUALITY ASSURANCE

- A. Preinstallation Conference: Conduct conference at Project site.

1.7 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 until directed by Engineer.
- C. Salvable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where indicated.

- D. Utility Locator Service: Notify Miss Utility for area where Project is located before site clearing.
- E. Do not commence site clearing operations until temporary erosion- and sedimentation-control and tree-protection measures are in place.
- F. The following practices are prohibited within protection zones:
 - 1. Storage of construction materials, debris, or excavated material.
 - 2. Parking vehicles or equipment.
 - 3. Foot traffic.
 - 4. Erection of sheds or structures.
 - 5. Impoundment of water.
 - 6. Excavation or other digging unless otherwise indicated.
 - 7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.
- G. Do not direct vehicle or equipment exhaust towards protection zones.
- H. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.
- I. Soil Stripping, Handling, and Stockpiling: Perform only when the topsoil is dry or slightly moist.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Section 312000 "Earth Moving."
 - 1. Obtain approved borrow soil material off-site when satisfactory soil material is not available on-site.
- B. Antirust Coating: Fast-curing, lead- and chromate-free, self-curing, universal modified-alkyd primer complying with MPI #79, Alkyd Anticorrosive Metal Primer.
 - 1. Use coating with a VOC content of 420 g/L (3.5 lb/gal.) or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

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. Wrap a 1-inch (25-mm) blue vinyl tie tape flag around each tree trunk at 54 inches (1372 mm) above the ground.
- 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 TEMPORARY EROSION AND SEDIMENTATION CONTROL

- A. Provide temporary erosion- and sedimentation-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to erosion- and sedimentation-control Drawings and requirements of authorities having jurisdiction.
- B. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.
- C. Inspect, maintain, and repair erosion- and sedimentation-control measures during construction until permanent vegetation has been established.
- D. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.3 TREE AND PLANT PROTECTION

- A. General: Protect trees and plants remaining on-site according to requirements in Section “Site Preparation”
- B. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations, in a manner approved by Architect.

3.4 EXISTING UTILITIES

- A. Owner will arrange for disconnecting and sealing indicated utilities that serve existing structures before site clearing, when requested by Contractor.
 - 1. Verify that utilities have been disconnected and capped before proceeding with site clearing.
- B. 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.
 - 2. Owner will arrange to shut off indicated utilities when requested by Contractor.
- C. Locate, identify, and disconnect utilities indicated to be abandoned in place.
- D. The Contractor shall be responsible for proper drainage of the site(s) during construction of the project. Water shall not be allowed to accumulate in any of the excavated areas. Storm or ground

water collecting on the site during construction shall be removed by pumping, ditching, or other suitable means.

- E. 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 Engineer not less than two (2) days in advance of proposed utility interruptions.
 - 2. Do not proceed with utility interruptions without Engineer's written permission.
- F. 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 18 inches (450 mm) 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. Place fill material in horizontal layers not exceeding a loose depth of 8 inches (200 mm), 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 (150 mm) in a manner to prevent intermingling with underlying subsoil or other waste materials.
 - 1. Remove subsoil and nonsoil materials from topsoil, including clay lumps, gravel, and other objects more than 2 inches (50 mm) 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 (1800 mm).
 - 2. Do not stockpile topsoil within protection zones.
 - 3. Dispose of surplus topsoil. Surplus topsoil is that which exceeds quantity indicated to be stockpiled or reused.
 - 4. Stockpile surplus topsoil to allow for respreading deeper topsoil.

3.7 SITE IMPROVEMENTS

- A. Remove existing above- and below-grade improvements as indicated and necessary to facilitate new construction.
- B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.
 - 1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut along line of existing pavement to remain before removing adjacent existing pavement. Saw-cut faces vertically.
 - 2. Paint cut ends of steel reinforcement in concrete to remain with two coats of antirust coating, following coating manufacturer's written instructions. Keep paint off surfaces that will remain exposed.

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.
- B. Separate recyclable materials produced during site clearing from other nonrecyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities. Do not interfere with other Project work.

END OF SECTION 311000

SECTION 312000 - EARTH MOVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 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. Drainage course for concrete slabs-on-grade.
4. Subbase course for concrete walks and pavements.
5. Subbase course and base course for asphalt paving.
6. Subsurface drainage backfill for walls and trenches.
7. Excavating and backfilling trenches for utilities and pits for buried utility structures.
8. Excavating well hole to accommodate elevator-cylinder assembly.

- B. Related Sections:

1. Section "Construction Facilities and Temporary Controls" for temporary controls, utilities, and support facilities; also for temporary site fencing if not in another Section.
2. Section "Cast-in-Place Concrete" for granular course if placed over vapor retarder and beneath the slab-on-grade.
3. Section "Site Clearing" for site stripping, grubbing, stripping and stockpiling topsoil, and removal of above- and below-grade improvements and utilities.
4. Section "Dewatering" for lowering and disposing of ground water during construction.

1.3 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. Base Course: Aggregate layer placed between the subbase course and hot-mix asphalt paving.
- C. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.
- D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

- E. Drainage Course: Aggregate layer supporting the slab-on-grade that also minimizes upward capillary flow of pore water.
- F. 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. Authorized additional excavation will be unclassified excavation.
 - 2. Bulk Excavation: Excavation more than 10 feet (3 m) in width and more than 30 feet (9 m) in length.
 - 3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Engineer. Unauthorized excavation, as well as remedial work directed by Engineer, shall be without additional compensation.
- G. Fill: Soil materials used to raise existing grades.
- H. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material that exceed 1 cu. yd. (0.76 cu. m) for bulk excavation or 3/4 cu. yd. (0.57 cu. m) for footing, trench, and pit excavation that cannot be removed by rock excavating equipment equivalent to the following in size and performance ratings, without systematic drilling, ram hammering, ripping, or blasting, when permitted:
 - 1. Excavation of Footings, Trenches, and Pits: Late-model, track-mounted hydraulic excavator; equipped with a 42-inch- (1065-mm-) wide, maximum, short-tip-radius rock bucket; rated at not less than 138-hp (103-kW) flywheel power with bucket-curling force of not less than 28,700 lbf (128 kN) and stick-crowd force of not less than 18,400 lbf (82 kN) with extra-long reach boom; measured according to SAE J-1179.
 - 2. Bulk Excavation: Late-model, track-mounted loader; rated at not less than 230-hp (172-kW) flywheel power and developing a minimum of 47,992-lbf (213.3-kN) breakout force with a general-purpose bare bucket; measured according to SAE J-732.
- I. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material 3/4 cu. yd. (0.57 cu. m) or more in volume that exceed a standard penetration resistance of 100 blows/2 inches (97 blows/50 mm) when tested by a geotechnical testing agency, according to ASTM D 1586.
- J. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
- K. 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 cement concrete pavement or a cement concrete or hot-mix asphalt walk.
- L. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.
- M. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of the following manufactured products required:
 - 1. Geotextiles.
 - 2. Controlled low-strength material, including design mixture.
 - 3. Geofoam.
 - 4. Warning tapes.
- B. Samples for Verification: For the following products, in sizes indicated below:
 - 1. Geotextile: 12 by 12 inches (300 by 300 mm).
 - 2. Warning Tape: 12 inches (300 mm) long; of each color.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified testing agency.
- B. 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.
- C. Blasting plan approved by authorities having jurisdiction.
- D. Seismic survey report from seismic survey agency.
- E. Preexcavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by earth moving operations. Submit before earth moving begins.

1.6 QUALITY ASSURANCE

- A. Blasting: Comply with applicable requirements in NFPA 495, "Explosive Materials Code," and prepare a blasting plan reporting the following:
 - 1. Types of explosive and sizes of charge to be used in each area of rock removal, types of blasting mats, sequence of blasting operations, and procedures that will prevent damage to site improvements and structures on Project site and adjacent properties.
 - 2. Seismographic monitoring during blasting operations.
- B. Seismic Survey Agency: An independent testing agency, acceptable to authorities having jurisdiction, experienced in seismic surveys and blasting procedures to perform the following services:
 - 1. Report types of explosive and sizes of charge to be used in each area of rock removal, types of blasting mats, sequence of blasting operations, and procedures that will prevent damage to site improvements and structures on Project site and adjacent properties.
 - 2. Seismographic monitoring during blasting operations.

- C. Geotechnical Testing Agency Qualifications: Qualified according to ASTM E 329 and ASTM D 3740 for testing indicated.
- D. Preexcavation Conference: Conduct conference at Project site.

1.7 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.
- 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.
- C. Utility Locator Service: Notify "Miss Utility" 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, specified in Section "Construction Facilities and Temporary Controls," Section "Site Clearing," are in place.
- E. Do not commence earth moving operations until plant-protection measures specified in Section "Site Preparation" are in place.
- F. The following practices are prohibited within protection zones:
 - 1. Storage of construction materials, debris, or excavated material.
 - 2. Parking vehicles or equipment.
 - 3. Foot traffic.
 - 4. Erection of sheds or structures.
 - 5. Impoundment of water.
 - 6. Excavation or other digging unless otherwise indicated.
 - 7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.
- G. Do not direct vehicle or equipment exhaust towards protection zones.
- H. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.

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 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 3 inches (75 mm) in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.
- C. Unsatisfactory Soils: Soil Classification Groups GC, SC, CL, ML, 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 2 percent of optimum moisture content at time of compaction.
- D. Subbase Material: 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 (37.5-mm) sieve and not more than 12 percent passing a No. 200 (0.075-mm) sieve.
- E. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 95 percent passing a 1-1/2-inch (37.5-mm) sieve and not more than 8 percent passing a No. 200 (0.075-mm) sieve.
- 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 (37.5-mm) sieve and not more than 12 percent passing a No. 200 (0.075-mm) sieve.
- G. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch (25-mm) sieve and not more than 8 percent passing a No. 200 (0.075-mm) sieve.
- H. Drainage Course: 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 (37.5-mm) sieve and 0 to 5 percent passing a No. 8 (2.36-mm) sieve.
- I. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D 448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch (25-mm) sieve and 0 to 5 percent passing a No. 4 (4.75-mm) sieve.
- J. Sand: ASTM C 33; fine aggregate.
- K. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

2.2 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. Survivability: Class 2; AASHTO M 288.
2. Grab Tensile Strength: 157 lbf (700 N); ASTM D 4632.
3. Sewn Seam Strength: 142 lbf (630 N); ASTM D 4632.
4. Tear Strength: 56 lbf (250 N); ASTM D 4533.
5. Puncture Strength: 56 lbf (250 N); ASTM D 4833.
6. Apparent Opening Size: No. 60 (0.250-mm) sieve, maximum; ASTM D 4751.
7. Permittivity: 0.2 per second, minimum; ASTM D 4491.
8. 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. Survivability: Class 2; AASHTO M 288.
2. Grab Tensile Strength: 247 lbf (1100 N); ASTM D 4632.
3. Sewn Seam Strength: 222 lbf (990 N); ASTM D 4632.
4. Tear Strength: 90 lbf (400 N); ASTM D 4533.
5. Puncture Strength: 90 lbf (400 N); ASTM D 4833.
6. Apparent Opening Size: No. 60 (0.250-mm) sieve, maximum; ASTM D 4751.
7. Permittivity: 0.02 per second, minimum; ASTM D 4491.
8. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.

2.3 CONTROLLED LOW-STRENGTH MATERIAL

A. Controlled Low-Strength Material: Self-compacting flowable concrete material produced from the following:

1. Portland Cement: ASTM C 150, Type I.
2. Fly Ash: ASTM C 618, Class C or F.
3. Normal-Weight Aggregate: ASTM C 33, 3/4-inch (19-mm) nominal maximum aggregate size.
4. Foaming Agent: ASTM C 869.
5. Water: ASTM C 94/C 94M.
6. Air-Entraining Admixture: ASTM C 260.

B. Produce low-density, controlled low-strength material with the following physical properties:

1. As-Cast Unit Weight: 30 to 36 lb/cu. ft. (480 to 576 kg/cu. m) at point of placement, when tested according to ASTM C 138/C 138M.
2. Compressive Strength: 80 psi (550 kPa), when tested according to ASTM C 495.

C. Produce conventional-weight, controlled low-strength material with 80-psi (550-kPa) compressive strength when tested according to ASTM C 495.

2.4 GEOFOAM

- A. Extruded-Polystyrene Board Insulation: ASTM C 578, Type IV, 1.55-lb/cu. ft. (25-kg/cu. m) density, 25-psi (173-kPa) compressive strength.
- B. Molded-Polystyrene Board Insulation: ASTM C 578, Type I, 0.90-lb/cu. ft. (15-kg/cu. m) density, 10-psi (69-kPa) compressive strength.
 - 1. Manufacture molded polystyrene with an inorganic mineral registered with the EPA and suitable for application as a termite deterrent.
- C. Rigid Cellular Polystyrene Geofoam: ASTM D 6817, Type EPS 19, 1.15-lb/cu. ft. (18.4-kg/cu. m) density, 5.8-psi (40-kPa) compressive strength at 1 percent deformation; 16-psi (110-kPa) compressive strength at 10 percent deformation.
- D. Connectors: Geofoam manufacturer's multibarbed, galvanized-steel sheet connectors.

2.5 ACCESSORIES

- A. Detectable Warning Tape: Underground marking tape shall be a 2-inch wide detectable marking tape, with a minimum 5.0 mil overall thickness. Tape shall be manufactured using a 0.8 mil clear virgin polypropylene film, reverse printed and laminated to a solid 0.35 mil solid aluminum foil core, and then laminated to a 3.75 mil clear Virginia polyethylene film. Tape shall be printed "CAUTION BURIED SEWER LINE BELOW" and meet the APWA Color-Code standard for identification of buried utilities. Acceptable marking tapes are:
 - 1. Pro-Line Safety Products.
 - 2. Presco.
 - 3. Mutual Industries, Inc.

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: Obtain written permission from authorities having jurisdiction before bringing explosives to Project site or using explosives on Project site.
 - 1. Perform blasting without damaging adjacent structures, property, or site improvements.
 - 2. Perform blasting without weakening the bearing capacity of rock subgrade and with the least-practicable disturbance to rock to remain.

3.4 EXCAVATION, GENERAL

- A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions. All excavation is to be unclassified.
 - 1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.
 - 2. Remove rock to lines and grades indicated to permit installation of permanent construction without exceeding the following dimensions:
 - a. 24 inches (600 mm) outside of concrete forms other than at footings.
 - b. 12 inches (300 mm) outside of concrete forms at footings.
 - c. 6 inches (150 mm) 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 (150 mm) beneath bottom of concrete slabs-on-grade.
 - f. 6 inches (150 mm) beneath pipe in trenches, and the greater of 24 inches (600 mm) wider than pipe or 42 inches (1065 mm) wide.
- B. Classified Excavation: Excavate to subgrade elevations. Material to be excavated will be classified as earth and rock. Do not excavate rock until it has been classified and cross sectioned by Engineer. The Contract Sum will be adjusted for rock excavation according to unit prices included in the Contract Documents. Changes in the Contract Time may be authorized for rock excavation. All excavation is to be unclassified.
 - 1. Earth excavation includes excavating pavements and obstructions visible on surface; underground structures, utilities, and other items indicated to be removed; together with soil, boulders, and other materials not classified as rock or unauthorized excavation.
 - a. Intermittent drilling; blasting, if permitted; ram hammering; or ripping of material not classified as rock excavation is earth excavation.

2. Rock excavation includes removal and disposal of rock. Remove rock to lines and subgrade elevations indicated to permit installation of permanent construction without exceeding the following dimensions:
 - a. 24 inches (600 mm) outside of concrete forms other than at footings.
 - b. 12 inches (300 mm) outside of concrete forms at footings.
 - c. 6 inches (150 mm) 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 (150 mm) beneath bottom of concrete slabs-on-grade.
 - f. 6 inches (150 mm) beneath pipe in trenches, and the greater of 24 inches (600 mm) wider than pipe or 42 inches (1065 mm) wide.

3.5 EXCAVATION FOR STRUCTURES

- A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch (25 mm). 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: Do not disturb bottom of excavation. 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.
 2. Pile Foundations: Stop excavations 6 to 12 inches (150 to 300 mm) above bottom of pile cap before piles are placed. After piles have been driven, remove loose and displaced material. Excavate to final grade, leaving solid base to receive concrete pile caps.
 3. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch (25 mm). Do not disturb bottom of excavations intended as bearing surfaces.
- B. Excavations at Edges of Tree- and Plant-Protection Zones:
 1. Excavate by hand to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
 2. Cut and protect roots according to requirements in "Site Preparation"

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.

