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CONTRACT DOCUMENTS

September 2019

TOWN OF

Colchester

CONNECTICUT

RFP 2019-08

D.P.W. Colchester Water Division

Well 3A – Pump House and

Associated Piping

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SECTION 00100

ADVERTISEMENT FOR BIDS

Town of Colchester, Connecticut
(Owner)

Sealed bids for construction of RFP 2019-08 D.P.W. Colchester Water Division, Well 3A – Pump House and Associated Piping for the Town of Colchester, Connecticut, will be received at the First Selectman’s Office until 2pm prevailing time, on October 11, 2019 at which time and place said bids will be publicly opened and read aloud.

The scope of work includes furnishing all labor, materials, equipment, and incidentals to install, test, and make fully operable a new drinking water supply well of 300 gpm capacity to replace Well No. 3 at the Colchester Taintor Hill Road Wellfield in the location shown on the Drawings and as specified herein. The work also includes, but is not limited to, the installation of a submersible well pump in the new well; connecting the new well to the existing raw water main; installation of a precast pump building, flow meter, valves and instrumentation appurtenances; installation of a new Variable Frequency Drive in the new pump building; installation of new power, digital and analog wiring between controls in the existing treatment building and the new precast building and well; and other appurtenant works as required.

The required contract completion period is 180 consecutive days.

The Instructions to Bidders, Form of General Bid, Agreement, Plans, Specifications, Performance and Payment Bond, and other Contract Documents may be examined at the following:

Town of Colchester Website

Contract Documents may be viewed and downloaded as a Portable Document Format (PDF) file free of charge at www.accentblueprints.com. Copies may be obtained for a fee by completing an order online or by calling 978-362-8038 for each set. Completed orders may be picked up at the office of Accent Printing located at 99 Chelmsford Road, North Billerica, MA 01862 (978-362-8038), from 9 a.m. to 4 p.m. Copies may also be shipped to prospective bidders for an additional charge to cover handling and mailing fees. All payments for printing and shipping are nonrefundable. For addition to the project plan holder’s list to guarantee receipt of addenda, it is recommended interested bidders obtain the Contract Documents directly from Accent. Interested bidders will be prompted to register an email address with Accent to access the documents.

The selected contractor shall furnish a performance bond and a payment bond in amount at least equal to one hundred percent (100%) of the contract price as stipulated in Section 00700 GENERAL CONDITIONS of these specifications.

By submission of a bid, the Bidder agrees that this bid shall be good and may not be withdrawn for a period of 60 working days, Saturdays, Sundays and legal holidays excluded after the opening of bids.

The Owner reserves the right to waive any informalities or to reject any or all bids.

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SECTION 00200

INSTRUCTIONS TO BIDDERS

1. RECEIPT AND OPENING OF BIDS
2. BID FORM
3. BID DEPOSIT
4. BID OPENING PROCEDURES
5. COMPARISON OF BIDS
6. WITHDRAWAL OF BIDS
7. ADDENDA AND INTERPRETATIONS
8. DELETIONS FROM CONTRACT
9. EXAMINATION
10. CONTRACT TIME
11. PERFORMANCE AND PAYMENT BONDS
12. ABILITY AND EXPERIENCE
13. INSURANCE CERTIFICATES
14. RIGHTS OF THE AWARDING AUTHORITY
15. EXECUTION OF THE AGREEMENT
16. SAFETY AND HEALTH REGULATIONS
17. NON-DISCRIMINATION IN EMPLOYMENT
18. ACCESS TO THE SITE
19. "OR EQUAL" CLAUSE
20. PROJECT GUARANTEE
21. INFORMATION NOT GUARANTEED
22. LAWS AND REGULATIONS
23. METHOD OF AWARD - LOWEST RESPONSIBLE AND ELIGIBLE BIDDER
24. SEVERABILITY
25. POWER OF ATTORNEY
26. UTILITY INFORMATION
27. PREPARATION OF CONTRACT DOCUMENTS AND PLANS
28. WAIVER OF LOCAL FEES
29. OSHA TEN HOUR TRAINING CERTIFICATION
30. BID SUBMITTAL REQUIREMENTS

1. RECEIPT AND OPENING OF BIDS

The Town of Colchester, Connecticut, herein called the Awarding Authority or Owner, acting by and through its Board of Selectmen, will receive sealed Bids for Construction of the work to be done under this Contract, including the following, all as indicated on the Contract Drawings and specified herein:

- A. Furnish all labor, materials, tools and equipment for the project as specified on the attached drawings and specifications.
- B. The construction of all incidentals to complete work as described above.

Such Bids, addressed to Town of Colchester, and clearly marked "Proposal for RFP 2019-08 D.P.W. Colchester Water Division Well 3A – Pump House an Associated Piping " will be received at the First Selectman's Office until the date and time listed in Section 00100 Advertisement for Bids.

2. BID FORM

- A. Each Bid shall be submitted on the required Bid Form. The Bid Form shall be removed and submitted separately. All blank spaces for Bid prices must be filled in with the lump sum and unit prices for which the Bid is being submitted.
- B. Bid Forms must be completed in ink or by typewriter. The Bid price for each item on the form shall be stated in words, and figures. Discrepancies between words and figures will be resolved in favor of words. Discrepancies between the indicated total of unit prices multiplied by the estimated quantities and the correct total will be resolved in favor of the correct total. Discrepancies between the indicated sum of any column of figures and the correct sum thereof will be resolved in favor of the correct sum.
- C. A Bid which includes for any item a Bid Price that is abnormally low or high may be rejected as unbalanced.

3. BID DEPOSIT

- A. Each Bid submitted by bidders filing bids in accordance with the required procedure shall be accompanied by a bid deposit in the form of a bid bond, or cash, or a certified check on, or a treasurer's or cashier's check issued by, a responsible bank or trust company in the amount of ten percent (10%) of the value of the proposed work, payable to the "Town of Colchester."
- B. All bid deposits of general bidders except those of the three lowest responsible and eligible general bidders shall be returned within five (5) working days, Saturday, Sunday and legal holidays excluded, after the opening of bids. Bid deposits withheld shall be returned upon execution and delivery of the general contract; except that if the selected general bidder fails to execute a contract and furnish the required bonds and insurance certificates, the contractor's deposit shall become the property of the Awarding Authority as liquidated damages in an amount not to exceed the difference between the contractor's bid price and the bid price of the next lowest responsible and eligible bidder.
- C. In case of death, disability, or other unforeseen circumstances affecting the bidder, such bid deposit may be returned. After execution of the Contract and acceptance of the bonds by the Awarding Authority, the bid deposit accompanying the proposal of the successful bidder will be returned.

- D. All bid deposits will be returned on the execution of the Contract, or if no award is made within 90 days after the date of the opening thereof, unless forfeited under the conditions stipulated above.

4. BID OPENING PROCEDURES

- A. Bid signatures will be checked.
- B. Acknowledgement of addenda will be checked (see Section 00410, Form of General Bid).
- C. The total dollar amount of each bid will be read, and the individual bid prices for each item of the three apparent low bidders will be read.
- D. The bid form attachments will be verified to be included with the bid and signatures confirmed. The review of the bid form attachments will be completed following the bid opening.
- E. The bid opening will then be closed. All those present at the bid opening may examine any of the bids after close of the bid opening.

5. COMPARISON OF BIDS

- A. Bids will be compared on the basis of the quantities and units and lump sum prices stated in Section 00410, Form of General Bid.
- B. In the event of a discrepancy between written and numerical figures in lump sum prices, the written figures shall govern.

6. WITHDRAWAL OF BIDS

Bidders may not withdraw or modify their bids for a period of 60 days, Saturday, Sunday and legal holidays excluded, prior to the opening of the bids.

7. ADDENDA AND INTERPRETATIONS

No interpretation of the meaning of the plans, specifications or other prebid documents will be made to any bidder orally, and if provided orally, shall not be relied upon by bidders unless confirmed in a written addendum. All information given to bidders other than by means of the plans, specifications, or by addenda, as described below, is given informally and shall not be used as the basis of a claim against the OWNER or the ENGINEER.

Every request for such interpretation should be in writing (typed, not handwritten) addressed to Weston & Sampson Engineers, Inc., 55 Walkers Brook Drive, Reading, Massachusetts 01867 Attention: CSD, or sent via FAX to Weston & Sampson at (978) 977-0100 and to be given consideration must be received at least ten working days prior to the date fixed for the opening of bids.

8. DELETIONS FROM CONTRACT

The Awarding Authority reserves the right, prior to award of the Contract, to delete any portion of the contractor's work as its interests may appear, and to adjust the quantities of work at any time.

9. EXAMINATION

By submitting a bid, the bidder warrants that they have examined the site of the work, the specifications and drawings and is fully acquainted with all conditions and restrictions pertaining to the work and the execution thereof. No claim for any extra work or extension of time will be allowed for failure to observe this requirement. Conditional bids will not be accepted.

10. CONTRACT TIME

All work related to the Contract shall be completed within one hundred and eighty (180) calendar days of the execution of the Contract or the Notice to Proceed, whichever is later.

11. PERFORMANCE AND PAYMENT BONDS

- A. The selected Bidder shall provide both performance and payment bonds prior to the time of execution of the contract.
- B. Each bond shall be in amounts equal to one hundred percent (100%) of the contract amount, shall be in the form as given elsewhere herein, shall be by a surety qualified to do business under the laws of the State of Connecticut and satisfactory to the Awarding Authority.

12. ABILITY AND EXPERIENCE

- A. The Awarding Authority will not award a contract to any bidder who cannot furnish satisfactory evidence of their ability and experience in this type of work and that they have sufficient plant and capital to enable them to prosecute and complete the work within the given time period.
- B. The Awarding Authority may make such investigations as it deems necessary to determine the above and a bidder shall furnish any information requested in this regard and shall furnish same under oath if required.

13. INSURANCE CERTIFICATES

The Contractor will not be permitted to start any construction work until they have submitted certificates of insurance acceptable to the Awarding Authority. Certificates shall be submitted prior to the time of execution of the contract. Refer to Section **00800** Supplementary Conditions for details regarding insurance requirements.

14. RIGHTS OF THE AWARDING AUTHORITY

- A. The Awarding Authority may reject, as informal, bids that are incomplete, conditional, or obscure, or that contain additions or erasures that are not initialed or other irregularities.
- B. The Awarding Authority reserves the right to reject any or all bids or to accept any bid as their interests may appear.

- C. The Awarding Authority anticipates awarding a contract for this project within Thirty (30) days of the date of bid opening; however, this date is subject to change. Bidders shall be prepared to submit within four (4) working days all documents and information required for full execution of the Agreement. If the Contractor fails to do so, the Awarding Authority reserves the right to rescind the Contract Award.

15. EXECUTION OF THE AGREEMENT

- A. Within ten (10) days of the receipt of the Agreement signed by the successful bidder and receipt of acceptable performance and payment bonds, the Awarding Authority shall sign the Agreement and return a duplicate of the executed Agreement.
- B. The Notice to Proceed shall be issued within ten (10) days of the execution of the Agreement. This time period may be extended by mutual agreement between the Awarding Authority and the Contractor.

16. SAFETY AND HEALTH REGULATIONS

- A. The successful bidder shall comply with the Department of Labor Safety and Health Regulations for Construction promulgated under the Occupational Safety and Health Act of 1970 (PC-91-596) and under Section 107 of the Contract Work Hours and Safety Standards Act (PL-91-54).
- B. The successful bidder shall have a competent person or persons, as required under Occupational Safety and Health Act, on the Site to inspect the work and to supervise the conformance of the work with the regulations of the Act.
- C. This project is subject to the Safety and Health regulations of the U.S. Department of Labor set forth in 29 CFR, Part 1926. Contractors shall be familiar with the requirements of these regulations.

17. NON-DISCRIMINATION IN EMPLOYMENT

- A. Contracts for work under this proposal shall obligate the Contractor and Subcontractor not to discriminate in employment practices.
- B. Bidders for the General Contract must submit with their initial bid a signed statement as to whether they have previously performed work subject to the President's Executive Order No. 11246, or any preceding similar Executive Order.
- C. Bidders must, if requested, submit a compliance report concerning their employment practices and policies in order to maintain their eligibility to receive the award of the contract.
- D. Bidders must, if requested, submit a list of all sub-contractors who will perform work on the project and submit written signed statements from authorized agents of the labor pools with which they will or may deal for employees on the work, together with supporting information to the effect that said labor pools' practices and policies are in conformity with Executive Order 11246, and that said labor pools will affirmatively cooperate in or offer no hindrance to the recruitment, employment, and equal treatment of employees seeking employment and performing work under the Contract,

or certification as to what efforts have been made to secure such statement when such agents or labor pools have failed to furnish same prior to the Award of the Contract.

18. ACCESS TO THE SITE

Representatives of the Grant Awarding Agency and of the State of Connecticut shall have access to the work wherever it is in preparation or progress and the successful Bidder shall provide proper facilities for such access and inspection.

19. "OR EQUAL" CLAUSE

- A. Whenever the specifications define the material or article required by using the name of the proprietary product or of a manufacturer or vendor rather than by using descriptive detail of substance and function, the words "or equal" are to be understood to follow immediately the name of the maker, vendor, or proprietary product. The words, "or equal" shall be interpreted as including any material or article which, in the opinion of the Engineer, is equal in quality durability, appearance, strength, and design to the article named and which will perform adequately the functions imposed by the general design.
- B. Whenever in the specifications the names of manufacturers are mentioned as indicating that their products will comply with a particular specification, or when specific trade names or plate numbers or letters are mentioned, it is not intended to exclude products of other manufacturers whose names, trade names or symbols have not been mentioned, provided however, that such products otherwise comply, in the opinion of the Engineer, with the specification. The Engineer's opinion in all cases mentioned in this section shall be final.

20. PROJECT GUARANTEE

- A. The Contractor guarantees that the work and services to be performed under the Contract and all work, material, and equipment performed, furnished, used or installed in the construction of the same, shall be free from defects and flaws and shall be performed and furnished in strict accordance with the Drawings, Specifications, and other Contract Documents; that the strength of all parts of all manufactured equipment shall be adequate and as specified and that the performance test requirements of the Contract shall be fulfilled. This guarantee shall be for a period of one (1) year from and after the date of completion and acceptance of the work as stated in the final estimate. If part of the work is accepted by the Awarding Authority, the guarantee for that part of the work shall be for a period of one (1) year from the date fixed for such acceptance.
- B. If at any time within said period of guarantee any part of the work requires repairing, correction or replacement, the Awarding Authority may notify the Contractor in writing to make the required repairs, correction or replacements. If the Contractor neglects to commence making such repairs, corrections or replacements to the satisfaction of the Awarding Authority within three (3) days from the date of receipt of such notice, or having commenced fails to prosecute such work with diligence, the Awarding Authority may employ other persons to make the same, and all direct and indirect costs of making said repairs, corrections or replacements, including compensation for additional professional services, shall be paid by the Contractor.
- C. It is hereby, however, agreed and understood that this guarantee shall not include any repairs or replacements made necessary by any cause or causes other than improper, inadequate, or defective work, quality of the work, materials or design by the Contractor or those employed directly or indirectly by the Contractor.

21. INFORMATION NOT GUARANTEED

- A. All information given on the Drawings or in the other Contract Documents relating to subsurface and other conditions, natural phenomena, existing pipes, and other structures is from the best sources available to the Awarding Authority. All such information is furnished only for the information and convenience of bidders and is not guaranteed.
- B. It is agreed and understood that the Awarding Authority does not warrant or guarantee that the subsurface or other conditions, natural phenomena, existing pipes, or other structures encountered during construction will be the same as those indicated on the Drawings or in the other Contract Documents.
- C. It is agreed further and understood that no bidder or contractor shall use or be entitled to use any of the information made available to them or obtained in any examination made by them in any manner as a basis of or ground for any claim or demand against the Awarding Authority or the Engineer, arising from or by reason of any variance which may exist between the information made available and the actual subsurface or other conditions, natural phenomena, existing pipes or other structures actually encountered during the construction work, except as may be otherwise be expressly provided for in the Contract Documents.

22. LAWS AND REGULATIONS

The Bidder's attention is directed to the fact that all applicable Federal and State Laws, municipal ordinances, and the construction of the project shall apply to the contract throughout, as though herein written out in full.