1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.
- B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches (300 mm) higher than top of pipe or conduit unless otherwise indicated.
 1. Clearance: 12 inches (300 mm) each side of pipe or conduit.
- C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.
 1. For pipes and conduit less than 6 inches (150 mm) in nominal diameter, hand-excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.
 2. For pipes and conduit 6 inches (150 mm) or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe or conduit circumference. Fill depressions with tamped sand backfill.
 3. For flat-bottomed, multiple-duct conduit units, hand-excavate trench bottoms and support conduit on an undisturbed subgrade.
 4. Excavate trenches 6 inches (150 mm) deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.
- D. Trench Bottoms:
 1. 4" min bedding required for ductile iron pipe larger than 12", and for all pipe sizes when cover exceeds 10 feet.
 2. Bedding for plastic pipe shall be from the top of pipe to 6" min. below pipe.
 3. Depth of bedding for all types of pipe shall be 6" when trench bottom is located in rock.
 4. Bedding stone shall be #57 or #68.
- E. Trenches in Tree- and Plant-Protection Zones:
 1. Hand-excavate to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
 2. Do not cut main lateral roots or taproots; cut only smaller roots that interfere with installation of utilities.
 3. Cut and protect roots according to requirements in Section "Site Preparation"

3.8 SUBGRADE INSPECTION

- A. Notify Engineer when excavations have reached required subgrade.
- B. If Engineer 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 (13.6 tonnes) 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 (5 km/h).
 - 2. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Engineer, and replace with compacted backfill or fill as directed.
- D. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Engineer, 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 (17.2 MPa), may be used when approved by Engineer.
 - 1. Fill unauthorized excavations under other construction, pipe, or conduit as directed by Engineer.

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.

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.

3.12 UTILITY TRENCH BACKFILL

- A. Place backfill on subgrades free of mud, frost, snow, or ice.

- B. 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.
- C. Trenches under Footings: Backfill trenches excavated under footings and within 18 inches (450 mm) of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings. Concrete is specified in Section "Cast-in-Place Concrete".
- D. Trenches under Roadways: Provide 4-inch- (100-mm-) thick, concrete-base slab support for piping or conduit less than 30 inches (750 mm) below surface of roadways. After installing and testing, completely encase piping or conduit in a minimum of 4 inches (100 mm) of concrete before backfilling or placing roadway subbase course. Concrete is specified in Section "Cast-in-Place Concrete".
- E. Backfill voids with satisfactory soil while removing shoring and bracing.
- F. Place and compact initial backfill of satisfactory soil, free of particles larger than 1 inch (25 mm) in any dimension, to a height of 12 inches (300 mm) over the pipe or conduit.
 - 1. 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.
- G. Controlled Low-Strength Material: Place initial backfill of controlled low-strength material to a height of 12 inches (300 mm) over the pipe or conduit. Coordinate backfilling with utilities testing.
- H. Place and compact final backfill of satisfactory soil to final subgrade elevation.
- I. Controlled Low-Strength Material: Place final backfill of controlled low-strength material to final subgrade elevation.
- J. Install warning tape directly above utilities, 18-24 inches below finished grade.

3.13 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.

3.14 GEOFOAM FILL

- A. Place a leveling course of sand, 2 inches (50 mm) thick, over subgrade. Finish leveling course to a tolerance of 1/2 inch (13 mm) when tested with a 10-foot (3-m) straightedge.
 - 1. Place leveling course on subgrades free of mud, frost, snow, or ice.
- B. Install geofoam blocks in layers with abutting edges and ends and with the long dimension of each block at right angles to blocks in each subsequent layer. Offset joints of blocks in successive layers.
- C. Install geofoam connectors at each layer of geofoam to resist horizontal displacement according to geofoam manufacturer's written instructions.
- D. Cover geofoam with subdrainage geotextile before placing overlying soil materials.

3.15 SOIL MOISTURE CONTROL

- A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 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 2 percent and is too wet to compact to specified dry unit weight.

3.16 COMPACTION OF SOIL BACKFILLS AND FILLS

- A. Place backfill and fill soil materials in layers not more than 8 inches (200 mm) in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches (100 mm) 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 12 inches (300 mm) of existing subgrade and each layer of backfill or fill soil material at 95 percent.
 - 2. Under walkways, scarify and recompact top 6 inches (150 mm) below subgrade and compact each layer of backfill or fill soil material at 95 percent.
 - 3. Under turf or unpaved areas, scarify and recompact top 6 inches (150 mm) below subgrade and compact each layer of backfill or fill soil material at 90 percent.
 - 4. For utility trenches, compact each layer of initial and final backfill soil material at 95 percent.

3.17 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 (25 mm).
 - 2. Walks: Plus or minus 1 inch (25 mm).
 - 3. Pavements: Plus or minus 1/2 inch (13 mm).
- C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch (13 mm) when tested with a 10-foot (3-m) straightedge.

3.18 SUBSURFACE DRAINAGE

- A. Subsurface Drain: Place subsurface drainage geotextile around perimeter of subdrainage trench. Place a 6-inch (150-mm) course of filter material on subsurface drainage geotextile to support subdrainage pipe. Encase subdrainage pipe in a minimum of 12 inches (300 mm) of filter material, placed in compacted layers 6 inches (150 mm) thick, and wrap in subsurface drainage geotextile, overlapping sides and ends at least 6 inches (150 mm).
 - 1. Compact each filter material layer to 85 percent of maximum dry unit weight according to ASTM D 698 with a minimum of two passes of a plate-type vibratory compactor.
- B. Drainage Backfill: Place and compact filter material over subsurface drain, in width indicated, to within 12 inches (300 mm) of final subgrade, in compacted layers 6 inches (150 mm) thick. Overlay drainage backfill with one layer of subsurface drainage geotextile, overlapping sides and ends at least 6 inches (150 mm).
 - 1. Compact each filter material layer to 85 percent of maximum dry unit weight according to ASTM D 698 with a minimum of two passes of a plate-type vibratory compactor.
 - 2. Place and compact impervious fill over drainage backfill in 6-inch- (150-mm-) thick compacted layers to final subgrade.

3.19 SUBBASE AND BASE COURSES UNDER PAVEMENTS AND WALKS

- A. Place subbase course and base course on subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade, place subbase course and base course under pavements and walks as follows:
 - 1. Install separation geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
 - 2. Place base course material over subbase course under hot-mix asphalt pavement.

3. Shape subbase course and base course to required crown elevations and cross-slope grades.
 4. Place subbase course and base course 6 inches (150 mm) or less in compacted thickness in a single layer.
 5. Place subbase course and base course that exceeds 6 inches (150 mm) in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches (150 mm) thick or less than 3 inches (75 mm) thick.
 6. Compact subbase course and base course 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.
- C. Pavement Shoulders: Place shoulders along edges of subbase course and base course to prevent lateral movement. Construct shoulders, at least 12 inches (300 mm) wide, of satisfactory soil materials and compact simultaneously with each subbase and base layer to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

3.20 DRAINAGE COURSE UNDER CONCRETE SLABS-ON-GRADE

- A. Place drainage course on subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade, place and compact drainage course 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 drainage course 6 inches (150 mm) or less in compacted thickness in a single layer.
 3. Place drainage course that exceeds 6 inches (150 mm) in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches (150 mm) thick or less than 3 inches (75 mm) thick.
 4. Compact each layer of drainage course to required cross sections and thicknesses to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

3.21 FIELD QUALITY CONTROL

- A. Special Inspections: Contractor will engage a qualified special inspector to perform the following special inspections:
 1. Determine prior to placement of fill that site has been prepared in compliance with requirements.
 2. Determine that fill material and maximum lift thickness comply with requirements.
 3. Determine, at the required frequency, that in-place density of compacted fill complies with requirements.
- B. Testing Agency: Contractor will engage a qualified geotechnical engineering testing agency to perform tests and inspections.
- C. 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.

- D. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Engineer.
- E. 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. (186 sq. m) 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 (30 m) 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 1000 feet (305 m) or less of trench length, but no fewer than two tests.
- F. 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.

3.22 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.

3.23 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.
- B. Transport surplus satisfactory soil to designated storage areas on Owner's property. Stockpile or spread soil as directed by Engineer.
 - 1. Remove waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION 312000

SECTION 312319 – DEWATERING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Section “General Requirements” Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes construction dewatering.
- B. Related Requirements:
 - 1. Section "Earth Moving" for excavating, backfilling, site grading, and controlling surface-water runoff and ponding.

1.3 ALLOWANCES

- A. Dewatering observation wells are part of dewatering allowance.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Verify availability of Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 2. Review condition of site to be dewatered including coordination with temporary erosion-control measures and temporary controls and protections.
 - 3. Review proposed site clearing and excavations.
 - 4. Review existing utilities and subsurface conditions.
 - 5. Review observation and monitoring of dewatering system.

1.5 ACTION SUBMITTALS

- A. Shop Drawings: For dewatering system, prepared by or under the supervision of a qualified professional engineer.
 - 1. Include plans, elevations, sections, and details.
 - 2. Show arrangement, locations, and details of wells and well points; locations of risers, headers, filters, pumps, power units, and discharge lines; and means of discharge, control of sediment, and disposal of water.
 - 3. Include layouts of piezometers and flow-measuring devices for monitoring performance of dewatering system.

4. Include written plan for dewatering operations including sequence of well and well-point placement coordinated with excavation shoring and bracings and control procedures to be adopted if dewatering problems arise.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Field quality-control reports.
- C. Existing Conditions: Using photographs or video recordings, show existing conditions of adjacent construction and site improvements that might be misconstrued as damage caused by dewatering operations. Submit before Work begins.
- D. Record Drawings: Identify locations and depths of capped wells and well points and other abandoned-in-place dewatering equipment.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer that has specialized in design of dewatering systems and dewatering work.

1.8 FIELD CONDITIONS

- A. Project-Site Information: A geotechnical report has not been prepared for this project.
 1. Make test borings and conduct other exploratory operations necessary for dewatering according to the performance requirements.
- B. Survey Work: Engage a qualified land surveyor or professional engineer to survey adjacent existing buildings, structures, and site improvements; establish exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Dewatering Performance: Design, furnish, install, test, operate, monitor, and maintain dewatering system of sufficient scope, size, and capacity to control hydrostatic pressures and to lower, control, remove, and dispose of ground water and permit excavation and construction to proceed on dry, stable subgrades.
 1. Design dewatering system, including comprehensive engineering analysis by a qualified professional engineer.
 2. Continuously monitor and maintain dewatering operations to ensure erosion control, stability of excavations and constructed slopes, prevention of flooding in excavation, and prevention of damage to subgrades and permanent structures.

3. Prevent surface water from entering excavations by grading, dikes, or other means.
 4. Accomplish dewatering without damaging existing buildings, structures, and site improvements adjacent to excavation.
 5. Remove dewatering system when no longer required for construction.
- B. Regulatory Requirements: Comply with governing EPA notification regulations before beginning dewatering. Comply with water- and debris-disposal regulations of authorities having jurisdiction.

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 dewatering operations.
1. Prevent surface water and subsurface or ground water from entering excavations, from ponding on prepared subgrades, and from flooding site or surrounding area.
 2. Protect subgrades and foundation soils from softening and damage by rain or water accumulation.
- B. Install dewatering system to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.
1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
- C. Provide temporary grading to facilitate dewatering and control of surface water.
- D. Protect and maintain temporary erosion and sedimentation controls, which are specified in Section "Construction Facilities and Temporary Controls," during dewatering operations.

3.2 INSTALLATION

- A. Install dewatering system utilizing wells, well points, or similar methods complete with pump equipment, standby power and pumps, filter material gradation, valves, appurtenances, water disposal, and surface-water controls.
1. Space well points or wells at intervals required to provide sufficient dewatering.
 2. Use filters or other means to prevent pumping of fine sands or silts from the subsurface.
- B. Place dewatering system into operation to lower water to specified levels before excavating below ground-water level.
- C. Provide sumps, sedimentation tanks, and other flow-control devices as required by authorities having jurisdiction.

- D. Provide standby equipment on-site, installed and available for immediate operation, to maintain dewatering on continuous basis if any part of system becomes inadequate or fails.

3.3 OPERATION

- A. Operate system continuously until drains, sewers, and structures have been constructed and fill materials have been placed or until dewatering is no longer required.
- B. Operate system to lower and control ground water to permit excavation, construction of structures, and placement of fill materials on dry subgrades. Drain water-bearing strata above and below bottom of foundations, drains, sewers, and other excavations.
 - 1. Do not permit open-sump pumping that leads to loss of fines, soil piping, subgrade softening, and slope instability.
 - 2. Reduce hydrostatic head in water-bearing strata below subgrade elevations of foundations, drains, sewers, and other excavations.
 - 3. Maintain piezometric water level a minimum of 24 inches (600 mm) below bottom of excavation.
- C. Dispose of water removed by dewatering in a manner that avoids endangering public health, property, and portions of work under construction or completed. Dispose of water and sediment in a manner that avoids inconvenience to others.
- D. Remove dewatering system from Project site on completion of dewatering. Plug or fill well holes with sand or cut off and cap wells a minimum of 36 inches (900 mm) below overlying construction.

3.4 FIELD QUALITY CONTROL

- A. Observation Wells: Provide observation wells or piezometers, take measurements, and maintain at least the minimum number indicated; additional observation wells may be required by authorities having jurisdiction.
 - 1. Observe and record daily elevation of ground water and piezometric water levels in observation wells.
 - 2. Repair or replace, within 24 hours, observation wells that become inactive, damaged, or destroyed. In areas where observation wells are not functioning properly, suspend construction activities until reliable observations can be made. Add or remove water from observation-well risers to demonstrate that observation wells are functioning properly.
 - 3. Fill observation wells, remove piezometers, and fill holes when dewatering is completed.
- B. Survey-Work Benchmarks: Resurvey benchmarks monthly during dewatering and maintain an accurate log of surveyed elevations for comparison with original elevations. Promptly notify Engineer if changes in elevations occur or if cracks, sags, or other damage is evident in adjacent construction.
- C. Provide continual observation to ensure that subsurface soils are not being removed by the dewatering operation.

- D. Prepare reports of observations.

3.5 PROTECTION

- A. Protect and maintain dewatering system during dewatering operations.
- B. Promptly repair damages to adjacent facilities caused by dewatering.

END OF SECTION 312319

SECTION 312513 - EROSION CONTROLS

PART 1 – GENERAL

1.1 DESCRIPTION

1. Work Included: Furnish all labor, materials, supplies, equipment, and appurtenances necessary for the complete and satisfactory construction and maintenance of the erosion control measures shown on the plans. Properties and natural waterways adjacent to the site of land disturbance shall be protected from sedimentation by the use of the erosion control and storm water drainage measures shown on the plans and as may be deemed necessary by the Owner during construction.
2. Related Sections: Additional Sections of the Documents which are referenced in this Section include:
 - 1) Section Submittals”
 - 2) Section “General Requirements”
 - 3) Section “Seeding”
3. Temporary Measures: Temporary erosion and sediment control shall be achieved by using the stated measures where indicated on the plans or as required for erosion control. Said measures shall be constructed and made workable prior to beginning site excavation and grading work. Refer to the VESCH for descriptions of additional measures.
4. Permanent Measures: Permanent erosion and sediment control shall be achieved by seeding and landscaping as detailed in Section “Seeding”. The Contractor shall schedule excavation, fill, finish grading, and seeding work in such a manner as to minimize exposure to erosive forces. Seeding of exposed areas shall commence as soon as possible after excavating, backfilling, grading, or other operations have been completed and shall be maintained until an acceptable stand of turf has been developed. Slope protection along indicated areas shall be installed as soon as the grading is complete.

1.2 REFERENCES

1. General: The work shall comply with the most recent standards or tentative standards as published at the date of the contract and as listed in this specification using the abbreviation shown.
2. American Society for Testing and Materials (ASTM):
 - 1) D 448 Standard Classification for Sizes of Aggregate for Road and Bridge Construction
3. Virginia Department of Conservation and Recreation Virginia Erosion and Sediment Control Handbook (VESCH):
4. Virginia Department of Transportation - Road and Bridge Specifications (VDOT)

1.3 QUALITY ASSURANCE

1. General: All erosion control measures shall be in accordance with the Virginia Erosion and Sediment Control Handbook (VESCH), and all revisions and addenda. Methods used on site shall include, but shall not be limited to VESCH Standard and Specifications, Chapter 3.
2. Performance Requirements: The erosion control measures shall be installed such that the erosion of disturbed ground and the siltation of storm drain pipes and inlets will be prevented.
3. Regulatory Requirements: All phases of the construction work shall comply with or exceed the minimum state requirements for controlling erosion and sedimentation from "land disturbing activities" as outlined in the "Virginia Erosion and Sediment Control Handbook" (VESCH), and all revisions and addenda thereto.

1.4 MAINTENANCE

1. Maintenance Service: The erosion control measures shall be maintained by the Contractor until a vegetative groundcover is achieved, which in the opinion of the Owner, is mature enough to control soil erosion and to survive severe weather conditions.

1.5 SUBMITTALS

1. General: Shall be in accordance with Section "Submittals"
2. Materials: The Contractor shall submit to the Owner or to the Engineer shop plans or catalog cuts for:
 - 1) Materials list of items proposed to be provided under this Section.
 - 2) Manufacturer's specifications and other data needed to prove compliance with the specified requirements.

1.6 PRODUCT HANDLING

1. General: Shall be in accordance with Section "General Requirements".

1.7 SITE CONDITIONS

1. Environmental Requirements: Properties and natural waterways adjacent to the site of land disturbance shall be protected from sedimentation by the use of the erosion control measures shown on the plans and in compliance with pertinent erosion and sediment control practices.
2. Vegetation: When conditions detrimental to plant growth are encountered such as rubble fill, adverse drainage conditions or obstructions, the Contractor shall notify the Owner before planting.
3. Planting Time: See VESCH 3.32 and Section "Seeding".

PART 2 - PRODUCTS

2.1 MATERIALS

1. Silt Fence: The silt fence used as a sediment barrier shall utilize extra strength synthetic filter fabrics.

2. Stone: Stone used to construct the temporary construction entrance shall be ASTM D 448 #1 or #2 stone as shown on the plans.
3. Soil Stabilization Mat: Mat shall be a degradable multi-layered soil stabilization blanket consisting of a netting of polyethylene, nylon, vinyl, or other material intertwined with a natural organic or manmade mulch, a jute mesh or excelsior mat specifically manufactured for maintaining soil slopes until vegetation becomes established. Soil stabilization mat shall be provided by a manufacturer from VDOT's "Approved Products List" as described in VESCH 3.36.
4. Riprap: Riprap shall be a rubble stone riprap, 50 to 150 pounds each, similar to VDOT 414 Class I (50 to 150 pounds) unless otherwise noted on the plans. Stone shall be placed to the depth indicated in accordance with VDOT 414
5. Gravel Outlet Structures: Gravel outlet structures shall be constructed of ASTM D 448 #2 stone or its equivalent.
6. Permanent Seeding: Seeding shall be in accordance with Section "Seeding".

PART 3 - EXECUTION

3.1 PREPARATION

1. General: See Virginia Erosion and Sediment Control Handbook for appropriate installation procedures.
2. Surface Preparation for Stabilization Mat: Any storm drainage channel in which soil stabilization mat is to be installed shall be prepared for installation of the mat according to the mat manufacturer's recommendations.

Any areas which are to be covered with a soil stabilization mat shall be protected from erosion prior to the installation of the mat. The protection shall include, but not be limited to, the installation and maintenance of silt fences, straw bale barriers, and temporary diversion dikes.

3. Rip Rap: Excavation of slopes, ditches, or roadways where riprap is to be placed shall be of sufficient depth to achieve finished grades shown on the plans or details. Rip Rap shall be installed in accordance with VESCH 3.19.
4. Cut and Fill Slope Preparation: Cut and fill slopes shall be constructed in a manner which will minimize erosion, in accordance with the following:
 - 1) All slopes steeper than 3:1 shall require surface roughening, either stair-step grading, grooving, furrowing, or tracking, if stabilized with vegetation, in accordance with VESCH 3.29.
 - 2) Areas with grades less than 3:1 shall have the soil surface lightly roughened and loosened to a depth of 4 inches prior to seeding.
 - 3) Areas which have been graded and will not be stabilized immediately shall be roughened to reduce runoff velocity until seeding takes place.
 - 4) Slopes with a stable rock face do not require roughening or stabilization.

3.2 INSTALLATION AND APPLICATION

1. Silt Fence: Silt fences shall be installed in accordance with the following:
 - 1) Installed height of silt fence shall not exceed 36 inches.
 - 2) Filter fabric splice joints shall occur only at a support post, minimum 6 inch overlap, and securely sealed.
 - 3) Posts shall be spaced a maximum of 10 feet on centers at the barrier location and driven securely into the ground (minimum of 12 inches). When extra strength fabric is used without wire support fence, post spacing shall not exceed 6 feet on centers.
 - 4) A trench shall be excavated approximately 4 inches wide and 4 inches deep along the line of posts and upslope from the barrier. Eight inches of fabric shall be extended into the trench. The trench shall be backfilled and the soil compacted over the filter fabric.
 - 5) For extra strength filter fabric installation utilizing closer post spacing, the wire mesh support fence may be eliminated. In such case, the fabric is attached to the upslope side of the posts using heavy-duty wire staples, minimum 1 inch long, or tie wires.
 - 6) Filter fabric shall not be stapled to existing trees.
 - 7) Silt fences shall be removed when they have served their useful purpose, but not before the upslope area has been permanently stabilized.
2. Stone and Riprap:
 - 1) Stone on the temporary construction entrance shall be installed to a minimum depth of 1 foot.
 - 2) Riprap shall be installed to the depth of 18 inches or as indicated on the plans, in accordance with VDOT 414. Stone shall be placed such that top of stone be within +/-2 inches of the finished grades shown on the plans or details.
3. Temporary Diversion Dike:
 - 1) A temporary diversion ridge of compacted soil shall be located at the top and/or base of sloping disturbed areas in accordance with VESCH 3.09. Dike shall divert storm runoff from higher drainage areas away from unprotected slopes to a sediment trapping facility or to a stabilized outlet.
 - 2) The minimum allowable height measured from the upslope side of the dike shall be 18 inches (except where dike is part of the proposed silt trap).
 - 3) Sideslopes shall be 1.5:1 or flatter. Minimum base width is 4.5 feet.
 - 4) The channel behind the dike shall have positive grade to a stabilized outlet. Channel slope less than or equal to 2 percent shall require no stabilized outlet. Slope greater than 2 percent shall be stabilized in accordance with VESCH 3.17.
4. Temporary Sediment Trap:
 - 1) A small temporary ponding area shall be constructed of earthen embankment with a gravel outlet across a drainage swale to detain sediment laden runoff from the disturbed areas to allow the majority of the sediment to settle out, as per VESCH 3.13. The sediment trap shall be constructed independently or in conjunction with temporary diversion dike.

- 2) The sediment trap shall have an initial storage volume as indicated on the plans, half of which shall be in the form of a permanent pool (see erosion control plan for required grading).
 - 3) If excavation is required to attain the required storage volume, side slopes shall not exceed 2:1 except for the excavated wet storage area which may be at a maximum 1:1 grade.
 - 4) The outlet for the sediment trap shall consist of a crushed stone section of the embankment located at the low point in the basin. The crest of the outlet shall be at least 1.0 feet below the top of the embankment during peak flow conditions. The outlet shall be constructed as shown in VESCH 3.13.
 - 5) Sediment shall be removed and the trap restored to its original dimensions when the sediment has accumulated to 1/2 the designed volume of the trap. Sediment removed from the basin shall be deposited in a suitable area and in such a manner that it will not erode.
 - 6) The structure shall be checked regularly to insure that it is structurally sound and has not been damaged by erosion or construction equipment. The height of the outlet shall be checked to insure that its center is at least one foot below the top of the embankment.
5. Sediment Trap Embankments:
- 1) The maximum height of the sediment trap embankment shall be measured from the low point. Minimum top widths and outlet heights for various embankment heights shall be in accordance with VESCH 3.13.
 - 2) Sediment traps shall be removed after the contributing drainage area is stabilized. Sediment trap areas shall be restored to original or proposed final grades.
 - 3) The area under the embankment shall be cleared, grubbed, and stripped of any vegetation and root mat to facilitate cleanout. The pool area shall be cleared.
 - 4) Fill material for the embankments shall be free of roots or other woody vegetation, organic materials, large stones, and other objectionable material. The embankment shall be compacted in 8-inch layers by transversing with construction equipment.
 - 5) The earthen embankment shall be seeded with temporary or permanent vegetation (VESCH 3.31 and 3.32) within 15 days of construction.
 - 6) Construction operations shall be implemented in such a manner that erosion and water pollution are minimized.
 - 7) All cut and fill slopes shall be 2:1 or flatter.
6. Construction Access Routes: Wherever construction vehicle access routes intersect paved public roads, provisions must be made to minimize the transport of sediment (mud) by runoff or vehicle tracking onto the paved surface (VESCH 3.02 and 3.03). Where sediment is transported onto a public road surface, the roads shall be cleaned thoroughly at the end of each day. Sediment shall be removed from roads by shoveling or sweeping and be transported to a sediment controlled disposal area. Street washing shall be allowed only after sediment is removed in this manner.
7. Temporary Seeding; Provide temporary seeding in accordance with Section "Seeding".
- 1) Provide temporary seeding of any areas when planting time does not permit permanent seeding within 30 days after completion of subgrades and on soil stockpiles.

8. Straw Bale Barriers: Straw bale barriers shall be placed in a single row, lengthwise, along the contour and embedded in the soil to a depth of three inches. Bales must be securely anchored in place by stakes or steel reinforcing-bars to prevent displacement. Barriers shall be inspected frequently and repair or replacement must be made promptly if needed.
9. Silt Fence: Burlap or geotechnical fabric filter barriers shall be constructed by setting 1 inch x 2 inches x 3 feet stakes and excavating a 4 inches x 4 inches trench along the line of stakes. Staple fabric to stakes and extend into trench. Backfill and compact excavated soil, anchoring fabric.
10. Gravel Outlet Structures: The bases and side slopes of the gravel shall be placed so as to conform to the dike configuration. The invert of the outlet shall be not less than six inches lower than the top of the adjoining earth dike, and the gravel shall extend to the top of the dike. Discharge from the outlet structure shall be onto an already stabilized area or watercourse. The gravel outlet structure shall be inspected for silt accumulation after each runoff-producing rain. If structure ceases to function properly due to silt accumulation, the silt shall be removed and gravel shall be replaced.
11. Temporary Interceptor Dikes: Temporary interceptor dikes shall be machine compacted and have a positive grade draining to the gravel outlet structure. Periodic inspection and maintenance of the dike shall be provided to insure proper functioning of the dike.

3.3 MAINTENANCE

1. Maintenance Service: The erosion control measures shall be maintained by the Contractor until all work covered by this contract is completed and permanent stabilization of disturbed areas has been achieved.

3.4 FIELD QUALITY CONTROL

1. Silt Fence Inspection: Silt fences and filter barriers shall be inspected by the Contractor immediately after each rainfall and at least daily during prolonged rainfall. Any required repairs shall be made immediately.
 - 1) Decomposed or ineffective silt fence or filter barriers shall be replaced promptly.
 - 2) Sediment deposits shall be removed when deposits reach approximately one-half the height of the barrier. Sediment shall be removed from the site and disposed at an approved waste area.
 - 3) Any sediment deposits remaining in place after the silt fence or filter barrier is no longer required shall be dressed to conform with the existing grade, then prepared and seeded.
2. Construction Entrance Inspection: The Contractor shall inspect the construction entrance periodically. The stone in the construction entrance shall be replaced when, in the opinion of the Owner, an excessive amount of mud is being carried into the public right-of-way.
3. Disposal: All temporary erosion and sediment control measures shall be disposed of within 30 days after final site stabilization is achieved or after the temporary measures are no longer needed, unless otherwise authorized by the Owner. Trapped sediment and other disturbed soil areas resulting from disposition of temporary measure shall be permanently stabilized to prevent further erosion and sedimentation.

END OF SECTION 312513

SECTION 323113 - CHAIN LINK FENCES AND GATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Section "General Requirements" Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Chain-link fences.
 - 2. Gates: Motor operated, horizontal slide, and swing.
- B. Related Sections:
 - 1. Section "Cast-in-Place Concrete" for cast-in-place concrete equipment bases/pads for gate operators and controls and post footings.

1.3 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design chain-link fences and gates, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Structural Performance: Chain-link fence and gate framework shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated according to ASCE/SEI 7:
 - 1. Minimum Post Size: Determine according to ASTM F 1043 for framework up to 12 feet (3.66 m) high, and post spacing not to exceed 10 feet (3 m).
 - 2. Minimum Post Size and Maximum Spacing: Determine according to CLFMI WLG 2445, based on mesh size and pattern specified and on the following:
 - a. Wind Loads: 90.
 - b. Exposure Category: B.
 - c. Fence Height: 10 feet (3 m).
 - d. Material Group: IA, ASTM F 1043, Schedule 40 steel pipe.
- C. Lightning Protection System: Maximum grounding-resistance value of 25 ohms under normal dry conditions.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for chain-link fences and gates.
 - 1. Fence and gate posts, rails, and fittings.
 - 2. Chain-link fabric, reinforcements, and attachments.
 - 3. Accessories: Barbed wire and Barbed tape.
 - 4. Gates and hardware.
 - 5. Gate operators, including operating instructions.
 - 6. Motors: Show nameplate data, ratings, characteristics, and mounting arrangements.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work. Show accessories, hardware, gate operation, and operational clearances.
 - 1. Gate Operator: Show locations and details for installing operator components, switches, and controls. Indicate motor size, electrical characteristics, drive arrangement, mounting, and grounding provisions.
 - 2. Wiring Diagrams: For power, signal, and control wiring.
- C. Samples for Initial Selection: For components with factory-applied color finishes.
- D. Samples for Verification: Prepared on Samples of size indicated below:
 - 1. Polymer-Coated Components: In 6-inch (150-mm) lengths for components and on full-sized units for accessories.
- E. Delegated-Design Submittal: For chain-link fences and gate framework indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified factory-authorized service representative.
- B. Product Certificates: For each type of chain-link fence, operator, and gate, from manufacturer.
- C. Product Test Reports: For framing strength according to ASTM F 1043.
- D. Field quality-control reports.
- E. Warranty: Sample of special warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For the following to include in emergency, operation, and maintenance manuals:
 - 1. Polymer finishes.

2. Gate hardware.
3. Gate operator.

1.7 QUALITY ASSURANCE

- A. Testing Agency Qualifications: For testing fence grounding. Member company of NETA or an NRTL.
 1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Emergency Access Requirements: Comply with requirements of authorities having jurisdiction for gates with automatic gate operators serving as a required means of access.
- D. Mockups: Build mockups to set quality standards for fabrication and installation.
 1. Include 10-foot (3 m) length of fence and gate.
- E. Preinstallation Conference: Conduct conference at Project site.
 1. Inspect and discuss electrical roughing-in, equipment bases, and other preparatory work specified elsewhere.
 2. Review sequence of operation for each type of gate operator.
 3. Review coordination of interlocked equipment specified in this Section and elsewhere.
 4. Review required testing, inspecting, and certifying procedures.

1.8 PROJECT CONDITIONS

- A. Field Measurements: Verify layout information for chain-link fences and gates shown on Drawings in relation to property survey and existing structures. Verify dimensions by field measurements.

1.9 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of chain-link fences and gates that fail in materials or workmanship within specified warranty period.
 1. Failures include, but are not limited to, the following:
 - a. Faulty operation of gate operators and controls.
 - b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CHAIN-LINK FENCE FABRIC

- A. General: Provide fabric in one-piece heights measured between top and bottom of outer edge of selvage knuckle or twist. Comply with CLFMI Product Manual and with requirements indicated below:
1. Fabric Height: As indicated on Drawings.
 2. Steel Wire Fabric: Wire with a diameter of 0.148 inch (3.76 mm).
 - a. Mesh Size: 2 inches (50 mm).
 - b. Aluminum-Coated Fabric: ASTM A 491, Type I, 0.30 oz./sq. ft. (92 g/sq. m).
 - c. Zinc-Coated Fabric: ASTM A 392, Type II, Class 1, 1.2 oz./sq. ft. (366 g/sq. m) with zinc coating applied after weaving.
 - d. Zn-5-Al-MM Aluminum-Mischmetal-Coated Fabric: ASTM F 1345, Type III, Class 1, 0.60 oz./sq. ft. (183 g/sq. m).
 - e. Polymer-Coated Fabric: ASTM F 668, Class 1 over aluminum-coated steel wire.
 - 1) Color: As selected by Engineer from manufacturer's full range, complying with ASTM F 934.
 - f. Coat selvage ends of fabric that is metallic coated before the weaving process with manufacturer's standard clear protective coating.
 3. Aluminum Wire Fabric: ASTM F 1183, with mill finish, and wire diameter of 0.148 inch (3.76 mm).
 - a. Mesh Size: 2 inches (50 mm).
 4. Selvage: Knuckled at both selvages.

2.2 FENCE FRAMING

- A. Posts and Rails: Comply with ASTM F 1043 for framing, including rails, braces, and line; terminal; and corner posts. Provide members with minimum dimensions and wall thickness according to ASTM F 1043 based on the following:
1. Fence Height: As indicated on Drawings.
 2. Light Industrial Strength: Material Group IC-L, round steel pipe, electric-resistance-welded pipe.
 - a. Line Post: 2.375 inches (60 mm) in diameter.
 - b. End, Corner and Pull Post: 2.875 inches (73 mm).
 3. Heavy Industrial Strength: Material Group IA, round steel pipe, Schedule 40.
 - a. Line Post: 4.0 inches (102 mm) in diameter.
 - b. End, Corner and Pull Post: 6.625 inches (168 mm) in diameter.