23. METHOD OF AWARD - LOWEST RESPONSIBLE AND ELIGIBLE BIDDER

- A. The Contract will be awarded on the basis of the lowest bid as submitted by a responsible and eligible Bidder if such bid does not exceed the amount of funds available to finance the Contract, in accordance with Town of Colchester Purchasing Policy.
- B. During the period of the Contract, the Awarding Authority shall have the right to add Alternate items through a Change Order at the Bid Price shown on the Bid Form.

24. SEVERABILITY

If any provisions of this Agreement or portion of such provision of the application thereof to any persons, entity, or circumstances is held invalid, the remainder of the Agreement (or remainder of such provision) and the application of such to other persons, entities, or circumstances shall not be affected thereby so long as such remaining or modified provisions reflect the intent of the parties.

25. POWER OF ATTORNEY

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

26. UTILITY INFORMATION

Following are the names and addresses of the agencies and utility companies which may be affected, but the completeness is not guaranteed:

Call-Before-You-Dig

Electric: Eversource 1-800-286-2000

Gas: There are no natural gas pipelines in Colchester, CT.

Telephone: Frontier 1-800-453-7638

Cable: Comcast 1-860-889-5505

27. PREPARATION OF CONTRACT DOCUMENTS AND PLANS

The plans and specifications for the work have been prepared by Weston & Sampson Engineers, Inc. of Rocky Hill, CT.

28. WAIVER OF LOCAL FEES

The Awarding Authority shall waive permit and other local fees that are under its jurisdiction to so waive. Bids should reflect the waiver of such fees in the total bid price.

29. OSHA TEN HOUR TRAINING CERTIFICATION

Not later than thirty days after the award of this contract, the Contractor shall furnish proof to the Labor Commissioner that all employees performing manual labor on this project have completed a course of at least ten hours in duration in construction safety and health approved by OSHA.

30. BID SUBMITTAL REQUIREMENTS

A complete bid shall consist of all of the following:

SECTION 00410 - BID FORM (*Pages 00410-1 through 00410-5*)

SECTION 00420 - BID FORM ATTACHMENTS: (*Pages 00420-1 through 00420-26*)

- CONTRACTOR'S QUALIFICATION STATEMENT – WITH REFERENCES
- LISTING OF PROPOSED SUBCONTRACTORS
- AFFIDAVIT
- CERTIFICATE OF BIDDER REGARDING EQUAL EMPLOYMENT OPPORTUNITY
- CERTIFICATION BY PROPOSED SUBCONTRACTOR REGARDING EQUAL EMPLOYMENT OPPORTUNITY
- ASSURANCE OF COMPLIANCE (SECTION 3, HUD ACT OF 1968)
- BID BOND
- CERTIFICATE AS TO CORPORATE BIDDER

- CERTIFICATE OF MATERIAL CONFORMANCE WITH THE SPECIFICATIONS
- CERTIFICATION OF BIDDER REGARDING SECTION 3 AND SEGREGATED FACILITIES
- SECTION 3 PLAN (FORMAT)
- GENERAL CONTRACTOR'S SECTION 3 PLAN CERTIFICATION
- CERTIFICATION OF COMPLIANCE WITH TAX LAWS
- CERTIFICATE OF NON-COLLUSION

Failure to submit a bid that includes both the Bid Form and all Bid Form attachments listed above may result in bidder's disqualification by the Awarding Authority.

END OF SECTION

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SECTION 00320
SUBSURFACE DATA

PART 1 - GENERAL

1.01 SCOPE:

- A. A subsurface exploration program consisting of probes, borings, test pits and monitoring wells has been performed, with reasonable care. The results of the exploration program are appended hereto and are a part of the Contract Documents. Samples of the materials encountered may be seen upon request during the bidding period only at the office of Weston & Sampson Engineers, Inc., 273 Dividend Road, Rocky Hill, CT. If Contractors deem the subsurface information insufficient, they may, after obtaining Owner's permission, carry out additional subsurface explorations, at no expense to the Owner.
- B. Subsurface information provided in the Contract Documents is limited by the methods used for obtaining and expressing such data and is subject to various interpretations. The terms used to describe soils, rock, groundwater and such other conditions are subject to local usage and individual interpretation.
- C. Borings have been drilled substantially at the locations indicated on the drawings and advanced to the depths shown on the logs. Soil information presented in the boring logs, as to classification, gradation, properties, density and consistency, is based on visual observation of recovered samples. Groundwater levels reported on the boring logs are those measured in the field at the particular location and at the time measurements were made, and do not necessarily represent permanent groundwater elevations. Groundwater elevations may be affected by temperature, rainfall, tidal fluctuation, and other factors that may not have been present at the time the measurements were made. The Contractors should be aware that groundwater level fluctuations may affect methods of construction.
- D. Subsurface exploration, soil and rock data are for the general information of the Contractors. The Contractors are obligated to examine the site, review boring and test pit logs, all available information and records of explorations, investigations and other pertinent data for the site, and then based upon their own interpretations and investigations decide the character of material to be encountered and excavated, the suitability of the materials to be used for backfilling and such other purposes, the groundwater conditions, difficulties or obstacles likely to be encountered, and other conditions affecting the work. The subsurface data is accurate only at the particular locations and times the subsurface explorations were made. No other warranty, either expressed or implied by the Owner, Engineer or their agents is made as to the accuracy of the subsurface information and data shown on the drawings or presented in the Contract Documents.

PART 2 – PRODUCTS (NOT APPLICABLE)

PART 3 – EXECUTION (NOT APPLICABLE)

END OF SECTION

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Record of Test Drilling
THE STEPHEN B CHURCH COMPANY
 OXFORD, CT

Client: Colchester P.W. 3B
 Test well #

Date: Apr 1962 Driller: J Tucker

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Depth from Surface	To	Took water?	Resistance?	Color	Hammer weight:		Drive shoe
					Static water level from top of casing:	Curb box/ protective casing	
		Very good	Very very hard			Screens slot sizes from bottom:	Bags of sakrete
		Good	Very hard			Overall screen length:	Stickup above grade
		Some	Hard			Bottom of screen from top of casing:	Time of development
		Poor	Good			2 1/2 inch pipe:	Estimated yield
		None					
0'	10'-0"						
10'-0"	15'-0"						
15'-0"	20'-0"						
20'-0"	22'-0"						
22'-0"	24'-0"						
24'-0"	26'-0"						
26'-0"	28'-0"						
28'-0"	30'-0"						

loose (good digging) v.f - c br forage sand, f - uc
 gravel, cobbles, stones, f - c br sand, f - uc
 (most of this was fill for lagoon)
 loose (good digging) v.f - c br forage sand, f - uc
 gravel (top of iron color)
 f - uc br sand, cobbles, boulders, f - uc gravel
 huge boulder at 20.5' + -
 cobbles, stones, boulder, fairly loose br. f - uc sand
 f - uc gravel, trace of gray sand
 loose v.f - c br sand, v.f - uc gravel, stones,
 cobbles
 loose v.f - uc br sand, v.f - uc gravel, stones +
 cobbles
 same as above
 same as above

Record of Test Drilling

THE STEPHEN B CHURCH COMPANY
OXFORD, CT

Client Colchester P.W. 3B
Testwell #

Date Apr 2005 Driller J. Tucker

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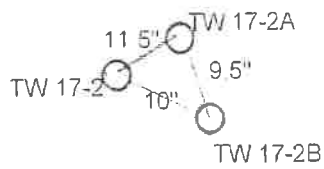
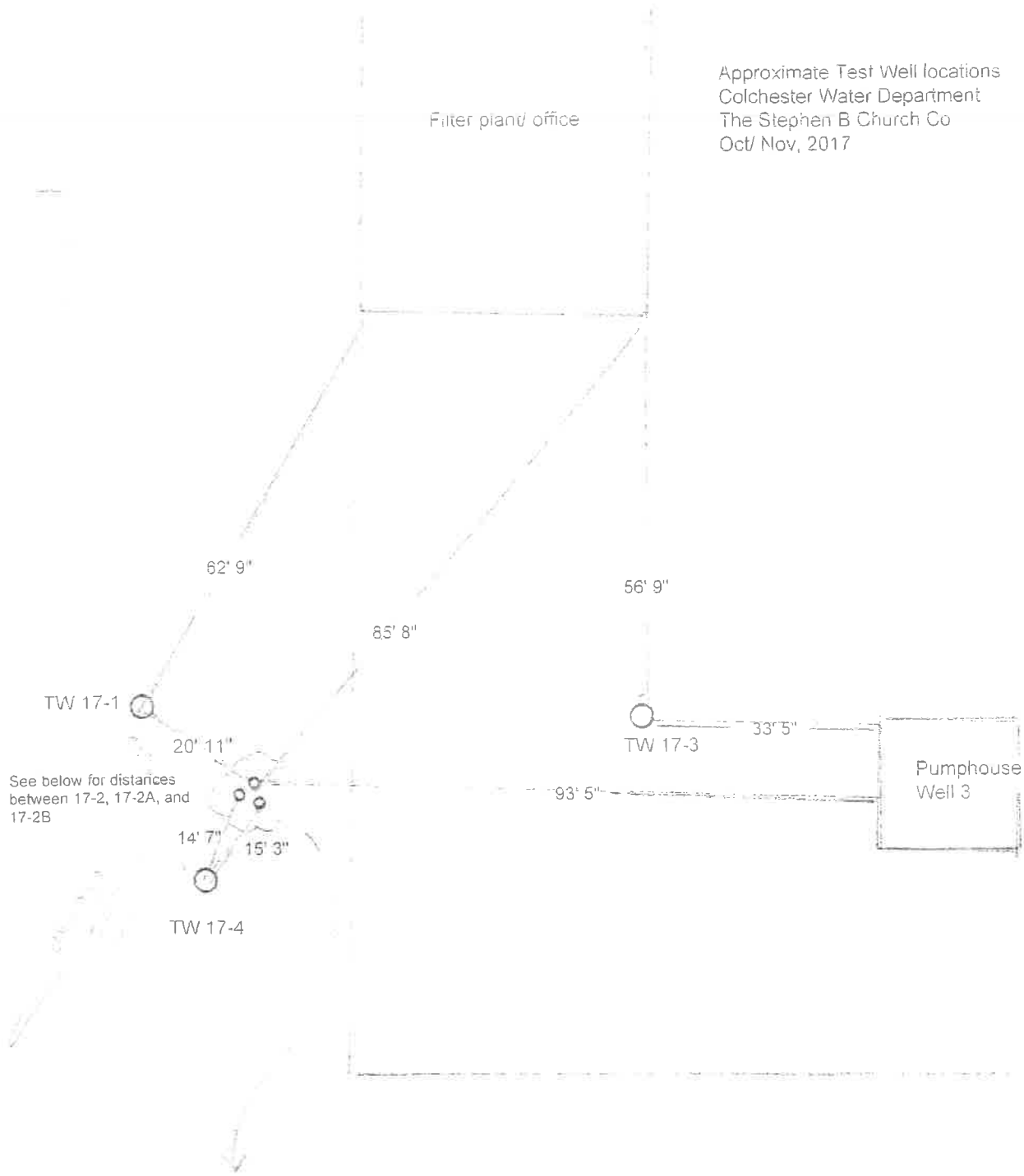
Depth from Surface	Took water?	Resistance?	Color	Hammer weight:		Drive shoe
				Static water level from top of casing:	Curb box/ protective casing	
From	Very good	Very very hard		Screens slot sizes from bottom:	Bags of sakrete	
To	Good	Very hard		Overall screen length:	Stickup above grade	
	Some	Hard		Bottom of screen from top of casing:	Time of development	
	Poor	Good		2 1/2 inch pipe:	Estimated yield	
	None					
30'-0"						
32'-0"						
34'-0"						
36'-0"						
38'-0"						
40'-0"						
42'-0"						
44'-0"						
46'-0"						
48'-0"						
50'-0"						
52'-0"						
54'-0"						
56'-0"						

Lighter w.f. - m sand b/gray layer, some f-c grav, stones, cobbles
 w.f. - med silty b/gray sand, trace f-c grav cobbles, stones
 u.f. - f b/gray sand, trace grav
 u.f. - m b/gray sand, trace grav stones
 u.f. - c layers/ seam b/gray sand, some f-c grav, stones, cobbles
 u.f. - c b/gray sand, u.f. - vc grav, stones, cobbles same as above, more stones
 u.f. - c gray sand, f - vc grav, cobbles, stones
 lighter w.f. - m gray sand, some f-c grav, cobbles, stones
 lighter w.f. - m clay sand, f-c grav, lots of cobbles, stones, boulder at 48.5'
 same as above to 51' - then loose f-c grav sand f-m grav, cleanest material yet
 loose, uniform, f-c gray clean sand, f-m grav
 same as above to 55' + - then hardpan like tight w.f. - f silty sand packed with stone + cobbles

Huge Boulder at 56.5' + - REFUSAL

Approximate Test Well locations
Colchester Water Department
The Stephen B Church Co
Oct/ Nov, 2017

Filter plant/ office



Not to scale



SECTION 00410

FORM OF GENERAL BID

Proposal of _____ (hereinafter called "Bidder")*

- a corporation, organized and existing under the laws of the State of Connecticut
- a partnership
- a joint venture
- a limited liability company
- an individual doing business as _____

*Insert corporation, partnership, joint venture or individual as applicable.

To the TOWN OF COLCHESTER, CONNECTICUT (hereinafter called "Owner").

Gentlemen:

The Bidder, in compliance with your invitation for bid for the RFP 2019-08 D.P.W. Colchester Water Division Well 3A – Pump House and Associated Piping, Colchester, CT, having examined the plans and specifications with related documents and the site of the proposed work and being familiar with all of the conditions surrounding the construction of the proposed project including the availability of materials and labor, hereby proposes to furnish all superintendence, labor, services, materials, equipment, plant, machinery, apparatus, appliances, tools, supplies, bailing, shoring, removal, and all other things necessary to construct the project in accordance with the contract documents, as prepared by Weston & Sampson Engineers, Inc., within the time set forth therein and at the prices stated below. These prices are to cover all expenses incurred in performing the work required under the contract documents, of which this proposal is a part.

The Bidder hereby agrees to commence work under this contract on or before a date to be fixed in the written "Notice to Proceed" given by the Owner to the Contractor and to fully complete all work related to the Contract within 180 calendar days of the execution of the Contract or the

Notice to Proceed, whichever is later. The Bidder further agrees to pay as liquidated damages the sum of \$750 for each consecutive calendar day thereafter during which the work has not been fully completed, as provided in the "Liquidated Damages" paragraph of Section 00800 SUPPLEMENTARY CONDITIONS.

Bidder acknowledges receipt of the following addenda:

No.	Dated:
No.	Dated:
No.	Dated:
No.	Dated:

The Bidder agrees to perform the work described in the specifications and shown on the plans for the sum of: _____ dollars and _____ cents (\$_____).

All entries shall be made clearly in ink or typewritten. Amounts are to be shown in both words and figures. Discrepancies between words and figures will be resolved in favor of words. Discrepancies between the indicated total of unit prices multiplied by the estimated quantities and the correct total will be resolved in favor of the correct total. Discrepancies between the indicated sum of any column of figures and the correct sum thereof will be resolved in favor of the correct sum.

The contract will be awarded to the lowest eligible and responsible bidder on the basis of the lowest bid.

The Bidder understands that the Owner reserves the right to reject any or all bids and to waive any informalities in the bidding.

The Bidder agrees that this bid shall be good and may not be withdrawn for a period of ninety (90) days, Saturdays, Sundays and legal holidays excluded, after the opening of bids.

Within ten (10) days of receipt of the written notice of acceptance of this bid, the Bidder will execute the formal agreement attached in Section 00520 AGREEMENT.

Bid security is attached in the sum of five percent (5%) of the total bid in accordance with the conditions of Section 00200 INSTRUCTIONS TO BIDDERS. The bid security may become

the property of the Owner in the event the contract and bond are not executed within the time set forth above.