4. Horizontal Framework Members: Intermediate, top, and bottom rails complying with ASTM F 1043.
 - a. Top Rail: 1.66 inches (42 mm) in diameter.
5. Brace Rails: Comply with ASTM F 1043.
6. Metallic Coating for Steel Framing:
 - a. Type A, consisting of not less than minimum 2.0-oz./sq. ft. (0.61-kg/sq. m) average zinc coating per ASTM A 123/A 123M or 4.0-oz./sq. ft. (1.22-kg/sq. m) zinc coating per ASTM A 653/A 653M.
 - b. Type B, zinc with organic overcoat, consisting of a minimum of 0.9 oz./sq. ft. (0.27 kg/sq. m) of zinc after welding, a chromate conversion coating, and a clear, verifiable polymer film.
 - c. External, Type B, zinc with organic overcoat, consisting of a minimum of 0.9 oz./sq. ft. (0.27 kg/sq. m) of zinc after welding, a chromate conversion coating, and a clear, verifiable polymer film. Internal, Type D, consisting of 81 percent, not less than 0.3-mil- (0.0076-mm-) thick, zinc-pigmented coating.
 - d. Type C, Zn-5-Al-MM alloy, consisting of not less than 1.8-oz./sq. ft. (0.55-kg/sq. m) coating.
 - e. Coatings: Any coating above.
7. Polymer coating over metallic coating.
 - a. Color: Match chain-link fabric, complying with ASTM F 934.

2.3 TENSION WIRE

- A. Metallic-Coated Steel Wire: 0.177-inch- (4.5-mm-) diameter, marcelled tension wire complying with ASTM A 817 and ASTM A 824, with the following metallic coating:
 1. Type I, aluminum coated (aluminized).
 2. Type II, zinc coated (galvanized) by hot-dip process, with the following minimum coating weight:
 - a. Class 3: Not less than 0.8 oz./sq. ft. (244 g/sq. m) of uncoated wire surface.
 - b. Class 4: Not less than 1.2 oz./sq. ft. (366 g/sq. m) of uncoated wire surface.
 - c. Class 5: Not less than 2 oz./sq. ft. (610 g/sq. m) of uncoated wire surface.
 - d. Matching chain-link fabric coating weight.
 3. Type III, Zn-5-Al-MM alloy with the following minimum coating weight:
 - a. Class 60: Not less than 0.6 oz./sq. ft. (183 g/sq. m) of uncoated wire surface.
 - b. Class 100: Not less than 1 oz./sq. ft. (305 g/sq. m) of uncoated wire surface.
 - c. Matching chain-link fabric coating weight.
- B. Polymer-Coated Steel Wire: 0.148-inch- (3.8-mm-) diameter, tension wire complying with ASTM F 1664, Class 1 over aluminum-coated steel wire.
 1. Color: Match chain-link fabric, complying with ASTM F 934.

- C. Aluminum Wire: 0.192-inch- (4.88-mm-) diameter tension wire, mill finished, complying with ASTM B 211 (ASTM B211M), Alloy 6061-T94 with 50,000-psi (344-MPa) minimum tensile strength.

2.4 SWING GATES

- A. General: Comply with ASTM F 900 for gate posts and single and/or double swing gate types. Provide automated vehicular gates that comply with ASTM F 2200.
 - 1. Gate Leaf Width: As indicated.
 - 2. Gate Fabric Height: As indicated.
- B. Pipe and Tubing:
 - 1. Zinc-Coated Steel: Comply with ASTM F 1043 and ASTM F 1083; protective coating and finish to match fence framing.
 - 2. Aluminum: Comply with ASTM B 429/B 429M; mill finish.
 - 3. Gate Posts: Round tubular steel.
 - 4. Gate Frames and Bracing: Round tubular steel.
- C. Frame Corner Construction: Welded or assembled with corner fittings.
- D. Extended Gate Posts and Frame Members: Extend gate posts and frame end members above top of chain-link fabric at both ends of gate frame 12 inches (300 mm) to attach barbed wire or tape assemblies.
- E. Hardware:
 - 1. Hinges: 360-degree inward and outward swing.
 - 2. Latches permitting operation from both sides of gate with provision for padlocking accessible from both sides of gate.
 - 3. Padlock and Chain: Owner furnished.
 - 4. Lock: Manufacturer's standard internal device.
 - 5. Closer: Manufacturer's standard.

2.5 HORIZONTAL-SLIDE GATES

- A. General: Comply with ASTM F 1184 for gate posts and single and/or double sliding gate types. Provide automated vehicular gates that comply with ASTM F 2200.
 - 1. Classification: Type I Overhead Slide.
 - a. Gate Leaf Width: As indicated.
 - b. Gate Fabric Height: As indicated.
 - 2. Classification: Type II Cantilever Slide, Class 1 with external roller assemblies.
 - a. Gate Frame Width and Height: As indicated.
- B. Pipe and Tubing:

1. Zinc-Coated Steel: Protective coating and finish to match fence framing.
 2. Aluminum: Comply with ASTM B 429/B 429M; mill finish.
 3. Gate Posts: Comply with ASTM F 1184. Provide round tubular steel posts.
 4. Gate Frames and Bracing: Round tubular steel.
- C. Frame Corner Construction: Welded or assembled with corner fittings.
- D. Extended Gate Posts and Frame Members: Extend gate posts and frame end members above top of chain-link fabric at both ends of gate frame 12 inches (300 mm) as required to attach barbed wire or tape assemblies.
- E. Overhead Track Assembly: Manufacturer's standard track, with overhead framing supports, bracing, and accessories, engineered to support size, weight, width, operation, and design of gate and roller assemblies.
- F. Hardware:
1. Latches permitting operation from both sides of gate with provision for padlocking accessible from both sides of gate.
 2. Padlock and Chain: Owner furnished.
 3. Lock: Manufacturer's standard internal device.
 4. Hangers, roller assemblies, and stops fabricated from galvanized steel.

2.6 FITTINGS

- A. General: Comply with ASTM F 626.
- B. Post Caps: Provide for each post.
1. Provide line post caps with loop to receive tension wire or top rail.
- C. Rail and Brace Ends: For each gate, corner, pull, and end post.
- D. Rail Fittings: Provide the following:
1. Top Rail Sleeves: Pressed-steel or round-steel tubing not less than 6 inches (152 mm) long.
 2. Rail Clamps: Line and corner boulevard clamps for connecting intermediate and bottom rails in the fence line-to-line posts.
- E. Tension and Brace Bands: Pressed steel.
- F. Tension Bars: Steel, length not less than 2 inches (50 mm) shorter than full height of chain-link fabric. Provide one bar for each gate and end post, and two for each corner and pull post, unless fabric is integrally woven into post.
- G. Truss Rod Assemblies: Steel, hot-dip galvanized after threading rod and turnbuckle or other means of adjustment.

- H. Barbed Wire Arms: Pressed steel or cast iron, with clips, slots, or other means for attaching strands of barbed wire, and means for attaching to posts, integral with post cap; for each post unless otherwise indicated, and as follows:
 - 1. Provide line posts with arms that accommodate top rail or tension wire.
 - 2. Provide corner arms at fence corner posts, unless extended posts are indicated.
 - 3. Type I, single slanted arm.
 - 4. Type II, single vertical arm.
 - 5. Type III, V-shaped arm.
 - 6. Type IV, A-shaped arm.

- I. Tie Wires, Clips, and Fasteners: According to ASTM F 626.
 - 1. Standard Round Wire Ties: For attaching chain-link fabric to posts, rails, and frames, complying with the following:
 - a. Hot-Dip Galvanized Steel: 0.148-inch- (3.76-mm-) diameter wire; galvanized coating thickness matching coating thickness of chain-link fence fabric.
 - b. Aluminum: ASTM B 211 (ASTM B 211M); Alloy 1350-H19; 0.148-inch- (3.76-mm-) diameter, mill-finished wire.

- J. Finish:
 - 1. Metallic Coating for Pressed Steel or Cast Iron: Not less than 1.2 oz. /sq. ft. (366 g /sq. m) zinc.
 - a. Polymer coating over metallic coating.
 - 2. Aluminum: Mill finish.

2.7 PRIVACY SLATS

- A. Material: PVC, UV-light stabilized, not less than 0.006 inch (0.15 mm) thick; sized to fit mesh specified for direction indicated.
- B. Material: Polyethylene tubular slats, not less than 0.023 inch (0.58 mm) thick, manufactured for chain-link fences from virgin polyethylene containing UV inhibitor, sized to fit mesh specified for direction indicated; with fins for increased privacy factor.
- C. Material: Fiber-glass-reinforced plastic, UV-light stabilized, not less than 0.06 inch (1.5 mm) thick, sized to fit mesh specified for direction indicated; with vandal-resistant fasteners and lock strips.
- D. Material: Aluminum, not less than 0.01 inch (0.25 mm) thick, sized to fit mesh specified for direction indicated.
- E. Material: Redwood, 5/16 inch (7.9 mm) thick, sized to fit mesh specified for direction indicated.
- F. Color: As selected by Engineer from manufacturer's full range.

2.8 BARBED WIRE

- A. Steel Barbed Wire: Comply with ASTM A 121, for two-strand barbed wire, 0.099-inch- (2.51-mm-) diameter line wire with 0.080-inch- (2.03-mm-) diameter, four-point round barbs spaced not more than 5 inches (127 mm) o.c.
 - 1. Aluminum Coating: Type A.
 - 2. Zinc Coating: Type Z, Class 3.
- B. Polymer-Coated, Galvanized-Steel Barbed Wire: Comply with ASTM F 1665 two-strand barbed wire, 0.080-inch- (2.03-mm-) diameter line wire with 0.080-inch- (2.03-mm-) diameter, four-point round aluminum alloy or galvanized-steel barbs spaced not more than 5 inches (127 mm) o.c.:
 - 1. Polymer Coating: Class 1 over aluminum-coated steel wire.
 - a. Color: Match chain-link fabric, complying with ASTM F 934.

2.9 BARBED TAPE

- A. Wire-Reinforced Tape: ASTM F 1910; with four-point, needle-sharp barbs permanently cold clenched around a core wire.
 - 1. Core Wire: High-tensile-strength, zinc-coated steel.
- B. Clips: Stainless steel, 0.065 inch (1.7 mm) thick by 0.375 inch (9.5 mm) wide, capable of withstanding a minimum 150-lbf (667-N) pull load to limit extension of coil, resulting in a concertina pattern when deployed.
- C. Tie Wires: Stainless steel, 0.065 inch (1.7 mm) in diameter.
- D. Fabrication: Continuous coils of barbed tape as defined in ASTM F 1379 for the following characteristics:
 - 1. Configuration: Single coil.
 - 2. Style: Helical pattern.
 - 3. Coil Diameter(s): 24 inches (610 mm).
 - 4. Coil Loop Spacing(s): 12 inches (300 mm).
 - 5. Barb Length Classification: Medium, 0.4-inch (10.2-mm) barb.
 - 6. Barb Spacing: 4 inches (102 mm) o.c.
 - 7. Barb Set: Straight.

2.10 GATE OPERATORS

- A. General: Provide factory-assembled automatic operating system designed for gate size, type, weight, and operation frequency. Provide operation control system with characteristics suitable for Project conditions, with remote-control stations, safety devices, and weatherproof enclosures; coordinate electrical requirements with building electrical system.

1. Provide operator designed so motor may be removed without disturbing limit-switch adjustment and without affecting auxiliary emergency operator.
 2. Provide operator with UL approval.
 3. Provide electronic components with built-in troubleshooting diagnostic feature.
 4. Provide unit designed and wired for both right-hand/left-hand opening, permitting universal installation.
- B. Comply with NFPA 70.
- C. UL Standard: Fabricate and label gate operators to comply with UL 325.
- D. Motor Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, within installed environment, with indicated operating sequence, and without exceeding nameplate rating or considering service factor. Comply with NEMA MG 1 and the following:
1. Voltage: NEMA standard voltage selected to operate on nominal circuit voltage to which motor is connected.
 2. Horsepower: 1/4.
 3. Enclosure: Open dripproof.
 4. Duty: Continuous duty at ambient temperature of 105 deg F (40 deg C) and at altitude of 3300 feet (1005 m) above sea level.
 5. Service Factor: 1.15 for open dripproof motors; 1.0 for totally enclosed motors.
 6. Phase: One.
- E. Gate Operators: Gate mounted and as follows:
1. Hydraulic Slide Gate Operators:
 - a. Duty: Medium duty, commercial/industrial.
 - b. Gate Speed: Minimum 45 feet (13.7 m) per minute.
 - c. Maximum Gate Weight: 300 lb (137 kg).
 - d. Frequency of Use: Continuous duty.
 - e. Locking: Hydraulic in both directions.
 - f. Heater: Manufacturer's standard track and roller heater with thermostatic control.
 - g. Operating Type: Wheel and rail drive.
 2. Mechanical Slide Gate Operators:
 - a. Duty: Medium duty, commercial/industrial.
 - b. Gate Speed: Minimum 45 feet (13.7 m) per minute.
 - c. Maximum Gate Weight: 600 lb (272 kg).
 - d. Frequency of Use: Continuous duty.
 - e. Operating Type: Wheel and rail drive.
 - f. Drive Type: Enclosed worm gear reducers, roller-chain drive.
- F. Remote Controls: Electric controls separated from gate and motor and drive mechanism, with NEMA ICS 6, Type 4 enclosure for recessed or flush mounting and with space for additional optional equipment. Provide the following remote-control device(s):
1. Control Station: Keyed, two-position switch, located remotely from gate. Provide two keys per station.

2. Control Station: Momentary-contact, single-button-operated; located remotely from gate.
 - a. Function: Open and close.
3. Card Reader: Functions only when authorized card is presented. Programmable, magnetic single-code system; face-lighted unit fully visible at night.
 - a. Reader Type: Swipe.
 - b. Features: Capable of monitoring and auditing gate activity.
4. Digital Keypad Entry Unit: Multiple-programmable, code capability of not less than 500 possible individual codes, consisting of one- to seven-digit codes.
 - a. Features: Capable of monitoring and auditing gate activity.
 - b. Face-lighted unit with keyless-membrane keypad fully visible at night.
5. Radio Control: Digital system consisting of code-compatible universal receiver for each gate, located where indicated, with remote antenna with coaxial cable and mounting brackets designed to operate gates. Provide one programmable transmitter(s) with multiple-code capability permitting validating or voiding of not less than 1000 codes per channel configured for the following functions:
 - a. Transmitters: Single-button operated, with open function.
 - b. Channel Settings: Two independent channel settings controlling separate receivers for operating more than one gate from each transmitter.
6. Telephone Entry System: Hands-free voice-communication system for connection to building telephone system with digital-entry code activation of gate operator.
 - a. Residential System: Designed to be wired to same line with telephone.
 - b. Multiunit System: Designed to be wired to a dedicated telephone line, with capacity to access 20 telephones and with electronic directory.
7. Vehicle Loop Detector: System including automatic closing timer with adjustable time delay before closing and loop detector designed to hold gate open until traffic clears. Provide electronic detector with adjustable detection patterns, adjustable sensitivity and frequency settings, and panel indicator light designed to detect presence or transit of a vehicle over an embedded loop of wire and to emit a signal activating the gate operator. Provide number of loops consisting of multiple strands of wire, number of turns, loop size, and method of placement at location shown on Drawings, as recommended in writing by detection system manufacturer for function indicated.
 - a. Loop: Wire, in size indicated for field assembly, for pave-over installation.
 - b. Loop: Factory preformed in size indicated; style for pave-over installation.
8. Vehicle Presence Detector: System including automatic closing timer with adjustable time delay before closing and presence detector designed to hold gate open until traffic clears. Provide retroreflective detector with adjustable detection zone pattern and sensitivity, designed to detect the presence or transit of a vehicle in gate pathway when infrared beam in zone pattern is interrupted, and to emit a signal activating the gate operator.

- G. Obstruction Detection Devices: Provide each motorized gate with automatic safety sensor(s). Activation of sensor(s) causes operator to immediately function as follows:
1. Action: Reverse gate in both opening and closing cycles and hold until clear of obstruction.
 2. Internal Sensor: Built-in torque or current monitor senses gate is obstructed.
 3. Sensor Edge: Contact-pressure-sensitive safety edge, profile, and sensitivity designed for type of gate and component indicated, in locations as follows. Connect to control circuit using take-up cable reel.
 - a. Along entire gate leaf leading edge.
 - b. Along entire gate leaf trailing edge.
 - c. Across entire gate leaf bottom edge.
 - d. Along entire length of gate posts.
 - e. Along entire length of gate guide posts.
 - f. Where indicated on Drawings.
 4. Photoelectric/Infrared Sensor System: Designed to detect an obstruction in gate's path when infrared beam in the zone pattern is interrupted.
- H. Limit Switches: Adjustable switches, interlocked with motor controls and set to automatically stop gate at fully retracted and fully extended positions.
1. Type: Integral fail-safe release, allowing gate to be pushed open without mechanical devices, keys, cranks, or special knowledge.
- I. Operating Features:
1. Digital Microprocessor Control: Electronic programmable means for setting, changing, and adjusting control features with capability for monitoring and auditing gate activity. Provide unit that is isolated from voltage spikes and surges.
 2. System Integration: With controlling circuit board capable of accepting any type of input from external devices.
 3. Master/Slave Capability: Control stations designed and wired for gate pair operation.
 4. Automatic Closing Timer: With adjustable time delay before closing.
 5. Open Override Circuit: Designed to override closing commands.
 6. Reversal Time Delay: Designed to protect gate system from shock load on reversal in both directions.
 7. Maximum Run Timer: Designed to prevent damage to gate system by shutting down system if normal time to open gate is exceeded.
 8. Clock Timer: Seven-day programmable for regular events.
- J. Accessories:
1. Warning Module: Visual, strobe-light alarm sounding three to five seconds in advance of gate operation and continuing until gate stops moving; compliant with the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines.
 2. Battery Backup System: Battery-powered drive and access-control system, independent of primary drive system.

- a. Fail Safe: Gate opens and remains open until power is restored.
 - b. Fail Secure: Gate cycles on battery power, then fail safe when battery is discharged.
3. External electric-powered solenoid lock with delay timer allowing time for lock to release before gate operates.
 4. Postal box.
 5. Fire strobe alarm.
 6. Intercom System.
 7. Instructional, Safety, and Warning Labels and Signs: According to UL 325.
 8. Equipment Bases/Pads: Cast-in-place or precast concrete, depth not less than 12 inches (300 mm), dimensioned and reinforced according to gate-operator component manufacturer's written instructions and as indicated on Drawings.

2.11 GROUT AND ANCHORING CEMENT

- A. Nonshrink, Nonmetallic Grout: Premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout, recommended in writing by manufacturer, for exterior applications.
- B. Erosion-Resistant Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with potable water at Project site to create pourable anchoring, patching, and grouting compound. Provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended in writing by manufacturer, for exterior applications.

2.12 FENCE GROUNDING

- A. Conductors: Bare, solid wire for No. 6 AWG and smaller; stranded wire for No. 4 AWG and larger.
 1. Material above Finished Grade: Copper.
 2. Material on or below Finished Grade: Copper.
 3. Bonding Jumpers: Braided copper tape, 1 inch (25 mm) wide, woven of No. 30 AWG bare copper wire, terminated with copper ferrules.
- B. Connectors and Grounding Rods: Comply with UL 467.
 1. Connectors for Below-Grade Use: Exothermic welded type.
 2. Grounding Rods: Copper-clad steel, 5/8 by 96 inches (16 by 2440 mm).

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for a verified survey of property lines and legal boundaries, site clearing, earthwork, pavement work, and other conditions affecting performance of the Work.

1. Do not begin installation before final grading is completed unless otherwise permitted by Engineer.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 500 feet (152.5 m) or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.

3.3 INSTALLATION, GENERAL

- A. Install chain-link fencing to comply with ASTM F 567 and more stringent requirements indicated.

1. Install fencing on established boundary lines inside property line.

3.4 CHAIN-LINK FENCE INSTALLATION

- A. Post Excavation: Drill or hand-excavate holes for posts to diameters and spacings indicated, in firm, undisturbed soil.

B. Post Setting: Set posts in concrete at indicated spacing into firm, undisturbed soil.

1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.

2. Concrete Fill: Place concrete around posts to dimensions indicated and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.

- a. Exposed Concrete: Extend 2 inches (50 mm) above grade; shape and smooth to shed water.

- b. Concealed Concrete: Top 2 inches (50 mm) below grade to allow covering with surface material.

- c. Posts Set into Concrete in Sleeves: Use steel pipe sleeves preset and anchored into concrete for installing posts. After posts have been inserted into sleeves, fill annular space between post and sleeve with anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions, and finished sloped to drain water away from post.

- d. Posts Set into Voids in Concrete: Form or core drill holes not less than 5 inches (125 mm) deep and 3/4 inch (20 mm) larger than OD of post. Clean holes of loose material, insert posts, and fill annular space between post and concrete with anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions, and finished sloped to drain water away from post.

3. Mechanically Driven Posts: Drive into soil to depth of 30 inches (762 mm). Protect post top to prevent distortion.

- C. Terminal Posts: Locate terminal end, corner, and gate posts per ASTM F 567 and terminal pull posts at changes in horizontal or vertical alignment of 15 degrees or more.
- D. Line Posts: Space line posts uniformly at 96 inches (2440 mm) o.c.
- E. Post Bracing and Intermediate Rails: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Diagonally brace terminal posts to adjacent line posts with truss rods and turnbuckles. Install braces at end and gate posts and at both sides of corner and pull posts.
 - 1. Locate horizontal braces at midheight of fabric 72 inches (1830 mm) or higher, on fences with top rail and at two-third fabric height on fences without top rail. Install so posts are plumb when diagonal rod is under proper tension.
- F. Tension Wire: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Pull wire taut, without sags. Fasten fabric to tension wire with 0.120-inch- (3.05-mm-) diameter hog rings of same material and finish as fabric wire, spaced a maximum of 24 inches (610 mm) o.c. Install tension wire in locations indicated before stretching fabric. Provide horizontal tension wire at the following locations:
 - 1. Extended along top and bottom of fence fabric. Install top tension wire through post cap loops. Install bottom tension wire within 6 inches (152 mm) of bottom of fabric and tie to each post with not less than same diameter and type of wire.
 - 2. Extended along top of barbed wire arms and top of fence fabric for supporting barbed tape.
- G. Top Rail: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Run rail continuously through line post caps, bending to radius for curved runs and terminating into rail end attached to posts or post caps fabricated to receive rail at terminal posts. Provide expansion couplings as recommended in writing by fencing manufacturer.
- H. Intermediate and Bottom Rails: Install and secure to posts with fittings.
- I. Chain-Link Fabric: Apply fabric to outside of enclosing framework. Leave 1 inch (25.4 mm) between finish grade or surface and bottom selvage unless otherwise indicated. Pull fabric taut and tie to posts, rails, and tension wires. Anchor to framework so fabric remains under tension after pulling force is released.
- J. Tension or Stretcher Bars: Thread through fabric and secure to end, corner, pull, and gate posts with tension bands spaced not more than 15 inches (380 mm) o.c.
- K. Tie Wires: Use wire of proper length to firmly secure fabric to line posts and rails. Attach wire at one end to chain-link fabric, wrap wire around post a minimum of 180 degrees, and attach other end to chain-link fabric per ASTM F 626. Bend ends of wire to minimize hazard to individuals and clothing.
 - 1. Maximum Spacing: Tie fabric to line posts at 12 inches (300 mm) o.c. and to braces at 24 inches (610 mm) o.c.
- L. Fasteners: Install nuts for tension bands and carriage bolts on the side of the fence opposite the fabric side.

- M. Privacy Slats: Install slats in direction indicated, securely locked in place.
 - 1. Vertically, for privacy factor of 70 to 75.
 - 2. Diagonally, for privacy factor of 80 to 85.
- N. Barbed Wire: Install barbed wire uniformly spaced as indicated on Drawings. Pull wire taut, install securely to extension arms, and secure to end post or terminal arms.
- O. Barbed Tape: Comply with ASTM F 1911. Install barbed tape uniformly in configurations indicated and fasten securely to prevent movement or displacement.

3.5 GATE INSTALLATION

- A. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach fabric as for fencing. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.

3.6 GATE OPERATOR INSTALLATION

- A. General: Install gate operators according to manufacturer's written instructions, aligned and true to fence line and grade.
- B. Excavation for Support Posts: Hand-excavate holes for bases/pads, in firm, undisturbed soil to dimensions and depths and at locations as required by gate-operator component manufacturer's written instructions and as indicated.
- C. Vehicle Loop Detector System: Bury and seal wire loop according to manufacturer's written instructions. Connect to equipment operated by detector.
- D. Comply with NFPA 70 and manufacturer's written instructions for grounding of electric-powered motors, controls, and other devices.

3.7 GROUNDING AND BONDING

- A. Fence Grounding: Install at maximum intervals of 1500 feet (450 m) except as follows:
 - 1. Fences within 100 Feet (30 m) of Buildings, Structures, Walkways, and Roadways: Ground at maximum intervals of 750 feet (225 m).
 - a. Gates and Other Fence Openings: Ground fence on each side of opening.
 - 1) Bond metal gates to gate posts.
 - 2) Bond across openings, with and without gates, except openings indicated as intentional fence discontinuities. Use No. 2 AWG wire and bury it at least 18 inches (460 mm) below finished grade.
- B. Protection at Crossings of Overhead Electrical Power Lines: Ground fence at location of crossing and at a maximum distance of 150 feet (45 m) on each side of crossing.

- C. Fences Enclosing Electrical Power Distribution Equipment: Ground as required by IEEE C2 unless otherwise indicated.
- D. Grounding Method: At each grounding location, drive a grounding rod vertically until the top is 6 inches (150 mm) below finished grade. Connect rod to fence with No. 6 AWG conductor. Connect conductor to each fence component at the grounding location, including the following:
 - 1. Make grounding connections to each barbed wire strand with wire-to-wire connectors designed for this purpose.
 - 2. Make grounding connections to each barbed tape coil with connectors designed for this purpose.
- E. Bonding Method for Gates: Connect bonding jumper between gate post and gate frame.
- F. Connections: Make connections to minimize possibility of galvanic action or electrolysis. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.
 - 1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer in order of galvanic series.
 - 2. Make connections with clean, bare metal at points of contact.
 - 3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
 - 4. Make aluminum-to-galvanized-steel connections with tin-plated copper jumpers and mechanical clamps.
 - 5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.
- G. Bonding to Lightning Protection System: If fence terminates at lightning-protected building or structure, ground the fence and bond the fence grounding conductor to lightning protection down conductor or lightning protection grounding conductor complying with NFPA 780.

3.8 FIELD QUALITY CONTROL

- A. Grounding-Resistance Testing: Engage a qualified testing agency to perform tests and inspections.
 - 1. Grounding-Resistance Tests: Subject completed grounding system to a megger test at each grounding location. Measure grounding resistance no fewer than two full days after last trace of precipitation, without soil having been moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural grounding resistance. Perform tests by two-point method according to IEEE 81.
 - 2. Excessive Grounding Resistance: If resistance to grounding exceeds specified value, notify Engineer promptly. Include recommendations for reducing grounding resistance and a proposal to accomplish recommended work.
 - 3. Report: Prepare test reports certified by a testing agency of grounding resistance at each test location. Include observations of weather and other phenomena that may affect test results.

3.9 ADJUSTING

- A. Gates: Adjust gates to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.
- B. Automatic Gate Operator: Energize circuits to electrical equipment and devices. Adjust operators, controls, safety devices, alarms, and limit switches.
 - 1. Hydraulic Operator: Purge operating system, adjust pressure and fluid levels, and check for leaks.
 - 2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - 3. Test and adjust controls, alarms, and safeties. Replace damaged and malfunctioning controls and equipment.
- C. Lubricate hardware, gate operator, and other moving parts.

3.10 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's personnel to adjust, operate, and maintain chain-link fences and gates.

END OF SECTION 323113

SECTION 330500 - COMMON WORK RESULTS FOR UTILITIES

PART 1 - GENERAL

1.01 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Section "General Requirements" Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes the following:
 - 1. Piping joining materials.
 - 2. Transition fittings.
 - 3. Dielectric fittings.
 - 4. Sleeves.
 - 5. Identification devices.
 - 6. Grout.
 - 7. Flowable fill.
 - 8. Piped utility demolition.
 - 9. Piping system common requirements.
 - 10. Equipment installation common requirements.
 - 11. Painting.
 - 12. Concrete bases.
 - 13. Metal supports and anchorages.

1.03 DEFINITIONS

- A. Exposed Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions.
- B. Concealed Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.
- C. ABS: Acrylonitrile-butadiene-styrene plastic.
- D. CPVC: Chlorinated polyvinyl chloride plastic.
- E. PE: Polyethylene plastic.
- F. PVC: Polyvinyl chloride plastic.

1.04 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Dielectric fittings.
 - 2. Identification devices.

1.05 INFORMATIONAL SUBMITTALS

- A. Welding certificates.

1.06 QUALITY ASSURANCE

- A. Steel Support Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Steel Piping Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
 - 1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
 - 2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.
- C. Comply with ASME A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pipes and tubes 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. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.08 COORDINATION

- A. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
- B. Coordinate installation of identifying devices after completing covering and painting if devices are applied to surfaces.
- C. Coordinate size and location of concrete bases. Formwork, reinforcement, and concrete requirements are specified in **Section "Cast-in-Place Concrete."**

PART 2 - PRODUCTS

2.01 PIPING JOINING MATERIALS

- A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
 - 1. ASME B16.21, nonmetallic, flat, asbestos free, **1/8-inch (3.2-mm)** maximum thickness, unless otherwise indicated.
 - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
 - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
 - 2. AWWA C110, rubber, flat face, **1/8 inch (3.2 mm)** thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.
- B. Flange Bolts and Nuts: Stainless steel.
- C. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.
- D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- E. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAgl, silver alloy for refrigerant piping, unless otherwise indicated.
- F. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- G. Solvent Cements for Joining Plastic Piping:
 - 1. ABS Piping: ASTM D 2235.
 - 2. CPVC Piping: ASTM F 493.
 - 3. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
 - 4. PVC to ABS Piping Transition: ASTM D 3138.
- H. Fiberglass Pipe Adhesive: As furnished or recommended by pipe manufacturer.

2.02 TRANSITION FITTINGS

- A. Transition Fittings, General: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.
- B. Transition Couplings **NPS 1-1/2 (DN 40)** and Smaller:
 - 1. Underground Piping: Manufactured piping coupling or specified piping system fitting.
 - 2. Aboveground Piping: Specified piping system fitting.

C. AWWA Transition Couplings **NPS 2 (DN 50)** and Larger:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Romac.
 - b. Dresser, Inc.; DMD Div.
 - c. Ford Meter Box Company, Inc. (The); Pipe Products Div.
 - d. JCM Industries.
 - e. Smith-Blair, Inc.
3. Description: AWWA C219, metal sleeve-type coupling for underground pressure piping.

D. Plastic-to-Metal Transition Fittings:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Spears Manufacturing Co.
3. Description: [**PVC**] one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint[**or threaded**] end.

E. Plastic-to-Metal Transition Unions:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Colonial Engineering, Inc.
 - b. NIBCO INC.
 - c. Spears Manufacturing Co.
3. Description: MSS SP-107, [**CPVC**] [**CPVC and PVC**] [**PVC**] four-part union. Include brass[**or stainless-steel**] threaded end, solvent-cement-joint[**or threaded**] plastic end, rubber O-ring, and union nut.

F. Flexible Transition Couplings for Underground Nonpressure Drainage Piping:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Cascade Waterworks Mfg. Co.
 - b. Fernco, Inc.
 - c. Mission Rubber Company.
 - d. Plastic Oddities.
3. Description: ASTM C 1173 with elastomeric sleeve, ends same size as piping to be joined, and corrosion-resistant metal band on each end.

2.03 DIELECTRIC FITTINGS

- A. Dielectric Fittings, General: Assembly of copper alloy and ferrous materials or ferrous material body with separating nonconductive insulating material suitable for system fluid, pressure, and temperature.
- B. Dielectric Unions:
 1. Basis-of-Design Product: Subject to compliance with requirements, provide Zurn Industries, LLC; Wilkins; [Model DUXL (Lead-Free)] [Model DUXLC (Lead-Free)] [Model DUXLM (Lead-Free)] or comparable product by one of the following:
 - a. Capitol Manufacturing Co.
 - b. Central Plastics Company.
 - c. Epco Sales, Inc.
 - d. Hart Industries, International, Inc.
 - e. Watts Water Technologies, Inc.
 2. Description: Factory fabricated, union, NPS 2 (DN 50) and smaller.
 - a. Pressure Rating: [250 psig (1725 kPa)] at 180 deg F (82 deg C).
 - b. End Connections: Solder-joint copper alloy and threaded ferrous; threaded ferrous.
- C. Dielectric Flanges:
 1. Basis-of-Design Product: Subject to compliance with requirements, provide Zurn Industries, LLC; Wilkins; Model DUXLC (Lead-Free) or comparable product by one of the following:
 - a. Capitol Manufacturing Co.
 - b. Central Plastics Company.
 - c. Epco Sales, Inc.
 - d. Watts Regulator Co., a division of Watts Water Technologies, Inc.
 2. Description: Factory-fabricated, bolted, companion-flange assembly, NPS 2-1/2 to NPS 3(DN 65 to DN 80) and larger.
 - a. Pressure Rating: [150 psig (1035 kPa) minimum].