The selected Contractor shall furnish a performance bond and a payment bond in an amount at least equal to one hundred percent (100%) of the contract prices in accordance with Section 00610 PERFORMANCE BOND, Section 00615 PAYMENT BOND, and as stipulated in paragraph 5.01 of Section 00700 GENERAL CONDITIONS of these specifications.

The undersigned offers the following information as evidence of its qualifications to perform the work as bid upon according to all the requirements of the plans and specifications.

1. Have been in business under present name for _____ years.
2. The names and addresses of all persons interested in the bid (if made by a partnership or corporation) as Principals, are as follows:

(Attach supplementary list if necessary)

3. The Bidder is requested to state below what work of a similar character to that included in the proposed contract it has done and give references that will enable the Owner to judge its experience, skill and business standing (add supplementary page if necessary).

Completion Date	Project Name	Contract Amount	Design Engineer	Reference Name	Telephone No.
-----------------	--------------	-----------------	-----------------	----------------	---------------

a.

b.

c.

d.

e.

f.

00410-4

The undersigned hereby certifies that it is able to furnish labor that can work in harmony with all other elements of labor employed or to be employed in the work.

The undersigned certifies under penalties of perjury that this bid is in all respects bona fide, fair and made without collusion or fraud with any other person. As used in this paragraph the word "person" shall mean any natural person, joint venture, partnership, corporation or other business or legal entity which sells materials, equipment or supplies used in or for, or engages in the performance of, the same or similar construction, reconstruction, installation, demolition, maintenance or repair work or any part thereof...

The undersigned further certifies under penalty of perjury that the said undersigned is not presently debarred from doing public construction work in the State of Connecticut under applicable debarment provisions of the Connecticut General Statutes or any rule or regulations promulgated thereunder.

Respectfully submitted:

Date _____

By _____
(Signature)

(Name – Typed or Printed)

(Title)

(SEAL - if bid is by a corporation)

(Business Name)

(Federal ID Number)

(Business Address)

(City and State)

(Telephone Number)

(Fax Number)

SECTION 00420

BID FORM ATTACHMENTS

1. CONTRACTOR'S QUALIFICATION STATEMENT
2. LISTING OF PROPOSED SUBCONTRACTORS
3. AFFIDAVIT
4. CERTIFICATE OF BIDDER REGARDING EQUAL EMPLOYMENT OPPORTUNITY
5. CERTIFICATION BY PROPOSED SUBCONTRACTOR REGARDING EQUAL EMPLOYMENT OPPORTUNITY
6. ASSURANCE OF COMPLIANCE (SECTION 3, HUD ACT OF 1968)
7. BID BOND
8. CERTIFICATE AS TO CORPORATE BIDDER
9. CERTIFICATE OF MATERIAL CONFORMANCE WITH THE SPECIFICATIONS
10. CERTIFICATION OF BIDDER REGARDING SECTION 3 AND SEGREGATED FACILITIES
11. CERTIFICATION OF COMPLIANCE WITH TAX LAWS
12. CERTIFICATE OF NON-COLLUSION
13. CERTIFICATION OF DUMPING FACILITIES

CONTRACTOR’S QUALIFICATION STATEMENT

TO: TOWN OF COLCHESTER, CONNECTICUT
hereinafter called “Owner”

Pursuant to bidding requirements for the Work titled: RFP 2019-08 D.P.W. Colchester Water Division Well 3A – Pump House and Associated Piping

The Bidder is qualified to complete the Work as stated below:

The scope of work includes furnishing all labor, materials, equipment, and incidentals to install, test, and make fully operable a new drinking water supply well of 300 gpm capacity to replace Well No. 3 at the Colchester Taintor Hill Road Wellfield in the location shown on the Drawings and as specified herein. The work also includes, but is not limited to, the installation of a submersible well pump in the new well; connecting the new well to the existing raw water main; installation of a precast pump building, flow meter, valves and instrumentation appurtenances; installation of a new Variable Frequency Drive in the new pump building; installation of new power, digital and analog wiring between controls in the existing treatment building and the new precast building and well; and other appurtenant works as required.

ORGANIZATION

If your organization is a corporation, provide the following:

Date of incorporation: _____
State of incorporation: _____
President’s name: _____
Vice-president’s name(s): _____

Secretary’s name: _____
Treasurer’s name: _____

If your organization is a partnership, answer the following:

Date of organization: _____
Type of partnership: _____
Name(s) of general partner(s): _____

If your organization is individually owned, answer the following:

Date of organization: _____

Name of owner: _____

If the form of your organization is other than those listed above, describe it and name the principles:

EXPERIENCE

List the categories of work that your organization normally performs with its own forces.

Claims and Suits. (If the answer to any of the questions below is yes, please attach details.)

- No Yes Has your organization ever failed to complete any work awarded to it?
No Yes Are there any judgements, claims, arbitration proceedings or suits pending or outstanding against your organization or its officers?
No Yes Has your organization filed any lawsuits or requested arbitration with regard to construction contracts within the last five years?
No Yes Within the last five years, has any officer or principal of your organization ever been an officer or principal of another organization when it failed to complete a construction contract?

On a separate sheet, list major construction projects your organization has in progress, giving the name of project, owner, engineer, contract amount, percent complete and scheduled completion date. State the total worth of work in progress and under construction.

On a separate sheet, list the major projects your organization has completed in the past five years, giving the name of the project, owner, engineer, contract amount, date of completion and percentage of the cost of the work performed with your own forces. State average annual amount of construction work performed during the past five years.

On a separate sheet, list the construction experience and present commitments of the key individuals of your organization.

Signature

Date

Printed Name

Title

LISTING OF PROPOSED SUBCONTRACTORS

Project: RFP 2019-08 D.P.W. Colchester Water Division Well 3A – Pump House and Associated Piping

Bidder intends to utilize the following subcontractors on this project:

If none, write “none” here: _____

	<i>Name, Address and Federal ID Number of Subcontractor</i>	<i>Description of Work</i>	<i>Est. Value of Work</i>
1.	_____	_____	\$ _____

2.	_____	_____	\$ _____

3.	_____	_____	\$ _____

4.	_____	_____	\$ _____

5.	_____	_____	\$ _____

6.	_____	_____	\$ _____

7.	_____	_____	\$ _____

8.	_____	_____	\$ _____

AFFIDAVIT

Project: RFP 2019-08 D.P.W. Colchester Water Division Well 3A – Pump House and Associated Piping

To the Town of Colchester, Connecticut:

This is to certify that in submitting this bid, BIDDER represents that this Bid is not made in the interest of or on behalf of any undisclosed person and is not submitted in conformity with any agreement or rules of any group, association, organization, or corporation; BIDDER has not directly or indirectly induced or solicited any other Bidder to submit a false or sham Bid; BIDDER has not solicited or induced any person, firm, or corporation to refrain from bidding; and BIDDER has not sought by collusion to obtain for himself any advantage over any other Bidder or over OWNER; and the BIDDER or any person in his behalf, has not agreed, connived, or colluded to produce a deceptive show of competition in the matter of the bidding or award of the referenced contract.

Signature to be by signer of Bid Form.

Signature

Printed Name

Title

Subscribed and sworn to before me this ____ day of _____, 2019.

Notary Public

My commission expires on: _____

**CERTIFICATION OF BIDDER
REGARDING EQUAL EMPLOYMENT OPPORTUNITY (EEO)**

Instructions

This certification is required pursuant to Executive Order 11246 (30 CFR 12319-25). The implementing rules and regulations provide that any bidder or prospective contractor, or any of their proposed subcontractors, shall state as an initial part of the bid or negotiations of the contract whether it has participated in any previous contract or subcontract subject to the equal opportunity clause; and if so, whether it has filed all compliance reports due under applicable instructions.

Where the certification indicates that the bidder has not filed a compliance report due under applicable instructions, such bidder shall be required to submit a compliance report within seven calendar days after bid opening. No contract shall be awarded unless such report is submitted.

Certification by Bidder

Name and Address of Bidder (include zip code)

1. Bidder has participated in a previous contract or subcontract subject to the Equal Opportunity Clause. Yes _____ No _____

2. Compliance Reports were required to be filed in connection with such contract or subcontract. Yes _____ No _____

3. Bidder has filed all compliance reports due under applicable instructions, including Monthly Employment Utilization Report (257).
Yes _____ No _____ None Required _____

4. Have you ever been or are you being considered for sanction due to a violation of Executive Order 11246, as amended?
Yes _____ No _____

Name and Title of Signer (please type)

Signature

Date

**CERTIFICATION BY PROPOSED SUBCONTRACTOR
REGARDING EQUAL EMPLOYMENT OPPORTUNITY (EEO)**

Name of Prime Contractor

Instructions

This certification is required pursuant to Executive Order 11246 (30 CFR 12319-25). The implementing rules and regulations provide that any bidder or prospective contractor, or any of their proposed subcontractors, shall state as an initial part of the bid or negotiations of the contract whether it has participated in any previous contract or subcontract subject to the equal opportunity clause; and if so, whether it has filed all compliance reports due under applicable instructions.

Where the certification indicates that the subcontractor has not filed a compliance report due under applicable instructions, such subcontractor shall be required to submit a compliance report before the owner approves the subcontract or permits work to begin under the subcontract.

Certification by Bidder

Name and Address of Subcontractor (include zip code)

1. Bidder has participated in a previous contract or subcontract subject to the Equal Opportunity Clause. Yes _____ No _____

2. Compliance Reports were required to be filed in connection with such contract or subcontract. Yes _____ No _____

3. Bidder has filed all compliance reports due under applicable instructions, including SF-100. Yes _____ No _____ None Required _____

4. Have you ever been or are you being considered for sanction due to a violation of Executive Order 11246, as amended? Yes _____ No _____

Name and Title of Signer (please type)

Signature

Date

BID BOND

BIDDER (Name and Address):

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

OWNER (Name and Address):

BID

BID DUE DATE: _____

PROJECT (Brief Description Including Location):

BOND

BOND NUMBER: _____

DATE (Not later than Bid due date): _____

PENAL SUM: _____

(Words)

(Figures)

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

BIDDER

SURETY

_____(Seal)

_____(Seal)

Bidder's Name and Corporate Seal

Surety's Name and Corporate Seal

By: _____

By: _____

Signature and Title

Signature and Title
(Attach Power of Attorney)

Attest: _____

Attest: _____

Signature and Title

Signature and Title

-
- Note: (1) Above addresses are to be used for giving required notice.
(2) Any singular reference to Bidder, Surety, OWNER or other party shall be considered plural where applicable.

1. Bidder and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to pay to OWNER upon default of Bidder the penal sum set forth on the face of this Bond.

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

3. This obligation shall be null and void if:

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

3.2. All Bids are rejected by OWNER, or

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

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

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

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

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

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

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

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

11. The term "Bid" as used herein includes a Bid, offer or proposal as applicable.

**CERTIFICATION OF MATERIAL CONFORMANCE WITH THE
SPECIFICATIONS**

Project: RFP 2019-08 D.P.W. Colchester Water Division Well 3A – Pump House and
Associated Piping

This statement must be completed by the Bidder and shall accompany his bid for this project.

IT IS HEREBY CERTIFIED THAT:

Name of Bidder: _____
Business Address: _____

That the equipment proposed to be supplied in fulfillment of this Contract conforms in all respects to the specifications. Further, the proposed equipment will perform its intended function in a manner acceptable and suitable to the Town of Colchester, CT.

(Signature)

(Title)

**CERTIFICATION OF BIDDER REGARDING SECTION 3
AND SEGREGATED FACILITIES**

Name of Prime Contractor

Project Name

The undersigned hereby certifies that

- (a) Section 3 provisions are included in the Contract.
- (b) A written Section 3 plan was prepared and submitted as part of the bid proceedings (if bid equals or exceeds \$10,000).
- (c) No segregated facilities will be maintained.

Name & Title of Signer (Print or Type)

(Signature)

(Date)

CERTIFICATION OF COMPLIANCE WITH TAX LAWS

Project: RFP 2019-08 D.P.W. Colchester Water Division Well 3A – Pump House and Associated Piping

I, _____ of _____
(Principal) (Corporation)

certify under pains and penalties of perjury that said corporation has complied with all laws of the State of Connecticut relating to taxes.

Signature Date

Printed Name

Title

Federal ID Number

CERTIFICATE OF NON-COLLUSION

The undersigned certifies under penalties of perjury that this bid or proposal has been made in good faith and without collusion or fraud with any other persons. As used in this certification, the word “person” shall mean any natural person, business, partnership, corporation, union, committee, club, or other organization, entity, or group of individuals.

By: _____
Signature of Authorized Individual

Name of Business

Address

City, State, Zip Code

Date

SECTION 00520

AGREEMENT

THIS AGREEMENT, made this _____ day of _____, _____, by and between the Town of Colchester, Connecticut hereinafter called "OWNER," acting herein through its _____, and _____ doing business as (a corporation) (a partnership) (a joint venture) (a limited liability company) (an individual)* located in the (City) (Town)* of _____, County of _____, and State of _____, hereinafter called "CONTRACTOR."

WITNESSETH: That for and in consideration of the payments and agreements hereinafter mentioned, to be made and performed by the OWNER, the CONTRACTOR hereby agrees with the OWNER to commence and complete the project described as follows:

The scope of work includes furnishing all labor, materials, equipment, and incidentals to install, test, and make fully operable a new drinking water supply well of 300 gpm capacity to replace Well No. 3 at the Colchester Taintor Hill Road Wellfield in the location shown on the Drawings and as specified herein. The work also includes, but is not limited to, the installation of a submersible well pump in the new well; connecting the new well to the existing raw water main; installation of a precast pump building, flow meter, valves and instrumentation appurtenances; installation of a new Variable Frequency Drive in the new pump building; installation of new power, digital and analog wiring between controls in the existing treatment building and the new precast building and well; and other appurtenant works as required.

hereinafter called the project, for the sum of _____ Dollars and _____ Cents (\$ _____) and all extra work in connection therewith, under the terms as stated in the Contract Documents; and at its own proper cost and expense to furnish superintendence, labor, services, materials, equipment, plant, machinery, apparatus, appliances, tools, supplies, bailing, shoring, removal, and all other things necessary to complete the said project in accordance with the conditions and prices stated in Section 00410, FORM OF GENERAL BID, Section 00700, GENERAL CONDITIONS, Section 00800, SUPPLEMENTARY CONDITIONS, Section 00830, STATE AND FEDERAL REGULATIONS, the plans, which include all maps, plates, drawings, blue prints, and the specifications and all other contract documents therefor as prepared by Weston & Sampson Engineers, Inc., including all bid documents.

The CONTRACTOR hereby agrees to commence work under this contract on or before a date to be fixed in the written Notice to Proceed given by the OWNER to the CONTRACTOR and to fully complete the project within 180 consecutive days of the start date fixed in the Notice to Proceed. The CONTRACTOR further agrees to pay as liquidated damages the sum of \$750 for each consecutive calendar day thereafter during which the work has not been fully completed, as

provided in the Liquidated Damages provisions of Section 00800 SUPPLEMENTARY CONDITIONS.

The CONTRACTOR shall not discriminate against or exclude any person from participation herein on grounds of race, religion, color, sex, age or national origin; and that it shall take affirmative actions to insure that applicants are employed, and that employees are treated during their employment, without regard to race, religion, color, sex, age, handicapped status, or national origin.

The CONTRACTOR shall not participate in or cooperate with an international boycott, as defined in Section 999 (b)(3) and (4) of the Internal Revenue Code of 1986, as amended.

Applicable provisions of Connecticut General Statutes and/or the United States Code and Code of Federal Regulations govern this Agreement and any provision in violation of the foregoing shall be deemed null, void and of no effect. Where conflict between Code of Federal Regulations and State laws and Regulations exist, the more stringent requirement shall apply.

The OWNER agrees to pay the CONTRACTOR in current funds for the performance of the Agreement, subject to additions and deductions, as provided in Section 00700, GENERAL CONDITIONS, and to make payments on account thereof as provided in Section 00700, GENERAL CONDITIONS.

IN WITNESS WHEREOF, the parties to these presents have executed this Agreement in six (6) counterparts, each of which shall be deemed an original, in the year and day first above mentioned.