- b. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric-Flange Kits:

- 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Advance Products & Systems, Inc.
 - b. Calpico, Inc.
 - c. Central Plastics Company.
 - d. Pipeline Seal and Insulator, Inc.
- 3. Description: Nonconducting materials for field assembly of companion flanges, **NPS 2-1/2 (DN 65)** and larger.
 - a. Pressure Rating: [**150 psig (1035 kPa) minimum**].
 - b. Gasket: Neoprene or phenolic.
 - c. Bolt Sleeves: Phenolic or polyethylene.
 - d. Washers: Phenolic with steel backing washers.

E. Dielectric Couplings:

- 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Calpico, Inc.
 - b. Lochinvar Corporation.
- 3. Description: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining, **NPS 3 (DN 80)** and smaller.
 - a. Pressure Rating: **300 psig (2070 kPa)** at **225 deg F (107 deg C)**.
 - b. End Connections: Threaded.

F. Dielectric Nipples:

- 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Perfection Corporation.
 - b. Precision Plumbing Products, Inc.

- c. Victaulic Company.
- 3. Description: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining.
 - a. Pressure Rating: [**300 psig (2070 kPa) at 225 deg F (107 deg C)**].
 - b. End Connections: Threaded or grooved.

2.04 SLEEVES

- A. Cast-Iron Sleeves: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- B. Molded PVC Sleeves: Permanent, with nailing flange for attaching to wooden forms.
- C. PVC Pipe Sleeves: ASTM D 1785, Schedule 40.
- D. Molded PE Sleeves: Reusable, PE, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

2.05 IDENTIFICATION DEVICES

- A. General: Products specified are for applications referenced in other utilities Sections. If more than single type is specified for listed applications, selection is Installer's option.
- B. Equipment Nameplates: Metal permanently fastened to equipment with data engraved or stamped.
 - 1. Data: Manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and essential data.
 - 2. Location: Accessible and visible.
- C. Stencils: Standard stencils prepared with letter sizes complying with recommendations in ASME A13.1. Minimum letter height is **1-1/4 inches (30 mm)** for ducts, and **3/4 inch (20 mm)** for access door signs and similar operational instructions.
 - 1. Material: [**Fiberboard**] [**Brass**].
 - 2. Stencil Paint: Exterior, oil-based, alkyd-gloss black enamel, unless otherwise indicated. Paint may be in pressurized spray-can form.
 - 3. Identification Paint: Exterior, oil-based, alkyd enamel in colors according to ASME A13.1, unless otherwise indicated.
- D. Snap-on Plastic Pipe Markers: Manufacturer's standard preprinted, semirigid, snap-on type. Include color-coding according to ASME A13.1, unless otherwise indicated.
- E. Pressure-Sensitive Pipe Markers: Manufacturer's standard preprinted, color-coded, pressure-sensitive-vinyl type with permanent adhesive.
- F. Pipes with OD, Including Insulation, Less Than **6 Inches (150 mm)**: Full-band pipe markers, extending 360 degrees around pipe at each location.

- G. Pipes with OD, Including Insulation, **6 Inches (150 mm)** and Larger: Either full-band or strip-type pipe markers, at least three times letter height and of length required for label.
- H. Lettering: Manufacturer's standard preprinted captions as selected by Engineer.
- I. Lettering: Use piping system terms indicated and abbreviate only as necessary for each application length.
 - 1. Arrows: Either integrally with piping system service lettering to accommodate both directions of flow, or as separate unit on each pipe marker to indicate direction of flow.
- J. Plastic Tape: Manufacturer's standard color-coded, pressure-sensitive, self-adhesive vinyl tape, at least **3 mils (0.08 mm)** thick.
 - 1. Width: **1-1/2 inches (40 mm)** on pipes with OD, including insulation, less than **6 inches (150 mm)**; **2-1/2 inches (65 mm)** for larger pipes.
 - 2. Color: Comply with ASME A13.1, unless otherwise indicated.
- K. Valve Tags: Stamped or engraved with **1/4-inch (6.4-mm)** letters for piping system abbreviation and **1/2-inch (13-mm)** sequenced numbers. Include **5/32-inch (4-mm)** hole for fastener.
 - 1. Material: **0.032-inch- (0.8-mm-)** thick, [**polished brass**].
 - 2. Size: **1-1/2 inches (40 mm)** in diameter, unless otherwise indicated.
 - 3. Shape: As indicated for each piping system.
- L. Valve Tag Fasteners: Brass, wire-link or beaded chain; or brass S-hooks.
- M. Engraved Plastic-Laminate Signs: ASTM D 709, Type I, cellulose, paper-base, phenolic-resin-laminate engraving stock; Grade ES-2, black surface, black phenolic core, with white melamine subcore, unless otherwise indicated. Fabricate in sizes required for message. Provide holes for mechanical fastening.
 - 1. Engraving: Engraver's standard letter style, of sizes and with terms to match equipment identification.
 - 2. Thickness: [**1/8 inch (3 mm)**], unless otherwise indicated.
 - 3. Fasteners: Self-tapping, stainless-steel screws or contact-type permanent adhesive.
- N. Plastic Equipment Markers: Manufacturer's standard laminated plastic, in the following color codes:
 - 1. Green: Cooling equipment and components.
 - 2. Yellow: Heating equipment and components.
 - 3. Brown: Energy reclamation equipment and components.
 - 4. Blue: Equipment and components that do not meet criteria above.
 - 5. Hazardous Equipment: Use colors and designs recommended by ASME A13.1.
 - 6. Terminology: Match schedules as closely as possible. Include the following:
 - a. Name and plan number.
 - b. Equipment service.
 - c. Design capacity.

- d. Other design parameters such as pressure drop, entering and leaving conditions, and speed.
- 7. Size: 2-1/2 by 4 inches (65 by 100 mm) for control devices, dampers, and valves; 4-1/2 by 6 inches (115 by 150 mm) for equipment.
- O. Plasticized Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with mat finish suitable for writing.
 - 1. Size: 3-1/4 by 5-5/8 inches (83 by 143 mm).
 - 2. Fasteners: Brass grommets and wire.
 - 3. Nomenclature: Large-size primary caption such as DANGER, CAUTION, or DO NOT OPERATE.
- P. Lettering and Graphics: Coordinate names, abbreviations, and other designations used in piped utility identification with corresponding designations indicated. Use numbers, letters, and terms indicated for proper identification, operation, and maintenance of piped utility systems and equipment.
 - 1. Multiple Systems: Identify individual system number and service if multiple systems of same name are indicated.

2.06 GROUT

- A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
 - 1. Characteristics: Post hardening, volume adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
 - 2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
 - 3. Packaging: Premixed and factory packaged.

2.07 FLOWABLE FILL

- A. Description: Low-strength-concrete, flowable-slurry mix.
 - 1. Cement: ASTM C 150, Type I, portland.
 - 2. Density: [115- to 145-lb/cu. ft. (1840- to 2325-kg/cu. m)].
 - 3. Aggregates: ASTM C 33, natural sand, fine and crushed gravel or stone, coarse.
 - 4. Aggregates: ASTM C 33, natural sand, fine.
 - 5. Admixture: ASTM C 618, fly-ash mineral.
 - 6. Water: Comply with ASTM C 94/C 94M.
 - 7. Strength: [100 to 200 psig (690 to 1380 kPa)] at 28 days.

PART 3 - EXECUTION

3.01 PIPED UTILITY DEMOLITION

- A. Disconnect, demolish, and remove piped utility systems, equipment, and components indicated to be removed.
 - 1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
 - 2. Piping to Be Abandoned in Place: Drain piping. Fill abandoned piping with flowable fill, and cap or plug piping with same or compatible piping material.
 - 3. Equipment to Be Removed: Disconnect and cap services and remove equipment.
 - 4. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make operational.
 - 5. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
- B. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.02 DIELECTRIC FITTING APPLICATIONS

- A. Dry Piping Systems: Connect piping of dissimilar metals with the following:
 - 1. **NPS 2 (DN 50)** and Smaller: Dielectric unions.
 - 2. **NPS 2-1/2 to NPS 12 (DN 65 to DN 300)**: Dielectric flanges[**or dielectric flange kits**].
- B. Wet Piping Systems: Connect piping of dissimilar metals with the following:
 - 1. **NPS 2 (DN 50)** and Smaller: Dielectric [**couplings**] [**couplings or dielectric nipples**] [**nipples**].
 - 2. **NPS 2-1/2 to NPS 4 (DN 65 to DN 100)**: Dielectric nipples.
 - 3. **NPS 2-1/2 to NPS 8 (DN 65 to DN 200)**: Dielectric nipples[**or dielectric flange kits**].
 - 4. **NPS 10 and NPS 12 (DN 250 and DN 300)**: Dielectric flange kits.

3.03 PIPING INSTALLATION

- A. Install piping according to the following requirements and utilities Sections specifying piping systems.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on the Coordination Drawings.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

- D. Install piping to permit valve servicing.
- E. Install piping at indicated slopes.
- F. Install piping free of sags and bends.
- G. Install fittings for changes in direction and branch connections.
- H. Select system components with pressure rating equal to or greater than system operating pressure.
- I. Sleeves are not required for core-drilled holes.
- J. Permanent sleeves are not required for holes formed by removable PE sleeves.
- K. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.
 - 1. Cut sleeves to length for mounting flush with both surfaces.
 - a. Exception: Extend sleeves installed in floors of equipment areas or other wet areas [2 inches (50 mm)] above finished floor level.
 - 2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
 - a. [PVC] Pipe Sleeves: For pipes smaller than NPS 6 (DN 150).
 - b. Steel Sheet Sleeves: For pipes NPS 6 (DN 150) and larger, penetrating gypsum-board partitions.
- L. Verify final equipment locations for roughing-in.
- M. Refer to equipment specifications in other Sections for roughing-in requirements.

3.04 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and utilities Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

- E. Welded Joints: Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
- F. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
- G. Grooved Joints: Assemble joints with grooved-end pipe coupling with coupling housing, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.
- H. Soldered Joints: Apply ASTM B 813 water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy (0.20 percent maximum lead content) complying with ASTM B 32.
- I. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
- J. Pressure-Sealed Joints: Assemble joints for plain-end copper tube and mechanical pressure seal fitting with proprietary crimping tool to according to fitting manufacturer's written instructions.
- K. Plastic Piping Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 - 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
 - 2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 appendixes.
 - 3. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
 - 4. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
 - 5. PVC Nonpressure Piping: Join according to ASTM D 2855.
 - 6. PVC to ABS Nonpressure Transition Fittings: Join according to ASTM D 3138 Appendix.
- L. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.
- M. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.
- N. Plastic Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.
 - 1. Plain-End PE Pipe and Fittings: Use butt fusion.
 - 2. Plain-End PE Pipe and Socket Fittings: Use socket fusion.
- O. Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

3.05 PIPING CONNECTIONS

- A. Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping **NPS 2 (DN 50)** and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping **NPS 2-1/2 (DN 65)** and larger, adjacent to flanged valves and at final connection to each piece of equipment.
3. Install dielectric fittings at connections of dissimilar metal pipes.

3.06 EQUIPMENT INSTALLATION

- A. Install equipment level and plumb, unless otherwise indicated.
- B. Install equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference with other installations. Extend grease fittings to an accessible location.
- C. Install equipment to allow right of way to piping systems installed at required slope.

3.07 PAINTING

- A. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.08 IDENTIFICATION

- A. Piping Systems: Install pipe markers on each system. Include arrows showing normal direction of flow.
 1. Stenciled Markers: According to ASME A13.1.
 2. Plastic markers, with application systems. Install on insulation segment if required for hot noninsulated piping.
 3. Locate pipe markers on exposed piping according to the following:
 - a. Near each valve and control device.
 - b. Near each branch, excluding short takeoffs for equipment and terminal units. Mark each pipe at branch if flow pattern is not obvious.
 - c. Near locations where pipes pass through walls or floors or enter inaccessible enclosures.
 - d. At manholes and similar access points that permit view of concealed piping.
 - e. Near major equipment items and other points of origination and termination.
- B. Equipment: Install engraved plastic-laminate sign or equipment marker on or near each major item of equipment.
 1. Lettering Size: Minimum **1/4 inch (6.4 mm)** high for name of unit if viewing distance is less than **24 inches (610 mm)**, **1/2 inch (13 mm)** high for distances up to **72 inches (1800 mm)**, and proportionately larger lettering for greater distances. Provide secondary lettering two-thirds to three-fourths of size of principal lettering.

2. Text of Signs: Provide name of identified unit. Include text to distinguish among multiple units, inform user of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.
- C. Adjusting: Relocate identifying devices that become visually blocked by work of this or other Divisions.

3.09 CONCRETE BASES

- A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.
1. Construct concrete bases of dimensions indicated, but not less than **4 inches (100 mm)** larger in both directions than supported unit.
 2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on **18-inch (450-mm)** centers around the full perimeter of base.
 3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
 4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 5. Install expansion anchors to elevations required for proper attachment to supported equipment.
 6. Install expansion anchors according to anchor manufacturer's written instructions.
 7. Use [**3000-psi (20.7-MPa)**] 28-day compressive-strength concrete and reinforcement as specified in [**Section "Cast-in-Place Concrete."**]

3.010 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor piped utility materials and equipment.
- B. Field Welding: Comply with AWS D1.1/D1.1M.

3.011 GROUTING

- A. Mix and install grout for equipment base bearing surfaces, pump and other equipment base plates, and anchors.
- B. Clean surfaces that will come into contact with grout.
- C. Provide forms as required for placement of grout.
- D. Avoid air entrapment during placement of grout.
- E. Place grout, completely filling equipment bases.
- F. Place grout on concrete bases and provide smooth bearing surface for equipment.

- G. Place grout around anchors.
- H. Cure placed grout.

END OF SECTION 330500

SECTION 333200 – WASTEWATER PUMPING STATION

PART 1 GENERAL

1.1 DESCRIPTION

1. Work Included: Furnish all labor, materials, tools, equipment, and appurtenances as specified herein and where shown on the plans and as needed for a complete operational wastewater pump station(s).

1.2 REFERENCES

1. General: The work shall comply with the most recent standards or tentative standards as published at the date of the contract and as listed in this specification using the abbreviation shown.
2. American Society for Testing and Materials (ASTM):
 - 1) A48 Standard Specification for Gray Iron Castings
 - 2) A536 Standard Specification for Ductile Iron Castings
3. American National Standards Institute (ANSI)/National Fire Protection Association (NFPA):
 - 1) 70 National Electrical Code

1.3 GENERAL REQUIREMENTS

1. Pumps: All pumps shall be supplied by a single manufacturer.
2. Alternative Equipment: If the use of alternative equipment requires the redesign of any aspect of the facilities as shown on the design plans, the expense and time allotted for any redesign shall be specifically listed as an attachment to the Bid and shall be included in the bid price for the item.

1.4 SUBMITTALS

1. General: Shall be in accordance with Section “General Requirements”.

1.5 QUALITY ASSURANCE

1. Start Up Service: Include the services of the equipment manufacturer's field service technician for a minimum period of 2 trips and 2 days.
2. Factory Tests: Pumps shall be tested by the manufacturer or a nationally recognized testing agency in compliance with Hydraulic Institute Standards. Where two or more identical pumps are specified, only one representative pump shall be tested. Certified test results shall be submitted to the ENGINEER.
3. Pump Characteristics Curves: Pump characteristic curves showing capacity in gpm, head, efficiency and pumping horsepower should be submitted with the shop plans and contained in the O & M Manual.
4. Warranty: The pump manufacturer shall warrant the pumps to be supplied to the OWNER for a period of five years under normal use.

1.6 DELIVERY, STORAGE, AND HANDLING

1. General: Shall be in accordance with Section “General Requirements”.

PART 2 PRODUCTS

2.1 SUBMERSIBLE PUMP STATION EQUIPMENT

1. General: Provide and install two submersible raw wastewater pumps as indicated on the plans. Provide one spare pump to owner. Pumps shall be slide rail mounted to allow pump maintenance without entry into the wetwell. All opening and passages shall be large enough to permit the passage of a sphere 3 inches in diameter and any trash or stringy material which can pass through a 4 inch house lateral. Pumps shall have a minimum efficiency of 40 percent. Pumps shall be Pentair Hydromatic S4T or approved equal.

2. Pump Characteristics:

Model	Hydromatic S4T
Design Point	675 gpm @ 224 Feet TDH
Impeller	14.25”
Minimum Motor Horsepower	125 HP

3. Pump Construction: Major pump components shall be of ASTM A48, Class 30, gray cast iron with smooth surfaces devoid of blow holes porosity, hard spots, shrinkage cracks, and other irregularities. All exposed nuts, bolts, washers, and other hardware shall be of 316 stainless steel. All surfaces coming into contact with sewage, other than stainless steel, shall be protected by an approved sewage resistant coating. The volute shall have smooth passages which provide unobstructed flow through the pump shall be fitted with ANSI 125 pound flanges, and tested to Hydraulic Institute Standards at 150 percent of shutoff head. Mating surfaces where a watertight seal is required shall be machined and fitted with nitrile or Buna-N rubber O-rings. Fitting shall be such that sealing is accomplished by metal-to-metal contact between mating surfaces, resulting in proper compression of the O-rings without the requirement of specific torque limits.
4. Non-clog Impeller: Non-clog impeller shall be of ASTM A48 gray cast iron or ASTM A536 ductile iron and shall be of a non-clogging design to minimize clogging of solids and fibrous materials. Impellers shall contain pressure vanes on the back shroud to prevent accumulation of debris around seals. The impeller shall be statically, dynamically, and hydraulically balanced. Impellers shall be keyed and bolted to a shaft.
5. Pump Shaft: The pump shaft shall be of stainless steel with a Brinell hardness of 200, and shall be of adequate size and strength to transmit the full horsepower with a liberal safety factor.
6. Wear Rings : Renewable wearing rings shall be provided on the impeller and casing and shall have wearing surfaces normal to the axis of rotation. Wear rings shall be constructed of brass. Wear rings shall be designed for ease of maintenance and shall be adequately secured to prevent rotation.
7. Seals: A tandem mechanical shaft seal system running in an oil bath shall be provided. Seals shall be of carbon and ceramic with each interface held in contact by its own spring system.
8. Bearings: Pump bearings shall be ball and roller type designed to handle all thrust loads in either direction. Bearing shall have a B-10 life of 50,000 hours minimum at any point on the pump curve.

9. Motor: Motor shall be rated NEMA Class B and housed in a watertight chamber. The starter winding and stator leads shall be insulated with moisture resistant Class F insulation. The motor shall be oil filled and be specifically designed to be operated partially or completely submerged in the liquid being pumped. The motor shall be designed for continuous duty and provide adequate power to meet the pump design point. Motor shall be 480 volt, 3 phase, 60 Hertz with a service factor of 1.25.
10. Heat Sensor: Bi-metallic heat sensors shall be embedded in the end turns of each phase group. Sensors shall be normally closed contacts that should be wired into the control circuit for each pump to alarm on high temperature in the stator. Sensor shall be wired into the pump starter to shut the pump down on high temperature. The contacts shall close back to normal once the stator cools.
11. Moisture Sensor: Moisture sensor shall be a stainless steel probe located in the seal oil chamber. The probe shall sense the presence of water intrusion into the seal oil chamber and indicate water leakage past the lower mechanical seal. The probe shall be energized through a relay located in the control panel. The relay shall be powered by 120V AC line.
12. Rail Mounted Systems: Rail mounted systems shall consist of guide rails, a sliding bracket, and a discharge connection elbow. Guide rails shall be of the size standard with the pump manufacturer and shall not support any portion of the weight of the pump. Guide rails shall be constructed of stainless steel. The sliding guide bracket shall be an integral part of the pump unit. The discharge connection elbow shall be permanently installed in the wet well along with the discharge piping. The pump shall be automatically connected to the discharge connection elbow when lowered into place and shall be easily removed for inspection and service without entering the wet well.
13. Lifting Chain: A lifting chain to raise and lower the pump shall be provided for each pump. The chain shall be type 316 stainless steel and shall be capable of supporting the weight of the pump.
14. Power Cable: The power cable shall comply with ANSI/NFPA No. 70, Type SO or SJO, and shall be of standard construction for submersible pump applications. The cable shall enter the pump through a heavy duty entry assembly provided with an internal grommet assembly to prevent leakage. The cable entry junction chamber and motor shall be separated by a stator lead sealing gland or terminal board which shall isolate the motor interior from foreign material gaining access through the pump top. Power cables shall be a minimum length of 50 feet.
15. Pressure Transducer: The pump on and pump off settings shall be measured by a submersible level transducer with a minimum bottom diaphragm of 2-5/8" providing a 4-20 mA instrumentation signal. The transducer shall be of the solid state head pressure sensing type mounted using a removable cable suspension mounting kit utilizing all stainless steel hardware and cable attached to a 25# plastisol coated cast iron weight. The transducer housing shall be fabricated of type 316 stainless steel. A hydraulic fill liquid behind the diaphragm shall transmit the sensed pressure to a solid state variable capacitance transducer element to convert the sensed pressure to a corresponding electrical value. The sensed media shall exert its pressure against the diaphragm that flexes minutely so as to vary the proximity between an internal ceramic diaphragm and a ceramic substrate to vary the capacitance of an electrical field created between the two surfaces. A stable, hybrid operational amplifier assembly shall be incorporated in the transducer to excite and demodulate the sensing mechanism. The internal pressure of the transducer assembly shall be relieved to atmospheric pressure through a urethane jacketed hose/cable assembly and a slack PVC bellows mounted in the upper assembly panel. The sealed breather system shall compensate for variations in barometric pressure and expansion and contraction of air due to temperature changes and altitude as well as prevent fouling from moisture and other corrosive elements. The transducer shall be Keller LevelRat Submersible

Level Transducer Model #1023.01607.051916.13 with 100' cage protector cable or approved equal.

16. Float Switch: The high water alarm & low water alarm shall be controlled by float switches. Switches shall be a 5-1/2" diameter type 316 stainless steel device with a 4 amp mercury free switch at 250 VAC. The float switch cable shall be type SO with three #14 AWG fine stranded copper conductors. The switch assembly shall be installed in the neck of the float switch and held in place by a dual circular crimp. The float switch shall have a minimum net positive buoyancy of two pounds. The float switch shall be attached to the transducer suspension mounting cable.

2.2 WETWELLS

1. Precast Concrete Wetwells: Wetwells shall be of the size and configuration shown on the plans, using precast manhole sections in accordance with Section "Construction Materials".
2. Cast in Place Concrete Wetwells: Wetwells shall be of cast in place concrete construction in accordance with Section "Cast in Place Concrete".

2.3 WETWELL LINING

1. Spray on Epoxy Liners.
 - a. Seamless manhole formed in place, within existing manhole extending from channel to frame.
 - b. Two or three part epoxy coating.
 - c. Existing wall preparation: Follow manufacturers recommendations.
 - d. Minimum thickness: Structurally independent of existing manhole structure or sufficient to form protective barrier when used with Cementitious Manhole Restoration.
 - e. Minimum Tensile Strength (ASTM C307): 2,500 psi.
 - f. Minimum Flexural Strength (ASTM C580): 4,600 psi.
 - g. Approved Manufacturers.
 - 1) Raven.
 - a) Raven 400S (Non Structural Application Only).
 - 2) Sauereisen.
 - a) Sewer Gard No. 210 Sprayable.
 - b) Sewer Gard No. 210 Rotary Spray.
 - c) Sewer Gard No. 210G (Non-Structural Application Only)
 - d) Sewer Gard No. 210 FS
 - e) Hi-Build Filler Compound No. 209HB (Non Structural Application Only).
 - 3) Terre Hill.
 - a) Hydropoxy (Non Structural Application Only).
 - 4) AP/M Permaform.
 - a) Cor+Gard (Non Structural Application Only)
 - 5) SprayRoq, Inc.
 - a) SR6100 (Non Structural Application Only).
 - 6) Warren Environmental, Inc.
 - a) S-301-14 Epoxy Spray System.
 - b) M-301-18 Epoxy Trowel-On Mastic System.
 - c) S-301-20 Thermaflex (Non Structural Application Only).
 - d) SG-201 Injection Grout (Non Structural Application Only).
 - 7) Sherwin Williams
 - a) Cor-cote SC Sewer Cote.

- b) Cor-cote SC Plus Hi-Build Epoxy.
- 8) Sika
 - a) Sikagard 62
- 9) Or Equal.

2.4 PIPING

1. General: Pump station piping shall be Protecto 401 lined ductile iron pressure pipe, Thickness Class 51, in accordance with Section "Construction materials".

2.5 ACCESS HATCHES

1. General: Access hatches shall be Halliday, Bilco, or approved equal. Hatch size shall be confirmed by pump supplier to allow adequate room for the installation and removal of the pumps provided. Deviations in the sizes shown on the plans shall be noted to the ENGINEER during the submittal process. All hatches shall have fall protection grates.

PART 3 EXECUTION

3.1 INSTALLATION

1. General: Install all equipment in strict accordance with the manufacturer's recommendations. Supply all equipment and accessories not specifically provided by the manufacturer but required for satisfactory installation and operation. All anchor bolts shall be plated steel while all other miscellaneous fasteners shall be stainless steel. All bolts shall be of ample size for the purpose intended.
2. Startup: Coordinate startup services of the equipment manufacturer's field service technician with the ENGINEER and OWNER.

END OF SECTION

SECTION 406101 – INSTRUMENTATION & CONTROLS GENERAL REQUIREMENTS

PART 1 – GENERAL

1.01 SUMMARY

- A. Section Includes
 - 1. Provide instrumentation and controls in accordance with this Section and applicable reference standards listed in Article 1.03.
 - 2. Work by Engineer
 - a. PLC Programming
 - b. OIT Programming
 - c. HMI Programming
 - d. Integration of new SCADA system
- B. Related Requirements
 - 1. Division 26 Electrical – Specifications for electrical wiring standards and practices
 - 2. Section 40 6343 – Programmable Logic Controllers
 - 3. Section 406700 – Control System Equipment Panels and Racks

1.02 REFERENCES

- A. Reference Standards
 - 1. American National Standards Institute (ANSI)
 - 2. ASTM International (ASTM)
 - 3. FM Global (FM)
 - 4. International Society of Automation (ISA)
 - a. ISA-RP60.3 Recommended Practice
 - 5. National Electrical Code (NEC)
 - 6. National Electrical Manufacturers Association (NEMA)
 - 7. National Fire Protection Association (NFPA)
 - a. NFPA 70
 - b. NFPA 79 Electrical Standard for Industrial Machinery
 - 8. Occupational Safety and Health Administration (OSHA)

9. Underwriters Laboratories (UL)
 - a. Standard 508A - Standard for Industrial Control Panels
- B. Definitions
 1. PLC – Programmable Logic Controller
 2. RIO – Remote Input/Output Rack
 3. OIT – Operator Interface Terminal
 4. HMI – Human Machine Interface
 5. RTU – Remote Terminal Unit
 6. I/O – Input/Output
 7. SCADA – Supervisory Control and Data Acquisition
 8. Modules – devices that plug into a chassis or connect to an adjacent module and are keyed to allow installation in only one direction

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordination, Sequencing, and Scheduling as follows:
 1. Coordinate equipment, instrument, and material delivery with Project schedule. Notify Engineer if delivery schedule of equipment, instruments, or material affects Project schedule. Include documentation from equipment Supplier indicating revised delivery schedule and reason for change.
 2. Coordinate delivery of equipment, instruments, or materials for installation in system or control panel provided under Sections 406343 and 406700.

1.04 SUBMITTALS

- A. Product Data
 1. PLC and OIT: in accordance with Section 406343.
- B. Shop Drawings
 1. SCADA control panels: in accordance with Section 406700.
- C. Closeout and Maintenance Material Submittals as follows:
 1. Provide operation procedures, equipment descriptions, intended modes of operation, system unit testing procedures and safety measures during operation.

2. Provide record drawings and instructions for maintenance of system equipment. Incorporate maintenance procedures and schedules, coordinate, and cross-reference to detailed operational procedures provided by manufacturers.
3. Include a list of local, authorized distributor's service departments stocking manufacturer's parts and equipment and providing local service.
4. Instrument list or ISA data sheets, including tag numbers
5. Configuration and programming manuals for each type of PLC and each type of OIT.
6. Copies of all Shop Drawings, reports, maintenance data, and schedules, description of operation, and spare parts information.
7. Control panel section of O&M manuals shall include
 - a. Record drawings of control panels updated to reflect the panels after checkout and startup.
 - b. Installation and operation manuals for all major control panel components, network switches, PLCs, I/O modules, and communication equipment.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Acceptance at Site
 1. Check equipment, instruments and materials for damage or defects within 7 days of delivery.

1.06 MAINTENANCE

- A. Extra Materials and Spare Parts: as specified below. Make interchangeable with and of same material and workmanship as corresponding original parts.
- B. Control Panel Spares: one of each type of the following.
 1. Surge arrestor
 2. Fuses (minimum 10 percent spares of each type)
 3. 24 VDC communication power supply
 4. Intrinsic safety barrier
 5. Radio
- C. Programmable Logic Controllers: one of each type of the following.
 1. PLC power supply
 2. PLC processor

3. I/O module
4. Communication module
5. Memory module

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Provide instruments, SCADA control panels, and materials in accordance with the following:
 1. Verify availability of equipment, instruments and materials and submit an “or-equal” or substitute if production is discontinued.

PART 3 – EXECUTION

3.01 STARTUP & COMMISSIONING

- A. Provide in accordance with the following:
 1. Test instruments and SCADA control panels for proper termination and operation, in presence of Engineer.
 2. Calibrate instruments in accordance with manufacturer’s recommended procedure.

3.02 CLOSEOUT ACTIVITIES

- A. Provide in accordance with Division 01 General Requirements.

END OF SECTION

SECTION 406343 - PROGRAMMABLE LOGIC CONTROLLERS

PART 1 – GENERAL

1.01 SUMMARY

- A. Section Includes
 - 1. Provide programmable logic controllers and operator interface terminals in accordance with this Section and applicable reference standards listed in Section 406101.
 - 2. The Owner has determined that **all programable logic controllers and operator interface terminals are proprietary equipment for the Project** is in the public's best interest to coordinate with existing equipment.
- B. Work by Engineer: as specified in Section 406101.
- C. Related Requirements
 - 1. Section 406101 – Instrumentation and Controls General Requirements
 - 2. Section 406700 – Control System Equipment Panels and Racks

1.02 REFERENCES

- A. Reference Standards: in accordance with Section 406101.
- B. Definitions: in accordance with Section 406101.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordination, Sequencing, and Scheduling: in accordance with Section 406101.

1.04 SUBMITTALS

- A. Closeout and Maintenance Material Submittals: per Section 406101.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Provide in accordance with Division 01 General Requirements.
- B. Acceptance at Site
 - 1. Check equipment, instruments, and materials for damage or defects within 7 days of delivery. Repair or replace to satisfaction of Engineer.

1.06 MAINTENANCE

- A. Extra Materials and Spare Parts: as specified in Section 406101.

PART 2 – PRODUCTS

2.01 PROGRAMMABLE LOGIC CONTROLLERS

- A. PLC hardware and programming software: by same manufacturer.
- B. House PLCs in new or existing control panel as specified in Section 406700 and Drawings. Provide 120VAC, 60 Hz, single phase power to control panel.
- C. Minimum PLC input/output (I/O) requirements as indicated on Drawings. Provide additional 20 percent active spare I/O wired to terminal blocks; relay outputs, wired to interposing relays.
- D. Provide PLC rack or mounting space to accommodate additional 20 percent minimum spare slots for future expansion.
- E. Provide microprocessor-based PLC devices with power supplies, processors, process input and output modules, communication cards and chassis, mounted in control panel.
 - 1. Size power supplies to accommodate analog signals, including spares, and card's entire I/O capacity.
- F. Provide PLC capable of stand-alone operation in the event of SCADA network or SCADA computer failure.
- G. Provide UL listed PLC system using modular, field expandable design.
- H. Module design shall prohibit upside down insertion or connection of modules and be compatible with processor type specified.
- I. Operate programmable controller hardware at ambient temperature of 32-140 degrees F. Ambient temperature rating for storage: minus 40-185 degrees F.
- J. Provide PLC hardware to function continuously in relative humidity range of 5-95 percent, non-condensing.
- K. Provide PLC system designed and tested to operate in the high electrical noise environment of an industrial plant.
- L. Module-expandable PLCs and associated modules
 - 1. Series processor acceptable level of quality: equivalent to Allen-Bradley Micro 870.
 - 2. Discrete input modules acceptable level of quality: equivalent to Allen-Bradley 2085-IQ16.
 - 3. Analog input modules acceptable level of quality: equivalent to Allen-Bradley 2085-IF8.

2.02 OPERATOR INTERFACE TERMINALS

- A. House OITs in new or existing control panel as specified in Section 406700 and Drawings.
- B. Operator interface terminal: color graphic display connecting directly to PLC communication port or a communication module, allowing viewing and changing of PLC parameters, rated NEMA 4/4X, powered by 24VDC with integrated real-time clock and battery backup.
- C. Minimum OIT resolution of 1024 by 600 WSVGA graphics, touch screen operation. Minimum display size: 15 inch.
- D. Provide OIT with 26MB internal project memory with compact flash port. Provide 1 GB compact flash card for each operator terminal.
- E. Provide OIT with real-time trending of process variables.
- F. Provide OIT with active and historical alarm screens with ability to acknowledge and clear.
- G. Provide OIT with ability to display a selectable screen based on specific alarm bits.
- H. Provide all communication modules and cables for OIT - PLC communications. PLC interface: Ethernet/IP.
- I. Provide and coordinate communications protocol drivers to establish reliable communications between PLC and OIT.
- J. Provide OIT programming & configuration cables.
- K. Provide OIT with licensed copy of programming software.
- L. OIT acceptable level of quality: equivalent to Automation Direct C-More 10-inch Color active-matrix TFT Touch Panel, part number EA9-T10WCL.
- M. Backup float system PLCs
 - 1. Acceptable level of quality: equivalent to Allen-Bradley Micro 850.
 - 2. Memory module acceptable level of quality: equivalent to Allen-Bradley 2080 MEMBAK-RTC.