AGREED:

_____, Connecticut
(Owner)

By _____

Art Shilosky

(Name)

First Selectman

(Title)

(Contractor)

By _____

(Name)

(Title)

(Address)

(City and State)

CERTIFICATE OF VOTE
(to be filed if Contractor is a Corporation)

I, _____, hereby certify that I am the duly qualified and acting Secretary of
(Secretary of Corporation)
_____ and I further certify that a meeting of the Directors of said company,
(Name of Corporation)
duly called and held on _____, at which all members were present and voting, the
(Date of Meeting)
following vote was unanimously passed:

VOTED: To authorize and empower

Anyone acting singly, to execute Forms of General Bid, Contracts or Bonds on behalf of the Corporation.

I further certify that the above vote is still in effect and has not been changed or modified in any respect.

By: _____
(Secretary of Corporation)

A True Copy:

Attest: _____
(Notary Public)

My Commission Expires: _____
(Date)

SECTION 00610

PERFORMANCE BOND

KNOW ALL MEN BY THESE PRESENTS: That we _____
(Name of Contractor)

a _____ hereinafter called "Principal" and
(Corporation, Partnership, Joint Venture, Limited Liability Company or Individual)

_____ of _____, State of _____
(Surety) (City) (State)

called the "Surety" and licensed by the Connecticut Insurance Department to do business under the laws of the State of Connecticut are held and firmly bound to Town of Colchester, Connecticut, hereinafter called "Owner," in the penal sum of _____ Dollars and _____ Cents (\$ _____) in lawful money of the United States, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators and successors, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION is such that Whereas, the Principal entered into a certain contract with the Owner, dated the _____ day of _____, _____, a copy of which is hereto attached and made a part hereof for the construction described as follows:

The scope of work includes furnishing all labor, materials, equipment, and incidentals to install, test, and make fully operable a new drinking water supply well of 300 gpm capacity to replace Well No. 3 at the Colchester Taintor Hill Road Wellfield in the location shown on the Drawings and as specified herein. The work also includes, but is not limited to, the installation of a submersible well pump in the new well; connecting the new well to the existing raw water main; installation of a precast pump building, flow meter, valves and instrumentation appurtenances; installation of a new Variable Frequency Drive in the new pump building; installation of new power, digital and analog wiring between controls in the existing treatment building and the new precast building and well; and other appurtenant works as required.

NOW, THEREFORE, if the Principal shall well, truly and faithfully perform its duties, all the undertakings, covenants, terms, conditions, and agreements of said contract during the original term thereof, and any extensions thereof which may be granted by the Owner, with or without notice to the Surety, and if he shall satisfy all claims and demands incurred under such contract, and shall fully indemnify and save harmless the Owner from all costs and damages which it may suffer by reason of failure to do so, and shall reimburse and repay the Owner all outlay and expense which the Owner may incur in making good any default, then this obligation shall be void; otherwise to remain in full force and effect.

PROVIDED, FURTHER, that the said Surety, for value received hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the contract or to the work to be performed thereunder or the specifications accompanying the same shall in any way affect its obligation on this bond, and it does hereby waive notice of any such change, extension of time, alteration or addition to the terms of this contract or to the work or to the specifications.

The Surety Company providing the bond shall have a rating of A or better within the Best Key Rating Guide.

PROVIDED, FURTHER, that no final settlement between the Owner and the Contractor shall abridge the right of any beneficiary hereunder, whose claim may be unsatisfied.

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

ATTEST:

_____	_____
Principal	Witness as to Principal Signature
By _____	_____
Signature	Name and Title
_____	_____
Name and Title	Address
_____	_____
Address	City and State

City and State	(SEAL)

ATTEST:

_____	_____
Surety	Witness as to Surety Signature
By _____	_____
Attorney-in-Fact Signature	Name and Title
_____	_____
Name and Title	Address
_____	_____
Address	City and State

City and State	(SEAL)

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

END OF SECTION

SECTION 00615

PAYMENT BOND

KNOW ALL MEN BY THESE PRESENTS: That we _____
(Name of Contractor)
a _____ hereinafter called "Principal"
and (Corporation, Partnership, Joint Venture, Limited Liability Company or Individual)
_____ of _____, State of _____
(Surety) (City) (State)
hereinafter called "Surety" and licensed by the Connecticut Insurance Department to do business under the laws of the State of Connecticut are held and firmly bound to the Town of Colchester, Connecticut, hereinafter called "Owner," in the penal sum of _____ Dollars and _____ Cents (\$ _____) in lawful money of the United States, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators and successors, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION is such that Whereas, the Principal entered into a certain contract with the Owner, dated the _____ day of _____, _____, a copy of which is hereto attached and made a part hereof for the construction described as follows:

The scope of work includes furnishing all labor, materials, equipment, and incidentals to install, test, and make fully operable a new drinking water supply well of 300 gpm capacity to replace Well No. 3 at the Colchester Taintor Hill Road Wellfield in the location shown on the Drawings and as specified herein. The work also includes, but is not limited to, the installation of a submersible well pump in the new well; connecting the new well to the existing raw water main; installation of a precast pump building, flow meter, valves and instrumentation appurtenances; installation of a new Variable Frequency Drive in the new pump building; installation of new power, digital and analog wiring between controls in the existing treatment building and the new precast building and well; and other appurtenant works as required.

NOW, THEREFORE, if the Principal shall promptly make payment to all persons, firms, subcontractors, and corporations furnishing materials for or performing labor in the prosecution of the work provided for in such contract, and any authorized extension or modification thereof, including all amounts due for materials, lubricants, oil, gasoline, repairs on machinery, equipment and tools, consumed or used in connection with the construction of such work, and all insurance premiums on said work, and for all labor, performed in such work whether by subcontractor or otherwise, then this obligation shall be void; otherwise to remain in full force and effect.

PROVIDED, FURTHER, that the said Surety, for value received hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the contract or to the work to be performed thereunder or the specifications accompanying the same shall in any way affect its obligation on this bond, and it does hereby waive notice of any such change, extension of time, alteration or addition to the terms of this contract or to the work or to the specifications. The Surety Company providing the bond shall have a rating of A or better within the Best Key Rating Guide.

PROVIDED, FURTHER, that no final settlement between the Owner and the Contractor shall abridge the right of any beneficiary hereunder, whose claim may be unsatisfied.

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

ATTEST:

_____	_____
Principal	Witness as to Principal Signature
By _____	_____
Signature	Name and Title
_____	_____
Name and Title	Address
_____	_____
Address	City and State

City and State	(SEAL)

ATTEST:

_____	_____
Surety	Witness as to Surety Signature
By _____	_____
Attorney-in-Fact Signature	Name and Title
_____	_____
Name and Title	Address
_____	_____
Address	City and State

City and State	(SEAL)

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

END OF SECTION

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

STANDARD
GENERAL CONDITIONS
OF THE
CONSTRUCTION CONTRACT

Prepared by

ENGINEERS JOINT CONTRACT DOCUMENTS COMMITTEE

and

Issued and Published Jointly By

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

AMERICAN CONSULTING ENGINEERS COUNCIL

AMERICAN SOCIETY OF CIVIL ENGINEERS

This document has been approved and endorsed by

The Associated General

Contractors of America

Construction Specifications Institute

These General Conditions have been prepared for use with the Owner-Contractor Agreements (No. 1910-8-A-1 or 1910-8-A-2) (1996 Editions). Their provisions are interrelated and a change in one may necessitate a change in the other. Comments concerning their usage are contained in the EJCDC User's Guide (No. 1910-50). For guidance in the preparation of Supplementary Conditions, see Guide to the Preparation of Supplementary Conditions (No. 1910-17) (1996 Edition).

EJCDC No. 1910-8 (1996 Edition)

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GENERAL CONDITIONS

ARTICLE 1 - DEFINITIONS AND TERMINOLOGY

1.01 Defined Terms

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

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

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

3. *Application for Payment*--The form acceptable to ENGINEER which is to be used by CONTRACTOR during the course of the Work in requesting progress or final payments and which is to be accompanied by such supporting documentation as is required by the Contract Documents.

4. *Asbestos*--Any material that contains more than one percent asbestos and is friable or is releasing asbestos fibers into the air above current action levels established by the United States Occupational Safety and Health Administration.

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

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

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

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

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

10. *Claim*--A demand or assertion by OWNER or CONTRACTOR seeking an adjustment of Contract Price or Contract Times, or both, or other relief with respect to the terms of the Contract. A demand for money or services by a third party is not a Claim.

11. *Contract*--The entire and integrated written agreement between the OWNER and CONTRACTOR concerning the Work. The Contract supersedes prior negotiations, representations, or agreements, whether written or oral.

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

13. *Contract Price*--The moneys payable by OWNER to CONTRACTOR for completion of the Work in accordance with the Contract Documents as stated in the Agreement (subject to the provisions of paragraph 11.03 in the case of Unit Price Work).

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

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

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

17. *Drawings*--That part of the Contract Documents prepared or approved by ENGINEER which graphically shows the scope, extent, and character of the Work to be performed by CONTRACTOR. Shop Drawings and other CONTRACTOR submittals are not Drawings as so defined.

18. *Effective Date of the Agreement*--The date indicated in the Agreement on which it becomes effective, but if no such date is indicated, it means the date on which the Agreement is signed and delivered by the last of the two parties to sign and deliver.

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

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

21. *Field Order*--A written order issued by ENGINEER which requires minor changes in the Work but which does not involve a change in the Contract Price or the Contract Times.

22. *General Requirements*--Sections of Division 1 of the Specifications. The General Requirements pertain to all sections of the Specifications.

23. *Hazardous Environmental Condition*--The presence at the Site of Asbestos, PCBs, Petroleum, Hazardous Waste, or Radioactive Material in such quantities or circumstances that may present a substantial danger to persons or property exposed thereto in connection with the Work.

24. *Hazardous Waste*--The term Hazardous Waste shall have the meaning provided in Section 1004 of the Solid Waste Disposal Act (42 USC Section 6903) as amended from time to time.

25. *Laws and Regulations; Laws or Regulations*--Any and all applicable laws, rules, regulations, ordinances, codes, and orders of any and all governmental bodies, agencies, authorities, and courts having jurisdiction.

26. *Liens*--Charges, security interests, or encumbrances upon Project funds, real property, or personal property.

27. *Milestone*--A principal event specified in the Contract Documents relating to an intermediate completion date or time prior to Substantial Completion of all the Work.

28. *Notice of Award*--The written notice by OWNER to the apparent successful bidder stating that upon timely compliance by the apparent successful bidder with the conditions precedent listed therein, OWNER will sign and deliver the Agreement.

29. *Notice to Proceed*--A written notice given by OWNER to CONTRACTOR fixing the date on which the Contract Times will commence to run and on which CONTRACTOR shall start to perform the Work under the Contract Documents.

30. *OWNER*--The individual, entity, public body, or authority with whom CONTRACTOR has entered into the Agreement and for whom the Work is to be performed.

31. *Partial Utilization*--Use by OWNER of a substantially completed part of the Work for the purpose for

which it is intended (or a related purpose) prior to Substantial Completion of all the Work.

32. *PCBs*--Polychlorinated biphenyls.

33. *Petroleum*--Petroleum, including crude oil or any fraction thereof which is liquid at standard conditions of temperature and pressure (60 degrees Fahrenheit and 14.7 pounds per square inch absolute), such as oil, petroleum, fuel oil, oil sludge, oil refuse, gasoline, kerosene, and oil mixed with other non-Hazardous Waste and crude oils.

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

35. *Project Manual*--The bound documentary information prepared for bidding and constructing the Work. A listing of the contents of the Project Manual, which may be bound in one or more volumes, is contained in the table(s) of contents.

36. *Radioactive Material*--Source, special nuclear, or byproduct material as defined by the Atomic Energy Act of 1954 (42 USC Section 2011 et seq.) as amended from time to time.

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

38. *Samples*--Physical examples of materials, equipment, or workmanship that are representative of some portion of the Work and which establish the standards by which such portion of the Work will be judged.

39. *Shop Drawings*--All drawings, diagrams, illustrations, schedules, and other data or information which are specifically prepared or assembled by or for CONTRACTOR and submitted by CONTRACTOR to illustrate some portion of the Work.

40. *Site*--Lands or areas indicated in the Contract Documents as being furnished by OWNER upon which the Work is to be performed, including rights-of-way and easements for access thereto, and such other lands furnished by OWNER which are designated for the use of CONTRACTOR.

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

42. *Subcontractor*--An individual or entity having a direct contract with CONTRACTOR or with any other Subcontractor for the performance of a part of the Work at the Site.

43. *Substantial Completion*--The time at which the Work (or a specified part thereof) has progressed to the

*See Supplementary General Conditions

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

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

45. *Supplier*--A manufacturer, fabricator, supplier, distributor, materialman, or vendor having a direct contract with CONTRACTOR or with any Subcontractor to furnish materials or equipment to be incorporated in the Work by CONTRACTOR or any Subcontractor.

46. *Underground Facilities*--All underground pipelines, conduits, ducts, cables, wires, manholes, vaults, tanks, tunnels, or other such facilities or attachments, and any encasements containing such facilities, including those that convey electricity, gases, steam, liquid petroleum products, telephone or other communications, cable television, water, wastewater, storm water, other liquids or chemicals, or traffic or other control systems.

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

48. *Work*--The entire completed construction or the various separately identifiable parts thereof required to be provided under the Contract Documents. Work includes and is the result of performing or providing all labor, services, and documentation necessary to produce such construction, and furnishing, installing, and incorporating all materials and equipment into such construction, all as required by the Contract Documents.

49. *Work Change Directive*--A written statement to CONTRACTOR issued on or after the Effective Date of the Agreement and signed by OWNER and recommended by ENGINEER ordering an addition, deletion, or revision in the Work, or responding to differing or unforeseen subsurface or physical conditions under which the Work is to be performed or to emergencies. A Work Change Directive will not change the Contract Price or the Contract Times but is evidence that the parties expect that the change ordered or documented by a Work Change Directive will be incorporated in a subsequently issued Change Order following negotiations by the parties as to its effect, if any, on the Contract Price or Contract Times.

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

1.02 Terminology

A. *Intent of Certain Terms or Adjectives*

1. Whenever in the Contract Documents the terms “as allowed,” “as approved,” or terms of like effect or import are used, or the adjectives “reasonable,” “suitable,” “acceptable,” “proper,” “satisfactory,” or adjectives of like effect or import are used to describe an action or determination of ENGINEER as to the Work, it is intended that such action or determination will be solely to evaluate, in general, the completed Work for compliance with the requirements of and information in the Contract Documents and conformance with the design concept of the completed Project as a functioning whole as shown or indicated in the Contract Documents (unless there is a specific statement indicating otherwise). The use of any such term or adjective shall not be effective to assign to ENGINEER any duty or authority to supervise or direct the performance of the Work or any duty or authority to undertake responsibility contrary to the provisions of paragraph 9.10 or any other provision of the Contract Documents.

B. *Day*

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

C. *Defective*

1. The word “defective,” when modifying the word “Work,” refers to Work that is unsatisfactory, faulty, or deficient in that it does not conform to the Contract Documents or does not meet the requirements of any inspection, reference standard, test, or approval referred to in the Contract Documents, or has been damaged prior to ENGINEER’s recommendation of final payment (unless responsibility for the protection thereof has been assumed by OWNER at Substantial Completion in accordance with paragraph 14.04 or 14.05).

D. *Furnish, Install, Perform, Provide*

1. The word “furnish,” when used in connection with services, materials, or equipment, shall mean to supply and deliver said services, materials, or equipment to the Site (or some other specified location) ready for use or installation and in usable or operable condition.

2. The word “install,” when used in connection with services, materials, or equipment, shall mean to put into use or place in final position said services, materials, or equipment complete and ready for intended use.

3. The words “perform” or “provide,” when used in connection with services, materials, or equipment, shall mean to furnish and install said

services, materials, or equipment complete and ready for intended use.

4. When “furnish,” “install,” “perform,” or “provide” is not used in connection with services, materials, or equipment in a context clearly requiring an obligation of CONTRACTOR, “provide” is implied.

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

ARTICLE 2 - PRELIMINARY MATTERS

2.01 Delivery of Bonds

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

2.02 Copies of Documents

A. OWNER shall furnish to CONTRACTOR up to ten copies of the Contract Documents. Additional copies will be furnished upon request at the cost of reproduction.

2.03 Commencement of Contract Times; Notice to Proceed *

A. The Contract Times will commence to run on the thirtieth day after the Effective Date of the Agreement or, if a Notice to Proceed is given, on the day indicated in the Notice to Proceed. A Notice to Proceed may be given at any time within 30 days after the Effective Date of the Agreement. In no event will the Contract Times commence to run later than the sixtieth day after the day of Bid opening or the thirtieth day after the Effective Date of the Agreement, whichever date is earlier.

2.04 Starting the Work

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

2.05 Before Starting Construction

A. *CONTRACTOR's Review of Contract Documents:* Before undertaking each part of the Work, CONTRACTOR shall carefully study and compare the Contract Documents and check and verify pertinent figures therein and all applicable field measurements. CONTRACTOR shall promptly report in writing to ENGINEER any conflict, error, ambiguity, or discrepancy which CONTRACTOR may discover and shall obtain a written interpretation or clarification from ENGINEER before proceeding with any Work affected thereby; however, CONTRACTOR shall not be liable to OWNER or

ENGINEER for failure to report any conflict, error, ambiguity, or discrepancy in the Contract Documents unless CONTRACTOR knew or reasonably should have known thereof.

B. *Preliminary Schedules:* Within ten days after the Effective Date of the Agreement (unless otherwise specified in the General Requirements), CONTRACTOR shall submit to ENGINEER for its timely review:

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

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

3. a preliminary schedule of values for all of the Work which includes quantities and prices of items which when added together equal the Contract Price and subdivides the Work into component parts in sufficient detail to serve as the basis for progress payments during performance of the Work. Such prices will include an appropriate amount of overhead and profit applicable to each item of Work.

~~* C. *Evidence of Insurance:* Before any Work at the Site is started, CONTRACTOR and OWNER shall each deliver to the other, with copies to each additional insured identified in the Supplementary Conditions, certificates of insurance (and other evidence of insurance which either of them or any additional insured may reasonably request) which CONTRACTOR and OWNER respectively are required to purchase and maintain in accordance with Article 5.~~

2.06 Preconstruction Conference

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

2.07 Initial Acceptance of Schedules

A. Unless otherwise provided in the Contract Documents, at least ten days before submission of the first Application for Payment a conference attended by CONTRACTOR, ENGINEER, and others as appropriate will be held to review for acceptability to ENGINEER as provided below the schedules submitted in accordance with paragraph 2.05.B. CONTRACTOR shall have an additional ten days to make corrections and adjustments and to complete and resubmit the schedules. No progress payment

shall be made to CONTRACTOR until acceptable schedules are submitted to ENGINEER.

1. The progress schedule will be acceptable to ENGINEER if it provides an orderly progression of the Work to completion within any specified Milestones and the Contract Times. Such acceptance will not impose on ENGINEER responsibility for the progress schedule, for sequencing, scheduling, or progress of the Work nor interfere with or relieve CONTRACTOR from CONTRACTOR's full responsibility therefor.

2. CONTRACTOR's schedule of Shop Drawing and Sample submittals will be acceptable to ENGINEER if it provides a workable arrangement for reviewing and processing the required submittals.

3. CONTRACTOR's schedule of values will be acceptable to ENGINEER as to form and substance if it provides a reasonable allocation of the Contract Price to component parts of the Work.

ARTICLE 3 - CONTRACT DOCUMENTS: INTENT, AMENDING, REUSE

3.01 Intent

* A. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.

B. It is the intent of the Contract Documents to describe a functionally complete Project (or part thereof) to be constructed in accordance with the Contract Documents. Any labor, documentation, services, materials, or equipment that may reasonably be inferred from the Contract Documents or from prevailing custom or trade usage as being required to produce the intended result will be provided whether or not specifically called for at no additional cost to OWNER.

C. Clarifications and interpretations of the Contract Documents shall be issued by ENGINEER as provided in Article 9.

3.02 Reference Standards

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

1. Reference to standards, specifications, manuals, or codes of any technical society, organization, or association, or to Laws or Regulations, whether such reference be specific or by implication, shall mean the standard, specification, manual, code, or Laws or Regulations in effect at the time of opening of Bids (or on the Effective Date of the Agreement if there were no Bids), except as may be otherwise specifically stated in the Contract Documents.

2. No provision of any such standard, specification, manual or code, or any instruction of a Supplier shall be effective to change the duties or responsibilities of OWNER, CONTRACTOR, or ENGINEER, or any of their subcontractors, consultants, agents, or employees from those set forth in the Contract Documents, nor shall any such provision or instruction be effective to assign to OWNER, ENGINEER, or any of ENGINEER's Consultants, agents, or employees any duty or authority to supervise or direct the performance of the Work or any duty or authority to undertake responsibility inconsistent with the provisions of the Contract Documents.

3.03 Reporting and Resolving Discrepancies

A. *Reporting Discrepancies*

1. If, during the performance of the Work, CONTRACTOR discovers any conflict, error, ambiguity, or discrepancy within the Contract Documents or between the Contract Documents and any provision of any Law or Regulation applicable to the performance of the Work or of any standard, specification, manual or code, or of any instruction of any Supplier, CONTRACTOR shall report it to ENGINEER in writing at once. CONTRACTOR shall not proceed with the Work affected thereby (except in an emergency as required by paragraph 6.16.A) until an amendment or supplement to the Contract Documents has been issued by one of the methods indicated in paragraph 3.04; provided, however, that CONTRACTOR shall not be liable to OWNER or ENGINEER for failure to report any such conflict, error, ambiguity, or discrepancy unless CONTRACTOR knew or reasonably should have known thereof.

B. *Resolving Discrepancies*

1. Except as may be otherwise specifically stated in the Contract Documents, the provisions of the Contract Documents shall take precedence in resolving any conflict, error, ambiguity, or discrepancy between the provisions of the Contract Documents and:

a. the provisions of any standard, specification, manual, code, or instruction (whether or not specifically incorporated by reference in the Contract Documents); or

b. the provisions of any Laws or Regulations applicable to the performance of the Work (unless such an interpretation of the provisions of the Contract Documents would result in violation of such Law or Regulation).

3.04 Amending and Supplementing Contract Documents

A. The Contract Documents may be amended to provide for additions, deletions, and revisions in the Work or to modify the terms and conditions thereof in one or more of the following ways: (i) a Written Amendment; (ii) a Change Order; or (iii) a Work Change Directive.

B. The requirements of the Contract Documents may be supplemented, and minor variations and deviations in the Work may be authorized, by one or more of the following ways: (i) a Field Order; (ii) ENGINEER's approval of a Shop Drawing or Sample; or (iii) ENGINEER's written interpretation or clarification.

3.05 Reuse of Documents

A. CONTRACTOR and any Subcontractor or Supplier or other individual or entity performing or furnishing any of the Work under a direct or indirect contract with OWNER: (i) shall not have or acquire any title to or ownership rights in any of the Drawings, Specifications, or other documents (or copies of any thereof) prepared by or bearing the seal of ENGINEER or ENGINEER's Consultant, including electronic media editions; and (ii) shall not reuse any of such Drawings, Specifications, other documents, or copies thereof on extensions of the Project or any other project without written consent of OWNER and ENGINEER and specific written verification or adaption by ENGINEER. This prohibition will survive final payment, completion, and acceptance of the Work, or termination or completion of the Contract. Nothing herein shall preclude CONTRACTOR from retaining copies of the Contract Documents for record purposes.

ARTICLE 4 - AVAILABILITY OF LANDS; SUBSURFACE AND PHYSICAL CONDITIONS; REFERENCE POINTS

4.01 Availability of Lands

A. OWNER shall furnish the Site. OWNER shall notify CONTRACTOR of any encumbrances or restrictions not of general application but specifically related to use of the Site with which CONTRACTOR must comply in performing the Work. OWNER will obtain in a timely manner and pay for easements for permanent structures or permanent changes in existing facilities. If CONTRACTOR and OWNER are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Contract Times, or both, as a result of any delay in OWNER's furnishing the Site, CONTRACTOR may make a Claim therefor as provided in paragraph 10.05.

B. Upon reasonable written request, OWNER shall furnish CONTRACTOR with a current statement of record legal title and legal description of the lands upon which the Work is to be performed and OWNER's interest therein as necessary for giving notice of or filing a mechanic's or construction lien against such lands in accordance with applicable Laws and Regulations.

C. CONTRACTOR shall provide for all additional lands and access thereto that may be required for temporary construction facilities or storage of materials and equipment.

4.02 Subsurface and Physical Conditions

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

1. those reports of explorations and tests of subsurface conditions at or contiguous to the Site that ENGINEER has used in preparing the Contract Documents; and

2. those drawings of physical conditions in or relating to existing surface or subsurface structures at or contiguous to the Site (except Underground Facilities) that ENGINEER has used in preparing the Contract Documents.

B. *Limited Reliance by CONTRACTOR on Technical Data Authorized:* CONTRACTOR may rely upon the general accuracy of the "technical data" contained in such reports and drawings, but such reports and drawings are not Contract Documents. Such "technical data" is identified in the Supplementary Conditions. Except for such reliance on such "technical data," CONTRACTOR may not rely upon or make any Claim against OWNER, ENGINEER, or any of ENGINEER's Consultants with respect to:

1. the completeness of such reports and drawings for CONTRACTOR's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences, and procedures of construction to be employed by CONTRACTOR, and safety precautions and programs incident thereto; or

2. other data, interpretations, opinions, and information contained in such reports or shown or indicated in such drawings; or

3. any CONTRACTOR interpretation of or conclusion drawn from any "technical data" or any such other data, interpretations, opinions, or information.

4.03 Differing Subsurface or Physical Conditions

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

1. is of such a nature as to establish that any "technical data" on which CONTRACTOR is entitled to rely as provided in paragraph 4.02 is materially inaccurate; or

2. is of such a nature as to require a change in the Contract Documents; or

3. differs materially from that shown or indicated in the Contract Documents; or

4. is of an unusual nature, and differs materially from conditions ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract Documents;

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

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

C. *Possible Price and Times Adjustments*

1. The Contract Price or the Contract Times, or both, will be equitably adjusted to the extent that the existence of such differing subsurface or physical condition causes an increase or decrease in CONTRACTOR's cost of, or time required for, performance of the Work; subject, however, to the following:

a. such condition must meet any one or more of the categories described in paragraph 4.03.A; and

b. with respect to Work that is paid for on a Unit Price Basis, any adjustment in Contract Price will be subject to the provisions of paragraphs 9.08 and 11.03.

2. CONTRACTOR shall not be entitled to any adjustment in the Contract Price or Contract Times if:

a. CONTRACTOR knew of the existence of such conditions at the time CONTRACTOR made a final commitment to OWNER in respect of Contract Price and Contract Times by the submission of a Bid or becoming bound under a negotiated contract; or

b. the existence of such condition could reasonably have been discovered or revealed as a result of any examination, investigation, exploration, test, or study of the Site and contiguous areas required by the Bidding Requirements or Contract Documents to be conducted by or for CONTRACTOR prior to CONTRACTOR's making such final commitment; or

c. CONTRACTOR failed to give the written notice within the time and as required by paragraph 4.03.A.

3. If OWNER and CONTRACTOR are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Contract Times, or both, a Claim may be made therefor as provided in paragraph 10.05. However, OWNER, ENGINEER, and ENGINEER's Consultants shall not be liable to CONTRACTOR for any claims, costs, losses, or damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) sustained by CONTRACTOR on or in connection with any other project or anticipated project.

4.04 *Underground Facilities*

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

1. OWNER and ENGINEER shall not be responsible for the accuracy or completeness of any such information or data; and

2. the cost of all of the following will be included in the Contract Price, and CONTRACTOR shall have full responsibility for:

a. reviewing and checking all such information and data,

b. locating all Underground Facilities shown or indicated in the Contract Documents,

c. coordination of the Work with the owners of such Underground Facilities, including OWNER, during construction, and

d. the safety and protection of all such Underground Facilities and repairing any damage thereto resulting from the Work.

B. *Not Shown or Indicated*

1. If an Underground Facility is uncovered or revealed at or contiguous to the Site which was not shown or indicated, or not shown or indicated with reasonable accuracy in the Contract Documents, CONTRACTOR shall, promptly after becoming aware thereof and before further disturbing conditions affected thereby or performing any Work in connection therewith (except in an emergency as required by paragraph 6.16.A), identify the owner of such Underground Facility and give written notice to

that owner and to OWNER and ENGINEER. ENGINEER will promptly review the Underground Facility and determine the extent, if any, to which a change is required in the Contract Documents to reflect and document the consequences of the existence or location of the Underground Facility. During such time, CONTRACTOR shall be responsible for the safety and protection of such Underground Facility.

2. If ENGINEER concludes that a change in the Contract Documents is required, a Work Change Directive or a Change Order will be issued to reflect and document such consequences. An equitable *adjustment shall be made in the Contract Price or Contract Times, or both, to the extent that they are attributable to the existence or location of any Underground Facility that was not shown or *indicated ~~or not shown or indicated with reasonable accuracy~~ in the Contract Documents and that CONTRACTOR did not know of and could not reasonably have been expected to be aware of or to have anticipated. If OWNER and CONTRACTOR are unable to agree on entitlement to or on the amount or extent, if any, of any such adjustment in Contract Price or Contract Times, OWNER or CONTRACTOR may make a Claim therefor as provided in paragraph 10.05.

4.05 Reference Points

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

4.06 Hazardous Environmental Condition at Site

A. *Reports and Drawings:* Reference is made to the Supplementary Conditions for the identification of those* reports and drawings relating to a Hazardous Environmental Condition identified at the Site, if any, that have been utilized by the ENGINEER in the preparation of the Contract Documents.*

B. *Limited Reliance by CONTRACTOR on Technical Data Authorized:* CONTRACTOR may rely upon the general accuracy of the "technical data" contained in such reports and drawings, but such reports and drawings are not Contract Documents. Such "technical data" is identified in

the Supplementary Conditions. Except for such reliance on such "technical data," CONTRACTOR may not rely upon or make any Claim against OWNER, ENGINEER or any of ENGINEER's Consultants with respect to:

1. the completeness of such reports and drawings for CONTRACTOR's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences and procedures of construction to be employed by CONTRACTOR and safety precautions and programs incident thereto; or

2. other data, interpretations, opinions and information contained in such reports or shown or indicated in such drawings; or

3. any CONTRACTOR interpretation of or conclusion drawn from any "technical data" or any such other data, interpretations, opinions or information.

C. CONTRACTOR shall not be responsible for any Hazardous Environmental Condition uncovered or revealed at the Site which was not shown or indicated in Drawings or Specifications or identified in the Contract Documents to be within the scope of the Work. CONTRACTOR shall be responsible for a Hazardous Environmental Condition created with any materials brought to the Site by CONTRACTOR, Subcontractors, Suppliers, or anyone else for whom CONTRACTOR is responsible.

D. If CONTRACTOR encounters a Hazardous Environmental Condition or if CONTRACTOR or anyone for whom CONTRACTOR is responsible creates a Hazardous Environmental Condition, CONTRACTOR shall immediately: (i) secure or otherwise isolate such condition; (ii) stop all Work in connection with such condition and in any area affected thereby (except in an emergency as required by paragraph 6.16); and (iii) notify OWNER and ENGINEER (and promptly thereafter confirm such notice in writing). OWNER shall promptly consult with ENGINEER concerning the necessity for OWNER to retain a qualified expert to evaluate such condition or take corrective action, if any.

E. CONTRACTOR shall not be required to resume Work in connection with such condition or in any affected area until after OWNER has obtained any required permits related thereto and delivered to CONTRACTOR written notice: (i) specifying that such condition and any affected area is or has been rendered safe for the resumption of Work; or (ii) specifying any special conditions under which such Work may be resumed safely. If OWNER and CONTRACTOR cannot agree as to entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times, or both, as a result of such Work stoppage or such special conditions under which Work is agreed to be resumed by CONTRACTOR, either party may make a Claim therefor as provided in paragraph 10.05.