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 406700 - CONTROL SYSTEM EQUIPMENT PANELS & RACKS

PART 1 – GENERAL

1.01 SUMMARY

- A. Section Includes
 - 1. Provide all wiring, labor, tools, materials, and equipment to furnish, install, and test control panels and enclosures in accordance with this Section and applicable reference standards listed in Section 40 61 01, and shop drawing level drawings.
 - 2. The Owner has determined that **all radio equipment is proprietary equipment for the Project** is in the public's best interest to coordinate with existing equipment. Reference Section 2.02A.
- B. Work by Engineer: as specified in Section 406101.
- C. Related Requirements
 - 1. Division 26 – Electrical
 - 2. Section 40 61 01 – Instrumentation and Controls General Requirements
 - 3. Section 40 63 43 – Programmable Logic Controllers

1.02 REFERENCES

- A. Reference Standards: as specified in Section 406101.
- B. Definitions: in accordance with Section 406101.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordination, Sequencing, and Scheduling: in accordance with Section 406101.

1.04 SUBMITTALS

- A. Submit in accordance with Section 406101.
- B. Product Data: as listed below unless letter regarding shop drawing level control panel drawings are submitted per Paragraph 1.05.C.1. below.
 - 1. Bill of materials (BOM) for each control panel, including panel tag name or number and component description, quantity, manufacturer name and model number for each component used in fabrication. BOM: keyed to easily correlate components shown in bill of materials with components shown on control panel equipment layout Drawings.

2. Manufacturer's literature for each component identified on BOM. Clearly designate part number with highlights or arrows.
 3. Equipment layout drawings for each control panel
 4. Panel communication diagrams for each control panel
 5. Power wiring diagrams for each control panel
 6. Programmable logic controllers (PLC) input/output (I/O) wiring diagrams, on a module-by-module basis
 7. Backup PLC wiring diagrams for each control panel
- C. Shop Drawings
1. A letter with copy of fabrication drawings confirming control panel fabricator will fabricate control panels as specified on shop drawing level control panel drawings may be provided in lieu of Shop Drawings.
- D. Closeout and Maintenance Material Submittals: per Division 01 General Requirements and Section 406101.
1. As-Built Drawings
 - a. After fabrication of control panels and factory acceptance testing is complete, panel shop shall provide drawings of control panels, representing as-built conditions. Submit panel drawings in AutoCAD DWG and Adobe PDF file formats, on DVD-R media.
 - b. Submit with panels at delivery.
 - c. Legible red-line markups of shop drawing level drawings from panel shop may be provided if used in lieu of Shop Drawings.

1.05 QUALITY ASSURANCE

- A. Qualifications: as follows.
1. Control panel fabricator/panel shop fabrication facility: UL 508A certified, in operation at least 5 years, regularly engaged in furnishing, installing, and wiring similar equipment for use in water and wastewater treatment facilities, and minimum of 3 projects of similar scope in past 5 years.
 2. Surge protection: provided by manufacturer with minimum of 5 years' experience in production of this equipment.
- B. Panel Shop

1. Following control panel fabrication, apply power to each panel to ensure panels are wired correctly and devices contained within panels power up correctly. Provide written confirmation that a power up test was completed.
2. Complete point-to-point wiring checkout for wiring contained in control panels and correct any errors or omissions found. Provide written confirmation that checkout was completed.
3. Provide Engineer 5 days' notice of completion of control panel fabrication and have control panels available in their facility for Factory Acceptance Test by Engineer or System Integrator. Control panels may not be shipped prior to execution of Factory Acceptance Test unless indicated in writing by Engineer.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Provide in accordance with Section 406101.

1.07 MAINTENANCE

- A. Extra Materials and Spare Parts: as specified below. Make interchangeable with and of same material and workmanship as corresponding original parts.
- B. Control Panel Spares: in accordance with Section 406101.

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Procurement of materials and manufacture of control panels shall not begin until related submittals have been reviewed and approved by the Engineer.

2.02 CONTROL PANEL COMPONENTS

- A. Control Panel Components and Recommended Manufacturers

Control Panel Components	Expected level of quality: equivalent to listed manufacturers	Comments
Enclosures	Hoffman Hammond Saginaw	Suitable for use in environments were located per (NEMA, NFPA, etc.)
Programmable Logic Controllers (PLCs)		Refer to Section 406343
Operator Interface Terminals (OITs)		Refer to Section 406343

Control Panel Components	Expected level of quality: equivalent to listed manufacturers	Comments
Wireway	Panduit Hoffman	
DIN Rail	Allen Bradley Phoenix Contact	
Radio Equipment	Cal Amp	PROPRIETARY ITEM Reference control panel drawings for part number specifics
Terminal Blocks	Allen Bradley Phoenix Contact Entelec	Utilize 2-tier terminal blocks wherever possible to conserve panel space.
Terminal Block Fuse Holders	Allen Bradley Phoenix Contact Entelec	Specify fuse holders with blown fuse indicators.
Circuit Breakers	Square D Allen Bradley	
120VAC Surge Suppressors	Phoenix Contact Square D	
Analog Surge Suppressors	Phoenix Contact Citel	
Media Converters	N-Tron B&B Electronics L-Com	Provide with DIN rail mount converters as required on the network architecture
Fuses	Bussman Ferraz Shawmut	All glass fuses in control panels shall be fast acting style. Motor circuit protection and/or inductive load fuses shall be time delay style.
Control Relays	Allen Bradley Square D Omron	Include all required bases, hardware, etc.
Power Supplies	Sola Phoenix Contact Allen Bradley	Provide with power supplies sized as required for equipment contained within the enclosures and to supply field equipment connected to the enclosure.
Intrinsic Safety Barriers	Pepperl & Fuchs MTL Phoenix Contact	Discrete barriers shall be 2-channel barriers. Analog barriers shall be 2-wire barriers.

Control Panel Components	Expected level of quality: equivalent to listed manufacturers	Comments
Ethernet Switches (Unmanaged)	Moxa B&B Electronics	Switches shall be provided with direct-wired low voltage power source within the enclosure.
Ethernet Switches (Managed)	N-Tron B&B Electronics Allen Bradley	All switches comprising the ring topology throughout the facility shall be provided from the same manufacturer.
Fiber Patch Panels	L-Com B&B Electronics	Provide with panel mount patch panels for incoming fiber optic cables as required
Emergency Power System	Sola Phoenix Contact Meanwell	Include uninterruptible power supply (UPS) in each control panel sized to furnish with at least 10 minutes of emergency power.
Panel Heaters	Hammond Hoffman	Provide with panel heaters for outside control panels where temperature is a concern for electronic components.
Receptacles	Pass & Seymour Hubbel Leviton	Provide with receptacle for UPS and convenience receptacle in each PLC control panel.
Pilot/Status Lights (Push to test)	Allen Bradley General Electric Square D	Color code as follows: Red-Fault, Green-Run
HOR, On/Off, L/R switches and push buttons	Allen Bradley General Electric Square D	Furnish switches and push buttons with matching nameplate

2.03 SOURCE QUALITY CONTROL

- A. Provide in accordance with Division 01 General Requirements.

PART 3 – EXECUTION

3.01 CONTROL PANEL FABRICATION

- A. General
1. **SCADA Control Panel:** As indicated in the detailed control panel drawings.
 2. Control panels shall include PLC, required I/O modules with chassis, if applicable, power supply, cables, and all appurtenances. Enclosures shall

include switches, lights, annunciators, and all appurtenances. Furnish panels and materials from one Supplier.

3. Provide electronic equipment utilizing printed circuitry and epoxy or equal coating to prevent contamination by dust, moisture, and fungus. Solid-state components: rated to provide reliable performance over ambient atmosphere fluctuations between 0 – 140 degrees F and 0 – 95 percent relative humidity, non-condensing. Field mounted equipment and system components: designed for installation in dusty, humid, and slightly corrosive service conditions.
4. Equipment installed in a hazardous area shall meet Class, Group, and Division to comply with the NFPA 70.
5. Provide heavy duty equipment, cabinets, and devices designed for continuous industrial service.
6. Fabrication requirements of control panels, enclosures, consoles, and cabinets.
 - a. Size control panel enclosures to provide at least 20 percent spare space for future expansion.
 - b. Provide PLC hardware to accommodate minimum 20 percent spare of each I/O type used in panel, wired to terminals and interposing relays during fabrication process.
 - c. Provide control panel assemblies in compliance with UL 508A Standards.

B. Wiring

1. Interconnecting wiring: stranded and have 600-volt insulation.
2. Power distribution wiring on line side of fuses in accordance with Division 26.
3. Power and low voltage direct current (DC) wiring systems: routed in separate wireways. Crossing of power distribution wiring and control wiring: at right angles. Different system wires routed parallel to each other: separated by at least 6 inches. Different wiring systems shall terminate on separate terminal blocks. Wiring troughs may not be filled to more than 60 percent visible fill.
4. All wiring shall terminate onto single-or-double tier terminal blocks, where each terminal is sequentially numbered with a unique identifier. Direct interlock wiring between equipment is not allowed. Control panel: fabricated with minimum 20 percent spare terminals. Terminal blocks: arranged in vertical rows and separated into groups; power, alternating

current (AC) control, DC signal. Terminal blocks: compression screw type. Spring-clamp style terminals will not be accepted.

- a. Discrete inputs (DI) and discrete outputs (DO) shall have 2 terminals per point with adjacent terminal assignments. Active and spare points: wired to terminal blocks.
 - b. Analog inputs (AI) and analog outputs (AO) shall have a minimum of 3 terminals per shielded pair. Provide 3 terminals for direct connection of powered, 4-wire loops. Provide 4 terminals for direct connection of loop powered 2-wire loops. Provide 5 terminals for connection of analog loops incorporating a local indicator or recorder. One terminal is for shielded ground connections for cable pairs. Ground the shielded signal cable at the PLC cabinet. Wire active and spare points to terminal blocks.
 - c. Wire and tube markers in accordance with Division 26.
 - d. Only 1 side of a terminal block row shall be used for internal wiring. Field wiring side of terminal shall not be within 6 inches of side panel or adjacent terminal, or within 8-inches of bottom of panel.
 - e. Locate terminals for field wiring to reduce amount of routing through wireway to carry wiring to termination point.
5. Provide wiring, internal to panel and field wiring, with service loop to allow for future adjustment of termination point. Service loop: no more than 4-5 inches, stored in associated wireway.
6. Identify live circuit wiring, independent of the panel's normal circuit breaker protection.
7. All wiring shall be clearly tagged and color-coded in accordance with NEC. All tag numbers and color-coding shall correspond to panel wiring diagrams prepared by Engineer. All power wiring, control wiring, grounding, and DC wiring shall utilize different color insulation for each wiring system used. Utilize the following color-coding scheme.
- a. Incoming 120 VAC Hot – Black
 - b. 120 VAC Hot Wiring (control circuit wires downstream of panel circuit breaker) – Red
 - c. 120 VAC Neutral – White
 - d. Ground – Green with yellow stripe
 - e. DC Wiring – Blue
 - f. DC Common – White with blue stripe
 - g. Intrinsically Safe Wiring - Light Blue
 - h. Foreign Voltage – Yellow

C. Control Panel Loss of Power

1. Each control panel containing a PLC shall have an input configured to alarm the operators upon loss of main control panel power. Display alarm on SCADA nodes to alert operators that attention is required.
2. Provide control panels containing a backup PLC for wet well level control with an input configured on the main PLC to alarm operators upon loss of backup PLC power.

D. Control Panel Overcurrent Protection

1. Overcurrent protection devices: properly sized to protect associated devices and loads.
2. Circuit breakers: sized to protect associated equipment and provide necessary power to operate.
3. Fuses
 - a. Glass fuses not associated with motor circuit protection or inductive loads: specified as fast-acting style. Fuses associated with motor circuit protection or inductive loads: specified as time delay style.

E. Lightning/Surge Suppression

1. Provide to protect control panel and associated equipment from surges on incoming power circuits, or those induced by lightning strikes and propagated along signal or power lines connected to control panels. Surge protection: sized properly for intended purpose.
2. 120 VAC Surge Suppression
 - a. Provide incoming 120 VAC power source for control panel with surge suppression located in the control panel. Provide surge suppressors with auxiliary contact, connected to PLC to indicate surge suppressor failure. If there are multiple circuits within the same control panel, provide each incoming 120 VAC power source with surge suppression.
3. Analog Signal Surge Suppression
 - a. Supply analog signals connected to equipment or instrumentation located outside the building where the control panel is installed with DIN rail mounted surge suppression in control panel. Provide surge protection at both ends of signal cable and mount surge protection as close to equipment, instrument, or termination point as possible. Provide minimum of 10 kA surge current suppression.
4. Telephone Line and Ethernet Surge Suppression

- a. Provide copper-based telephone lines and Ethernet cabling connected to control panel that leaves the building that houses the control panel with surge suppression in the control panel. Provide surge protection at both ends of telephone or Ethernet cabling and mount surge protection as close to termination point as possible.
- F. Selector Switches, Pushbuttons and Pilot Lights
- 1. Provide for the enclosures in accordance with Division 26.
- G. Uninterruptible Power Supplies
- 1. Provide control panel containing PLC with an uninterruptible power supply (UPS) sized to provide minimum of 10 minutes of power in event of main control power loss. Provide at minimum, UPS with relay contact outputs, connected to the PLC to indicate UPS fault and UPS low battery conditions.
- H. Ethernet Switches
- 1. Configure ethernet switches to accept number of connections shown on Drawings.
 - 2. Provide ethernet switches with minimum of 20 percent spare RJ-45 ports available for future expansion.
- I. Seal Fail and Motor Temperature Relays
- 1. Pumps, mixers and other equipment equipped with proprietary seal fail and motor temperature relays, require relays to be mounted in the SCADA control panel. Seal fail and motor over temperature alarm contacts: connected to PLC as discrete inputs.
- J. Intrinsic Safety Barrier Panels
- 1. Mount intrinsic safety barriers required for interfacing with equipment and instruments located in a classified area, in panel separate from control panels.
 - 2. Panels housing intrinsic safety barriers laid out to facilitate separation of hazardous and non-hazardous wiring. Wireway containing hazardous area wiring: clearly indicated.
- K. Equipment Mounting/Arrangement
- 1. Mount components in a manner that permits servicing, adjustment, testing and removal without disconnecting, moving or removing any other component. Mount components on inside of panels on removable plates, not directly to enclosure. Mounting: rigid and stable unless shock mounting is required by manufacturer to protect from vibration. Identify components with plastic or metal engraved tags attached with drive pins adjacent to each

component, identifying the component in accordance with the Drawings and Specifications.

2. Install exterior panel mounted equipment with suitable gaskets, faceplates, and other measures required to maintain NEMA rating of panel.
3. Provide minimum of 1-1/2 inches between panel wireway and terminal blocks for easy access to wiring.
4. Maintain manufacturer recommended spacing around panel-mounted equipment.
5. ISA-RP60.3 Recommended Practice: used as a guide in layout and arrangement of panels and panel mounted components.

L. Nameplates

1. Furnish panels and panel devices with nameplates identifying panel and individual devices with the following.
 - a. Device tag number as shown on Drawings.
 - b. Functional description
 - c. Functional control description
2. Furnish 3/32-inch thick, black, and white, Lamacoid nameplates with engraved inscriptions, unless escutcheon plates are specified or noted on Drawings. Letters: black against a white background. Edges of nameplates: beveled and smooth. Affix to panels using #4-40 threaded stainless steel button head hex screws.

3.02 INSTALLATION AND MOUNTING

- A. Location of control panel shown on Drawings is approximate. Obtain information relevant to process control placement Work in the field. Exact location: approved by Owner or Engineer during construction. In case of interference with other Work, proceed as directed by Engineer.

3.03 STARTUP & COMMISSIONING

- A. Power up SCADA Panel upon delivery to Owner.
- B. Power up control panels upon installation. Test field wiring for proper termination. Analog signals: simulated for a full scale 4-20mA test.
- C. Provide testing of SCADA system with Integrator after installation of control panels and instruments, and termination of field wiring to panels is complete. Start up and testing: witnessed by Owner and Engineer.

3.04 CLOSEOUT ACTIVITIES

- A. Provide in accordance with Section 406101.

END OF SECTION

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