F. If after receipt of such written notice CONTRACTOR does not agree to resume such Work based on a reasonable belief it is unsafe, or does not agree to

resume such Work under such special conditions, then OWNER may order the portion of the Work that is in the area affected by such condition to be deleted from the Work. If OWNER and CONTRACTOR cannot agree as to entitlement to or on the amount or extent, if any, of an adjustment in Contract Price or Contract Times as a result of deleting such portion of the Work, then either party may make a Claim therefor as provided in paragraph 10.05. OWNER may have such deleted portion of the Work performed by OWNER's own forces or others in accordance with Article 7.

G. To the fullest extent permitted by Laws and Regulations, OWNER shall indemnify and hold harmless CONTRACTOR, Subcontractors, ENGINEER, ENGINEER's Consultants and the officers, directors, partners, employees, agents, other consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to a Hazardous Environmental Condition, provided that such Hazardous Environmental Condition: (i) was not shown or indicated in the Drawings or Specifications or identified in the Contract Documents to be included within the scope of the Work, and (ii) was not created by CONTRACTOR or by anyone for whom CONTRACTOR is responsible. Nothing in this paragraph 4.06.E shall obligate OWNER to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.

H. To the fullest extent permitted by Laws and Regulations, CONTRACTOR shall indemnify and hold harmless OWNER, ENGINEER, ENGINEER's Consultants, and the officers, directors, partners, employees, agents, other consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to a Hazardous Environmental Condition created by CONTRACTOR or by anyone for whom CONTRACTOR is responsible. Nothing in this paragraph 4.06.F shall obligate CONTRACTOR to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.

I. The provisions of paragraphs 4.02, 4.03, and 4.04 are not intended to apply to a Hazardous Environmental Condition uncovered or revealed at the Site.

ARTICLE 5 - BONDS AND INSURANCE

5.01 Performance, Payment, and Other Bonds

A. CONTRACTOR shall furnish performance and payment Bonds, each in an amount at least equal to the Contract Price as security for the faithful performance and payment of all CONTRACTOR's obligations under the Contract Documents. These Bonds shall remain in effect at least until one year after the date when final payment

becomes due, except as provided otherwise by Laws or Regulations or by the Contract Documents. CONTRACTOR shall also furnish such other Bonds as are required by the Contract Documents. *

B. All Bonds shall be in the form prescribed by the Contract Documents except as provided otherwise by Laws or Regulations, and shall be executed by such sureties as are named in the current list of "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" as published in Circular 570 (amended) by the Financial Management Service, Surety Bond Branch, U.S. Department of the Treasury. All Bonds signed by an agent must be accompanied by a certified copy of such agent's authority to act.

C. If the surety on any Bond furnished by CONTRACTOR is declared bankrupt or becomes insolvent or its right to do business is terminated in any state where any part of the Project is located or it ceases to meet the requirements of paragraph 5.01.B, CONTRACTOR shall within 20 days thereafter substitute another Bond and surety, both of which shall comply with the requirements of paragraphs 5.01.B and 5.02.

5.02 Licensed Sureties and Insurers

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

5.03 Certificates of Insurance

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

5.04 CONTRACTOR's Liability Insurance

* A. CONTRACTOR shall purchase and maintain such liability and other insurance as is appropriate for the Work being performed and as will provide protection from claims set forth below which may arise out of or result from CONTRACTOR's performance of the Work and CONTRACTOR's other obligations under the Contract Documents, whether it is to be performed by CONTRACTOR, any Subcontractor or Supplier, or by anyone directly or indirectly employed by any of them to

perform any of the Work, or by anyone for whose acts any of them may be liable:

1. claims under workers' compensation, disability benefits, and other similar employee benefit acts;

2. claims for damages because of bodily injury, occupational sickness or disease, or death of CONTRACTOR's employees;

3. claims for damages because of bodily injury, sickness or disease, or death of any person other than CONTRACTOR's employees;

4. claims for damages insured by reasonably available personal injury liability coverage which are sustained: (i) by any person as a result of an offense directly or indirectly related to the employment of such person by CONTRACTOR, or (ii) by any other person for any other reason;

5. claims for damages, other than to the Work itself, because of injury to or destruction of tangible property wherever located, including loss of use resulting therefrom; and

6. claims for damages because of bodily injury or death of any person or property damage arising out of the ownership, maintenance or use of any motor vehicle.

B. The policies of insurance so required by this paragraph 5.04 to be purchased and maintained shall:

1. with respect to insurance required by paragraphs 5.04.A.3 through 5.04.A.6 inclusive, include as additional insureds (subject to any customary exclusion in respect of professional liability) OWNER, ENGINEER, ENGINEER's Consultants, and any other individuals or entities identified in the Supplementary Conditions, all of whom shall be listed as additional insureds, and include coverage for the respective officers, directors, partners, employees, agents, and other consultants and subcontractors of each and any of all such additional insureds, and the insurance afforded to these additional insureds shall provide primary coverage for all claims covered thereby;

2. include at least the specific coverages and be written for not less than the limits of liability provided in the Supplementary Conditions or required by Laws or Regulations, whichever is greater;

3. include completed operations insurance;

4. include contractual liability insurance covering CONTRACTOR's indemnity obligations under paragraphs 6.07, 6.11, and 6.20;

5. contain a provision or endorsement that the coverage afforded will not be canceled, materially changed or renewal refused until at least thirty days prior written notice has been given to OWNER and CONTRACTOR and to each other additional insured identified in the Supplementary Conditions to whom a certificate of insurance has been issued (and the certificates of insurance furnished by the CONTRACTOR pursuant to paragraph 5.03 will so provide);

6. remain in effect at least until final payment and at all times thereafter when CONTRACTOR may be correcting, removing, or replacing defective Work in accordance with paragraph 13.07; and

7. with respect to completed operations insurance, and any insurance coverage written on a claims-made basis, remain in effect for at least two years after final payment (and CONTRACTOR shall furnish OWNER and each other additional insured identified in the Supplementary Conditions, to whom a certificate of insurance has been issued, evidence satisfactory to OWNER and any such additional insured of continuation of such insurance at final payment and one year thereafter).*

~~5.05 — OWNER's Liability Insurance~~

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

~~5.06 — Property Insurance~~

~~* A. Unless otherwise provided in the Supplementary Conditions, OWNER shall purchase and maintain property insurance upon the Work at the Site in the amount of the full replacement cost thereof (subject to such deductible amounts as may be provided in the Supplementary Conditions or required by Laws and Regulations). This insurance shall:~~

~~1. include the interests of OWNER, CONTRACTOR, Subcontractors, ENGINEER, ENGINEER's Consultants, and any other individuals or entities identified in the Supplementary Conditions, and the officers, directors, partners, employees, agents, and other consultants and subcontractors of each and any of them, each of whom is deemed to have an insurable interest and shall be listed as an additional insured;~~

~~2. be written on a Builder's Risk "all risk" or open peril or special causes of loss policy form that shall at least include insurance for physical loss or damage to the Work, temporary buildings, false work, and materials and equipment in transit, and shall insure against at least the following perils or~~

*See Supplementary General Conditions

~~causes of loss: fire, lightning, extended coverage, theft, vandalism and malicious mischief, earthquake, ecollapse, debris removal, demolition occasioned by enforcement of Laws and Regulations, water damage, and such other perils or causes of loss as may be specifically required by the Supplementary Conditions;~~

~~3. include expenses incurred in the repair or replacement of any insured property (including but not limited to fees and charges of engineers and architects);~~

~~4. cover materials and equipment stored at the Site or at another location that was agreed to in writing by OWNER prior to being incorporated in the Work, provided that such materials and equipment have been included in an Application for Payment recommended by ENGINEER;~~

~~5. allow for partial utilization of the Work by OWNER;~~

~~6. include testing and startup; and~~

~~7. be maintained in effect until final payment is made unless otherwise agreed to in writing by OWNER, CONTRACTOR, and ENGINEER with 30 days written notice to each other additional insured to whom a certificate of insurance has been issued.~~

~~* B. OWNER shall purchase and maintain such boiler and machinery insurance or additional property insurance as may be required by the Supplementary Conditions or Laws and Regulations which will include the interests of OWNER, CONTRACTOR, Subcontractors, ENGINEER, ENGINEER's Consultants, and any other individuals or entities identified in the Supplementary Conditions, each of whom is deemed to have an insurable interest and shall be listed as an insured or additional insured.~~

~~* C. All the policies of insurance (and the certificates or other evidence thereof) required to be purchased and maintained in accordance with paragraph 5.06 will contain a provision or endorsement that the coverage afforded will not be canceled or materially changed or renewal refused until at least 30 days prior written notice has been given to OWNER and CONTRACTOR and to each other additional insured to whom a certificate of insurance has been issued and will contain waiver provisions in accordance with paragraph 5.07.~~

~~* D. OWNER shall not be responsible for purchasing and maintaining any property insurance specified in this paragraph 5.06 to protect the interests of CONTRACTOR, Subcontractors, or others in the Work to the extent of any deductible amounts that are identified in the Supplementary Conditions. The risk of loss within such identified deductible amount will be borne by CONTRACTOR, Subcontractors, or others suffering any such loss, and if any of them wishes property insurance coverage within the~~

~~limits of such amounts, each may purchase and maintain it at the purchaser's own expense.~~

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

5.07 Waiver of Rights

* A. OWNER and CONTRACTOR intend that all policies purchased in accordance with paragraph 5.06 will protect OWNER, CONTRACTOR, Subcontractors, ENGINEER, ENGINEER's Consultants, and all other individuals or entities identified in the Supplementary Conditions to be listed as insureds or additional insureds (and the officers, directors, partners, employees, agents, and other consultants and subcontractors of each and any of them) in such policies and will provide primary coverage for all losses and damages caused by the perils or causes of loss covered thereby. All such policies shall contain provisions to the effect that in the event of payment of any loss or damage the insurers will have no rights of recovery against any of the insureds or additional insureds thereunder. OWNER and CONTRACTOR waive all rights against each other and their respective officers, directors, partners, employees, agents, and other consultants and subcontractors of each and any of them for all losses and damages caused by, arising out of or resulting from any of the perils or causes of loss covered by such policies and any other property insurance applicable to the Work; and, in addition, waive all such rights against Subcontractors, ENGINEER, ENGINEER's Consultants, and all other individuals or entities identified in the Supplementary Conditions to be listed as insureds or additional insureds (and the officers, directors, partners, employees, agents, and other consultants and subcontractors of each and any of them) under such policies for losses and damages so caused. None of the above waivers shall extend to the rights that any party making such waiver may have to the proceeds of insurance * held by OWNER as trustee or otherwise payable under any policy so issued.

B. OWNER waives all rights against CONTRACTOR, Subcontractors, ENGINEER, ENGINEER's Consultants, and the officers, directors, partners, employees, agents, and other consultants and subcontractors of each and any of them for:

1. loss due to business interruption, loss of use, or other consequential loss extending beyond direct physical loss or damage to OWNER's property or the Work caused by, arising out of, or resulting from fire or other peril whether or not insured by OWNER; and

2. loss or damage to the completed Project or part thereof caused by, arising out of, or resulting from fire or other insured peril or cause of loss covered by any property insurance maintained on the completed Project or part thereof by OWNER during partial utilization pursuant to paragraph 14.05, after Substantial Completion pursuant to paragraph 14.04, or after final payment pursuant to paragraph 14.07.

C. Any insurance policy maintained by OWNER covering any loss, damage or consequential loss referred to in paragraph 5.07.B shall contain provisions to the effect that in the event of payment of any such loss, damage, or consequential loss, the insurers will have no rights of recovery against CONTRACTOR, Subcontractors, ENGINEER, or ENGINEER's Consultants and the officers, directors, partners, employees, agents, and other consultants and subcontractors of each and any of them.

5.08 Receipt and Application of Insurance Proceeds

* ~~A. Any insured loss under the policies of insurance required by paragraph 5.06 will be adjusted with OWNER and made payable to OWNER as fiduciary for the insureds, as their interests may appear, subject to the requirements of any applicable mortgage clause and of paragraph 5.08.B. OWNER shall deposit in a separate account any money so received and shall distribute it in accordance with such agreement as the parties in interest may reach. If no other special agreement is reached, the damaged Work shall be repaired or replaced, the moneys so received applied on account thereof, and the Work and the cost thereof covered by an appropriate Change Order or Written Amendment.~~

* ~~B. OWNER as fiduciary shall have power to adjust and settle any loss with the insurers unless one of the parties in interest shall object in writing within 15 days after the occurrence of loss to OWNER's exercise of this power. If such objection be made, OWNER as fiduciary shall make settlement with the insurers in accordance with such agreement as the parties in interest may reach. If no such agreement among the parties in interest is reached, OWNER as fiduciary shall adjust and settle the loss with the insurers and, if required in writing by any party in interest, OWNER as fiduciary shall give bond for the proper performance of such duties.~~

5.09 Acceptance of Bonds and Insurance; Option to Replace

* ~~A. If either OWNER or CONTRACTOR has any objection to the coverage afforded by or other provisions of the Bonds or insurance required to be purchased and maintained by the other party in accordance with Article 5 on the basis of non conformance with the Contract Documents, the objecting party shall so notify the other party in writing within 10 days after receipt of the certificates (or other evidence requested) required by paragraph 2.05.C. OWNER and CONTRACTOR shall each provide to the other such additional information in respect of insurance provided as the other may reasonably~~

~~request. If either party does not purchase or maintain all of the Bonds and insurance required of such party by the Contract Documents, such party shall notify the other party in writing of such failure to purchase prior to the start of the Work, or of such failure to maintain prior to any change in the required coverage. Without prejudice to any other right or remedy, the other party may elect to obtain equivalent Bonds or insurance to protect such other party's interests at the expense of the party who was required to provide such coverage, and a Change Order shall be issued to adjust the Contract Price accordingly.~~

5.10 Partial Utilization, Acknowledgment of Property Insurer

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

ARTICLE 6 - CONTRACTOR'S RESPONSIBILITIES

6.01 Supervision and Superintendence

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

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

6.02 Labor; Working Hours

A. CONTRACTOR shall provide competent, suitably qualified personnel to survey, lay out, and construct the Work as required by the Contract Documents. CONTRACTOR shall at all times maintain good discipline and order at the Site.

B. Except as otherwise required for the safety or protection of persons or the Work or property at the Site or adjacent thereto, and except as otherwise stated in the Contract Documents, all Work at the Site shall be performed during regular working hours, and CONTRACTOR will not permit overtime work or the performance of Work on Saturday, Sunday, or any legal holiday without OWNER's written consent (which will not be unreasonably withheld) given after prior written notice to ENGINEER.

6.03 Services, Materials, and Equipment

A. Unless otherwise specified in the General Requirements, CONTRACTOR shall provide and assume full responsibility for all services, materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, temporary facilities, and all other facilities and incidentals necessary for the performance, testing, start-up, and completion of the Work.

B. All materials and equipment incorporated into the Work shall be as specified or, if not specified, shall be of good quality and new, except as otherwise provided in the Contract Documents. All warranties and guarantees specifically called for by the Specifications shall expressly run to the benefit of OWNER. If required by ENGINEER, CONTRACTOR shall furnish satisfactory evidence (including reports of required tests) as to the source, kind, and quality of materials and equipment. All materials and equipment shall be stored, applied, installed, connected, erected, protected, used, cleaned, and conditioned in accordance with instructions of the applicable Supplier, except as otherwise may be provided in the Contract Documents.

6.04 Progress Schedule

A. CONTRACTOR shall adhere to the progress schedule established in accordance with paragraph 2.07 as it may be adjusted from time to time as provided below.

1. CONTRACTOR shall submit to ENGINEER for acceptance (to the extent indicated in paragraph 2.07) proposed adjustments in the progress schedule that will not result in changing the Contract Times (or Milestones). Such adjustments will conform generally to the progress schedule then in effect and additionally will comply with any provisions of the General Requirements applicable thereto.

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

*

6.05 Substitutes and "Or-Equals"

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

1. "*Or-Equal*" Items: If in ENGINEER's sole discretion an item of material or equipment proposed by CONTRACTOR is functionally equal to that named and sufficiently similar so that no change in related Work will be required, it may be considered by ENGINEER as an "or-equal" item, in which case review and approval of the proposed item may, in ENGINEER's sole discretion, be accomplished without compliance with some or all of the requirements for approval of proposed substitute items. For the purposes of this paragraph 6.05.A.1, a proposed item of material or equipment will be considered functionally equal to an item so named if:

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

b. CONTRACTOR certifies that: (i) there is no increase in cost to the OWNER; and (ii) it will conform substantially, even with deviations, to the detailed requirements of the item named in the Contract Documents.

2. Substitute Items

a. If in ENGINEER's sole discretion an item of material or equipment proposed by CONTRACTOR does not qualify as an "or-equal" item under paragraph 6.05.A.1, it will be considered a proposed substitute item.

b. CONTRACTOR shall submit sufficient information as provided below to allow ENGINEER to determine that the item of material or equipment proposed is essentially equivalent to that named and an acceptable substitute therefor. Requests for review of proposed substitute items of material or equipment will not be accepted by ENGINEER from anyone other than CONTRACTOR.

c. The procedure for review by ENGINEER will be as set forth in paragraph 6.05.A.2.d, as supplemented in the General

Requirements and as ENGINEER may decide is appropriate under the circumstances.

d. CONTRACTOR shall first make written application to ENGINEER for review of a proposed substitute item of material or equipment that CONTRACTOR seeks to furnish or use. The application shall certify that the proposed substitute item will perform adequately the functions and achieve the results called for by the general design, be similar in substance to that specified, and be suited to the same use as that specified. The application will state the extent, if any, to which the use of the proposed substitute item will prejudice CONTRACTOR's achievement of Substantial Completion on time, whether or not use of the proposed substitute item in the Work will require a change in any of the Contract Documents (or in the provisions of any other direct contract with OWNER for work on the Project) to adapt the design to the proposed substitute item and whether or not incorporation or use of the proposed substitute item in connection with the Work is subject to payment of any license fee or royalty. All variations of the proposed substitute item from that specified will be identified in the application, and available engineering, sales, maintenance, repair, and replacement services will be indicated. The application will also contain an itemized estimate of all costs or credits that will result directly or indirectly from use of such substitute item, including costs of redesign and claims of other contractors affected by any resulting change, all of which will be considered by ENGINEER in evaluating the proposed substitute item. ENGINEER may require CONTRACTOR to furnish additional data about the proposed substitute item.

B. Substitute Construction Methods or Procedures:

If a specific means, method, technique, sequence, or procedure of construction is shown or indicated in and expressly required by the Contract Documents, CONTRACTOR may furnish or utilize a substitute means, method, technique, sequence, or procedure of construction approved by ENGINEER. CONTRACTOR shall submit sufficient information to allow ENGINEER, in ENGINEER's sole discretion, to determine that the substitute proposed is equivalent to that expressly called for by the Contract Documents. The procedure for review by ENGINEER will be similar to that provided in subparagraph 6.05.A.2.

C. Engineer's Evaluation: ENGINEER will be allowed a reasonable time within which to evaluate each proposal or submittal made pursuant to paragraphs 6.05.A and 6.05.B. ENGINEER will be the sole judge of acceptability. No "or-equal" or substitute will be ordered, installed or utilized until ENGINEER's review is complete, which will be evidenced by either a Change Order for a substitute or an approved Shop Drawing for an "or equal."

ENGINEER will advise CONTRACTOR in writing of any negative determination.

D. Special Guarantee: OWNER may require CONTRACTOR to furnish at CONTRACTOR's expense a special performance guarantee or other surety with respect to any substitute.

E. ENGINEER's Cost Reimbursement: ENGINEER will record time required by ENGINEER and ENGINEER's Consultants in evaluating substitute proposed or submitted by CONTRACTOR pursuant to paragraphs 6.05.A.2 and 6.05.B and in making changes in the Contract Documents (or in the provisions of any other direct contract with OWNER for work on the Project) occasioned thereby. Whether or not ENGINEER approves a substitute item so proposed or submitted by CONTRACTOR, CONTRACTOR shall reimburse OWNER for the charges of ENGINEER and ENGINEER's Consultants for evaluating each such proposed substitute.

F. CONTRACTOR's Expense: CONTRACTOR shall provide all data in support of any proposed substitute or "or-equal" at CONTRACTOR's expense.

6.06 Concerning Subcontractors, Suppliers, and Others

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

B. If the Supplementary Conditions require the identity of certain Subcontractors, Suppliers, or other individuals or entities to be submitted to OWNER in advance for acceptance by OWNER by a specified date prior to the Effective Date of the Agreement, and if CONTRACTOR has submitted a list thereof in accordance with the Supplementary Conditions, OWNER's acceptance (either in writing or by failing to make written objection thereto by the date indicated for acceptance or objection in the Bidding Documents or the Contract Documents) of any such Subcontractor, Supplier, or other individual or entity so identified may be revoked on the basis of reasonable objection after due investigation. CONTRACTOR shall submit an acceptable replacement for the rejected Subcontractor, Supplier, or other individual or entity, and the Contract Price will be adjusted by the difference in the cost occasioned by such replacement, and an appropriate Change Order will be issued or Written Amendment signed. No acceptance by OWNER of any such Subcontractor, Supplier, or other individual or entity, whether initially or as a replacement, shall constitute a waiver of any right of OWNER or ENGINEER to reject defective Work.

C. CONTRACTOR shall be fully responsible to OWNER and ENGINEER for all acts and omissions of the Subcontractors, Suppliers, and other individuals or entities

performing or furnishing any of the Work just as CONTRACTOR is responsible for CONTRACTOR's own acts and omissions. Nothing in the Contract Documents shall create for the benefit of any such Subcontractor, Supplier, or other individual or entity any contractual relationship between OWNER or ENGINEER and any such Subcontractor, Supplier or other individual or entity, nor shall it create any obligation on the part of OWNER or ENGINEER to pay or to see to the payment of any moneys due any such Subcontractor, Supplier, or other individual or entity except as may otherwise be required by Laws and Regulations.

D. CONTRACTOR shall be solely responsible for scheduling and coordinating the Work of Subcontractors, Suppliers, and other individuals or entities performing or furnishing any of the Work under a direct or indirect contract with CONTRACTOR.

E. CONTRACTOR shall require all Subcontractors, Suppliers, and such other individuals or entities performing or furnishing any of the Work to communicate with ENGINEER through CONTRACTOR.

F. The divisions and sections of the Specifications and the identifications of any Drawings shall not control CONTRACTOR in dividing the Work among Subcontractors or Suppliers or delineating the Work to be performed by any specific trade.

G. All Work performed for CONTRACTOR by a Subcontractor or Supplier will be pursuant to an appropriate agreement between CONTRACTOR and the Subcontractor or Supplier which specifically binds the Subcontractor or Supplier to the applicable terms and conditions of the Contract Documents for the benefit of OWNER and ENGINEER. Whenever any such agreement is with a Subcontractor or Supplier who is listed as an additional insured on the property insurance provided in paragraph 5.06, the agreement between the CONTRACTOR and the Subcontractor or Supplier will contain provisions whereby the Subcontractor or Supplier waives all rights against OWNER, CONTRACTOR, ENGINEER, ENGINEER's Consultants, and all other individuals or entities identified in the Supplementary Conditions to be listed as insureds or additional insureds (and the officers, directors, partners, employees, agents, and other consultants and subcontractors of each and any of them) for all losses and damages caused by, arising out of, relating to, or resulting from any of the perils or causes of loss covered by such policies and any other property insurance applicable to the Work. If the insurers on any such policies require separate waiver forms to be signed by any Subcontractor or Supplier, CONTRACTOR will obtain the same.

6.07 Patent Fees and Royalties

A. CONTRACTOR shall pay all license fees and royalties and assume all costs incident to the use in the performance of the Work or the incorporation in the Work of any invention, design, process, product, or device which is the subject of patent rights or copyrights held by others. If a particular invention, design, process, product, or device

is specified in the Contract Documents for use in the performance of the Work and if to the actual knowledge of OWNER or ENGINEER its use is subject to patent rights or copyrights calling for the payment of any license fee or royalty to others, the existence of such rights shall be disclosed by OWNER in the Contract Documents. To the fullest extent permitted by Laws and Regulations, CONTRACTOR shall indemnify and hold harmless OWNER, ENGINEER, ENGINEER's Consultants, and the officers, directors, partners, employees or agents, and other consultants of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device not specified in the Contract Documents.

6.08 Permits

A. Unless otherwise provided in the Supplementary Conditions, CONTRACTOR shall obtain and pay for all construction permits and licenses. OWNER shall assist CONTRACTOR, when necessary, in obtaining such permits and licenses. CONTRACTOR shall pay all governmental charges and inspection fees necessary for the prosecution of the Work which are applicable at the time of opening of Bids, or, if there are no Bids, on the Effective Date of the Agreement. CONTRACTOR shall pay all charges of utility owners for connections to the Work, and OWNER shall pay all charges of such utility owners for capital costs related thereto, such as plant investment fees.

6.09 Laws and Regulations

A. CONTRACTOR shall give all notices and comply with all Laws and Regulations applicable to the performance of the Work. Except where otherwise expressly required by applicable Laws and Regulations, neither OWNER nor ENGINEER shall be responsible for monitoring CONTRACTOR's compliance with any Laws or Regulations.

B. If CONTRACTOR performs any Work knowing or having reason to know that it is contrary to Laws or Regulations, CONTRACTOR shall bear all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such Work; however, it shall not be CONTRACTOR's primary responsibility to make certain that the Specifications and Drawings are in accordance with Laws and Regulations, but this shall not relieve CONTRACTOR of CONTRACTOR's obligations under paragraph 3.03.

C. Changes in Laws or Regulations not known at the time of opening of Bids (or, on the Effective Date of the Agreement if there were no Bids) having an effect on the cost or time of performance of the Work may be the subject of an adjustment in Contract Price or Contract Times. If

OWNER and CONTRACTOR are unable to agree on entitlement to or on the amount or extent, if any, of any such adjustment, a Claim may be made therefor as provided in paragraph 10.05.

6.10 Taxes

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

6.11 Use of Site and Other Areas

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

1. CONTRACTOR shall confine construction equipment, the storage of materials and equipment, and the operations of workers to the Site and other areas permitted by Laws and Regulations, and shall not unreasonably encumber the Site and other areas with construction equipment or other materials or equipment. CONTRACTOR shall assume full responsibility for any damage to any such land or area, or to the owner or occupant thereof, or of any adjacent land or areas resulting from the performance of the Work.

2. Should any claim be made by any such owner or occupant because of the performance of the Work, CONTRACTOR shall promptly settle with such other party by negotiation or otherwise resolve the claim by arbitration or other dispute resolution proceeding or at law.

3. To the fullest extent permitted by Laws and Regulations, CONTRACTOR shall indemnify and hold harmless OWNER, ENGINEER, ENGINEER's Consultant, and the officers, directors, partners, employees, agents, and other consultants of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any claim or action, legal or equitable, brought by any such owner or occupant against OWNER, ENGINEER, or any other party indemnified hereunder to the extent caused by or based upon CONTRACTOR's performance of the Work.

* B. *Removal of Debris During Performance of the Work:* During the progress of the Work CONTRACTOR shall keep the Site and other areas free from accumulations of waste materials, rubbish, and other debris. Removal and disposal of such waste materials, rubbish, and other debris shall conform to applicable Laws and Regulations.

C. *Cleaning:* Prior to Substantial Completion of the Work CONTRACTOR shall clean the Site and make it ready for utilization by OWNER. At the completion of the

Work CONTRACTOR shall remove from the Site all tools, appliances, construction equipment and machinery, and surplus materials and shall restore to original condition all property not designated for alteration by the Contract Documents.

D. *Loading Structures:* CONTRACTOR shall not load nor permit any part of any structure to be loaded in any manner that will endanger the structure, nor shall CONTRACTOR subject any part of the Work or adjacent property to stresses or pressures that will endanger it.

6.12 Record Documents

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

6.13 Safety and Protection

A. CONTRACTOR shall be solely responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Work. CONTRACTOR shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury or loss to:

1. all persons on the Site or who may be affected by the Work;

2. all the Work and materials and equipment to be incorporated therein, whether in storage on or off the Site; and

3. other property at the Site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, utilities, and Underground Facilities not designated for removal, relocation, or replacement in the course of construction.

B. CONTRACTOR shall comply with all applicable Laws and Regulations relating to the safety of persons or property, or to the protection of persons or property from damage, injury, or loss; and shall erect and maintain all necessary safeguards for such safety and protection. CONTRACTOR shall notify owners of adjacent property and of Underground Facilities and other utility owners when prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation, and replacement of their property. All damage, injury, or loss to any property referred to in paragraph 6.13.A.2 or 6.13.A.3 caused, directly or indirectly, in whole or in part, by CONTRACTOR, any Subcontractor, Supplier, or any other individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for

whose acts any of them may be liable, shall be remedied by CONTRACTOR (except damage or loss attributable to the fault of Drawings or Specifications or to the acts or omissions of OWNER or ENGINEER or ENGINEER's Consultant, or anyone employed by any of them, or anyone for whose acts any of them may be liable, and not attributable, directly or indirectly, in whole or in part, to the fault or negligence of CONTRACTOR or any Subcontractor, Supplier, or other individual or entity directly or indirectly employed by any of them). CONTRACTOR's duties and responsibilities for safety and for protection of the Work shall continue until such time as all the Work is completed and ENGINEER has issued a notice to OWNER and CONTRACTOR in accordance with paragraph 14.07.B that the Work is acceptable (except as otherwise expressly provided in connection with Substantial Completion).

6.14 Safety Representative

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

6.15 Hazard Communication Programs

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

6.16 Emergencies

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

6.17 Shop Drawings and Samples

A. CONTRACTOR shall submit Shop Drawings to ENGINEER for review and approval in accordance with the acceptable schedule of Shop Drawings and Sample submittals. All submittals will be identified as ENGINEER may require and in the number of copies specified in the General Requirements. The data shown on the Shop Drawings will be complete with respect to quantities, dimensions, specified performance and design criteria, materials, and similar data to show ENGINEER the services, materials, and equipment CONTRACTOR proposes to provide and to enable ENGINEER to review the

information for the limited purposes required by paragraph 6.17.E.

B. CONTRACTOR shall also submit Samples to ENGINEER for review and approval in accordance with the acceptable schedule of Shop Drawings and Sample submittals. Each Sample will be identified clearly as to material, Supplier, pertinent data such as catalog numbers, and the use for which intended and otherwise as ENGINEER may require to enable ENGINEER to review the submittal for the limited purposes required by paragraph 6.17.E. The numbers of each Sample to be submitted will be as specified in the Specifications.

C. Where a Shop Drawing or Sample is required by the Contract Documents or the schedule of Shop Drawings and Sample submittals acceptable to ENGINEER as required by paragraph 2.07, any related Work performed prior to ENGINEER's review and approval of the pertinent submittal will be at the sole expense and responsibility of CONTRACTOR.

D. Submittal Procedures

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

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

b. all materials with respect to intended use, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work;

c. all information relative to means, methods, techniques, sequences, and procedures of construction and safety precautions and programs incident thereto; and

d. CONTRACTOR shall also have reviewed and coordinated each Shop Drawing or Sample with other Shop Drawings and Samples and with the requirements of the Work and the Contract Documents.

2. Each submittal shall bear a stamp or specific written indication that CONTRACTOR has satisfied CONTRACTOR's obligations under the Contract Documents with respect to CONTRACTOR's review and approval of that submittal.

3. At the time of each submittal, CONTRACTOR shall give ENGINEER specific written notice of such variations, if any, that the Shop Drawing or Sample submitted may have from the requirements of the Contract Documents, such notice to be in a written communication separate from the submittal;

and, in addition, shall cause a specific notation to be made on each Shop Drawing and Sample submitted to ENGINEER for review and approval of each such variation.

E. *ENGINEER's Review*

* 1. ENGINEER will ~~timely~~ review and approve Shop Drawings and Samples in accordance with the schedule of Shop Drawings and Sample submittals acceptable to ENGINEER. ENGINEER's review and approval will be only to determine if the items covered by the submittals will, after installation or incorporation in the Work, conform to the information given in the Contract Documents and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents.

2. ENGINEER's review and approval will not extend to means, methods, techniques, sequences, or procedures of construction (except where a particular means, method, technique, sequence, or procedure of construction is specifically and expressly called for by the Contract Documents) or to safety precautions or programs incident thereto. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.

3. ENGINEER's review and approval of Shop Drawings or Samples shall not relieve CONTRACTOR from responsibility for any variation from the requirements of the Contract Documents unless CONTRACTOR has in writing called ENGINEER's attention to each such variation at the time of each submittal as required by paragraph 6.17.D.3 and ENGINEER has given written approval of each such variation by specific written notation thereof incorporated in or accompanying the Shop Drawing or Sample approval; nor will any approval by ENGINEER relieve CONTRACTOR from responsibility for complying with the requirements of paragraph 6.17.D.1.

F. *Resubmittal Procedures*

1. CONTRACTOR shall make corrections required by ENGINEER and shall return the required number of corrected copies of Shop Drawings and submit as required new Samples for review and approval. CONTRACTOR shall direct specific attention in writing to revisions other than the corrections called for by ENGINEER on previous submittals.

6.18 Continuing the Work

A. CONTRACTOR shall carry on the Work and adhere to the progress schedule during all disputes or disagreements with OWNER. No Work shall be delayed or postponed pending resolution of any disputes or disagreements, except as permitted by paragraph 15.04 or as

OWNER and CONTRACTOR may otherwise agree in writing.

6.19 CONTRACTOR's General Warranty and Guarantee

A. CONTRACTOR warrants and guarantees to OWNER, ENGINEER, and ENGINEER's Consultants that all Work will be in accordance with the Contract Documents and will not be defective. CONTRACTOR's warranty and guarantee hereunder excludes defects or damage caused by:

1. abuse, modification, or improper maintenance or operation by persons other than CONTRACTOR, Subcontractors, Suppliers, or any other individual or entity for whom CONTRACTOR is responsible; or

2. normal wear and tear under normal usage.

B. CONTRACTOR's obligation to perform and complete the Work in accordance with the Contract Documents shall be absolute. None of the following will constitute an acceptance of Work that is not in accordance with the Contract Documents or a release of CONTRACTOR's obligation to perform the Work in accordance with the Contract Documents:

1. observations by ENGINEER;

2. recommendation by ENGINEER or payment by OWNER of any progress or final payment;

3. the issuance of a certificate of Substantial Completion by ENGINEER or any payment related thereto by OWNER;

4. use or occupancy of the Work or any part thereof by OWNER;

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

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

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

8. any correction of defective Work by OWNER.

6.20 Indemnification

* ~~A. To the fullest extent permitted by Laws and Regulations, CONTRACTOR shall indemnify and hold harmless OWNER, ENGINEER, ENGINEER's Consultants, and the officers, directors, partners, employees, agents, and other consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of~~

~~engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to the performance of the Work, provided that any such claim, cost, loss, or damage:~~

~~1. is attributable to bodily injury, sickness, disease, or death, or to injury to or destruction of tangible property (other than the Work itself), including the loss of use resulting therefrom; and~~

~~2. is caused in whole or in part by any negligent act or omission of CONTRACTOR, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work or anyone for whose acts any of them may be liable, regardless of whether or not caused in part by any negligence or omission of an individual or entity indemnified hereunder or whether liability is imposed upon such indemnified party by Laws and Regulations regardless of the negligence of any such individual or entity.~~

B. In any and all claims against OWNER or ENGINEER or any of their respective consultants, agents, officers, directors, partners, or employees by any employee (or the survivor or personal representative of such employee) of CONTRACTOR, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, the indemnification obligation under paragraph 6.20.A shall not be limited in any way by any limitation on the amount or type of damages, compensation, or benefits payable by or for CONTRACTOR or any such Subcontractor, Supplier, or other individual or entity under workers' compensation acts, disability benefit acts, or other employee benefit acts.

* ~~C. The indemnification obligations of CONTRACTOR under paragraph 6.20.A shall not extend to the liability of ENGINEER and ENGINEER's Consultants or to the officers, directors, partners, employees, agents, and other consultants and subcontractors of each and any of them arising out of:~~

~~1. the preparation or approval of, or the failure to prepare or approve, maps, Drawings, opinions, reports, surveys, Change Orders, designs, or Specifications; or~~

~~2. giving directions or instructions, or failing to give them, if that is the primary cause of the injury or damage.~~

ARTICLE 7 - OTHER WORK

7.01 Related Work at Site

A. OWNER may perform other work related to the Project at the Site by OWNER's employees, or let other direct contracts therefor, or have other work performed by utility owners. If such other work is not noted in the Contract Documents, then:

1. written notice thereof will be given to CONTRACTOR prior to starting any such other work; and

2. if OWNER and CONTRACTOR are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Contract Times that should be allowed as a result of such other work, a Claim may be made therefor as provided in paragraph 10.05.

B. CONTRACTOR shall afford each other contractor who is a party to such a direct contract and each utility owner (and OWNER, if OWNER is performing the other work with OWNER's employees) proper and safe access to the Site and a reasonable opportunity for the introduction and storage of materials and equipment and the execution of such other work and shall properly coordinate the Work with theirs. Unless otherwise provided in the Contract Documents, CONTRACTOR shall do all cutting, fitting, and patching of the Work that may be required to properly connect or otherwise make its several parts come together and properly integrate with such other work. CONTRACTOR shall not endanger any work of others by cutting, excavating, or otherwise altering their work and will only cut or alter their work with the written consent of ENGINEER and the others whose work will be affected. The duties and responsibilities of CONTRACTOR under this paragraph are for the benefit of such utility owners and other contractors to the extent that there are comparable provisions for the benefit of CONTRACTOR in said direct contracts between OWNER and such utility owners and other contractors.

C. If the proper execution or results of any part of CONTRACTOR's Work depends upon work performed by others under this Article 7, CONTRACTOR shall inspect such other work and promptly report to ENGINEER in writing any delays, defects, or deficiencies in such other work that render it unavailable or unsuitable for the proper execution and results of CONTRACTOR's Work. CONTRACTOR's failure to so report will constitute an acceptance of such other work as fit and proper for integration with CONTRACTOR's Work except for latent defects and deficiencies in such other work.

7.02 Coordination

A. If OWNER intends to contract with others for the performance of other work on the Project at the Site, the following will be set forth in Supplementary Conditions:

1. the individual or entity who will have authority and responsibility for coordination of the activities among the various contractors will be identified;

2. the specific matters to be covered by such authority and responsibility will be itemized; and

3. the extent of such authority and responsibilities will be provided.

B. Unless otherwise provided in the Supplementary Conditions, OWNER shall have sole authority and responsibility for such coordination.

ARTICLE 8 - OWNER'S RESPONSIBILITIES

8.01 Communications to Contractor

A. Except as otherwise provided in these General Conditions, OWNER shall issue all communications to CONTRACTOR through ENGINEER.

8.02 Replacement of ENGINEER

A. In case of termination of the employment of ENGINEER, OWNER shall appoint an engineer to whom CONTRACTOR makes no reasonable objection, whose status under the Contract Documents shall be that of the former ENGINEER.

8.03 Furnish Data

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

8.04 Pay Promptly When Due

A. OWNER shall make payments to CONTRACTOR promptly when they are due as provided in paragraphs 14.02.C and 14.07.C.

8.05 Lands and Easements; Reports and Tests

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

8.06 Insurance

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

8.07 Change Orders

A. OWNER is obligated to execute Change Orders as indicated in paragraph 10.03.

8.08 Inspections, Tests, and Approvals

A. OWNER's responsibility in respect to certain inspections, tests, and approvals is set forth in paragraph 13.03.B.

8.09 Limitations on OWNER's Responsibilities

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

8.10 Undisclosed Hazardous Environmental Condition

A. OWNER's responsibility in respect to an undisclosed Hazardous Environmental Condition is set forth in paragraph 4.06.

8.11 Evidence of Financial Arrangements

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

ARTICLE 9 - ENGINEER'S STATUS DURING CONSTRUCTION

9.01 OWNER'S Representative

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

*

9.02 Visits to Site

A. ENGINEER will make visits to the Site at intervals appropriate to the various stages of construction as ENGINEER deems necessary in order to observe as an experienced and qualified design professional the progress that has been made and the quality of the various aspects of CONTRACTOR's executed Work. Based on information obtained during such visits and observations, ENGINEER, for the benefit of OWNER, will determine, in general, if the Work is proceeding in accordance with the Contract Documents. ENGINEER will not be required to make exhaustive or continuous inspections on the Site to check the quality or quantity of the Work. ENGINEER's efforts will be directed toward providing for OWNER a greater degree of confidence that the completed Work will conform generally to the Contract Documents. On the basis of such visits and observations, ENGINEER will keep OWNER informed of the progress of the Work and will endeavor to guard OWNER against defective Work.

B. ENGINEER's visits and observations are subject to all the limitations on ENGINEER's authority and

responsibility set forth in paragraph 9.10, and particularly, but without limitation, during or as a result of ENGINEER's visits or observations of CONTRACTOR's Work ENGINEER will not supervise, direct, control, or have authority over or be responsible for CONTRACTOR's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of CONTRACTOR to comply with Laws and Regulations applicable to the performance of the Work.

9.03 Project Representative

A. If OWNER and ENGINEER agree, ENGINEER will furnish a Resident Project Representative to assist ENGINEER in providing more extensive observation of the Work. The responsibilities and authority and limitations thereon of any such Resident Project Representative and assistants will be as provided in paragraph 9.10 and in the Supplementary Conditions. If OWNER designates another representative or agent to represent OWNER at the Site who is not ENGINEER's Consultant, agent or employee, the responsibilities and authority and limitations thereon of such other individual or entity will be as provided in the Supplementary Conditions.

9.04 Clarifications and Interpretations

A. ENGINEER will issue with reasonable promptness such written clarifications or interpretations of the requirements of the Contract Documents as ENGINEER may determine necessary, which shall be consistent with the intent of and reasonably inferable from the Contract Documents. Such written clarifications and interpretations will be binding on OWNER and CONTRACTOR. If OWNER and CONTRACTOR are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Contract Times, or both, that should be allowed as a result of a written clarification or interpretation, a Claim may be made therefor as provided in paragraph 10.05.

9.05 Authorized Variations in Work

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

9.06 Rejecting Defective Work

A. ENGINEER will have authority to disapprove or reject Work which ENGINEER believes to be defective, or

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

9.07 Shop Drawings, Change Orders and Payments

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

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

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

9.08 Determinations for Unit Price Work

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

9.09 Decisions on Requirements of Contract Documents and Acceptability of Work

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

B. When functioning as interpreter and judge under this paragraph 9.09, ENGINEER will not show partiality to OWNER or CONTRACTOR and will not be liable in connection with any interpretation or decision rendered in good faith in such capacity. The rendering of a decision by ENGINEER pursuant to this paragraph 9.09 with respect to any such Claim, dispute, or other matter (except any which have been waived by the making or acceptance of final payment as provided in paragraph 14.07) will be a condition precedent to any exercise by OWNER or CONTRACTOR of such rights or remedies as either may otherwise have under the Contract Documents or by Laws or Regulations in respect of any such Claim, dispute, or other matter.

9.10 Limitations on ENGINEER's Authority and Responsibilities

A. Neither ENGINEER's authority or responsibility under this Article 9 or under any other provision of the Contract Documents nor any decision made by ENGINEER in good faith either to exercise or not exercise such authority or responsibility or the undertaking, exercise, or performance of any authority or responsibility by ENGINEER shall create, impose, or give rise to any duty in contract, tort, or otherwise owed by ENGINEER to CONTRACTOR, any Subcontractor, any Supplier, any other individual or entity, or to any surety for or employee or agent of any of them.

B. ENGINEER will not supervise, direct, control, or have authority over or be responsible for CONTRACTOR's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of CONTRACTOR to comply with Laws and Regulations applicable to the performance of the Work. ENGINEER will not be responsible for CONTRACTOR's failure to perform the Work in accordance with the Contract Documents.

C. ENGINEER will not be responsible for the acts or omissions of CONTRACTOR or of any Subcontractor, any Supplier, or of any other individual or entity performing any of the Work.

D. ENGINEER's review of the final Application for Payment and accompanying documentation and all maintenance and operating instructions, schedules, guarantees, Bonds, certificates of inspection, tests and approvals, and other documentation required to be delivered by paragraph 14.07.A will only be to determine generally that their content complies with the requirements of, and in the case of certificates of inspections, tests, and approvals that the results certified indicate compliance with, the Contract Documents.

E. The limitations upon authority and responsibility set forth in this paragraph 9.10 shall also apply to ENGINEER's Consultants, Resident Project Representative, and assistants.

ARTICLE 10 - CHANGES IN THE WORK; CLAIMS

10.01 Authorized Changes in the Work

A. Without invalidating the Agreement and without notice to any surety, OWNER may, at any time or from time to time, order additions, deletions, or revisions in the Work by a Written Amendment, a Change Order, or a Work Change Directive. Upon receipt of any such document, CONTRACTOR shall promptly proceed with the Work involved which will be performed under the applicable conditions of the Contract Documents (except as otherwise specifically provided).

B. If OWNER and CONTRACTOR are unable to agree on entitlement to, or on the amount or extent, if any, of an adjustment in the Contract Price or Contract Times, or

both, that should be allowed as a result of a Work Change Directive, a Claim may be made therefor as provided in paragraph 10.05.

10.02 Unauthorized Changes in the Work

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

10.03 Execution of Change Orders

A. OWNER and CONTRACTOR shall execute appropriate Change Orders recommended by ENGINEER (or Written Amendments) covering:

1. changes in the Work which are: (i) ordered by OWNER pursuant to paragraph 10.01.A, (ii) required because of acceptance of defective Work under paragraph 13.08.A or OWNER's correction of defective Work under paragraph 13.09, or (iii) agreed to by the parties;

2. changes in the Contract Price or Contract Times which are agreed to by the parties, including any undisputed sum or amount of time for Work actually performed in accordance with a Work Change Directive; and

3. changes in the Contract Price or Contract Times which embody the substance of any written decision rendered by ENGINEER pursuant to paragraph 10.05; provided that, in lieu of executing any such Change Order, an appeal may be taken from any such decision in accordance with the provisions of the Contract Documents and applicable Laws and Regulations, but during any such appeal, CONTRACTOR shall carry on the Work and adhere to the progress schedule as provided in paragraph 6.18.A.

10.04 Notification to Surety

A. If notice of any change affecting the general scope of the Work or the provisions of the Contract Documents (including, but not limited to, Contract Price or Contract Times) is required by the provisions of any Bond to be given to a surety, the giving of any such notice will be CONTRACTOR's responsibility. The amount of each applicable Bond will be adjusted to reflect the effect of any such change.

10.05 Claims and Disputes

A. *Notice:* Written notice stating the general nature of each Claim, dispute, or other matter shall be delivered by the claimant to ENGINEER and the other party to the Contract promptly (but in no event later than 30 days) after

the start of the event giving rise thereto. Notice of the amount or extent of the Claim, dispute, or other matter with supporting data shall be delivered to the ENGINEER and the other party to the Contract within 60 days after the start of such event (unless ENGINEER allows additional time for claimant to submit additional or more accurate data in support of such Claim, dispute, or other matter). A Claim for an adjustment in Contract Price shall be prepared in accordance with the provisions of paragraph 12.01.B. A Claim for an adjustment in Contract Time shall be prepared in accordance with the provisions of paragraph 12.02.B. Each Claim shall be accompanied by claimant's written statement that the adjustment claimed is the entire adjustment to which the claimant believes it is entitled as a result of said event. The opposing party shall submit any response to ENGINEER and the claimant within 30 days after receipt of the claimant's last submittal (unless ENGINEER allows additional time).

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

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

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

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

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

ARTICLE 11 - COST OF THE WORK; CASH ALLOWANCES; UNIT PRICE WORK

*11.01 Cost of the Work

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

- ~~1. Payroll costs for employees in the direct employ of CONTRACTOR in the performance of the Work under schedules of job classifications agreed upon by OWNER and CONTRACTOR. Such employees shall include without limitation superintendents, foremen, and other personnel employed full time at the Site. Payroll costs for employees not employed full time on the Work shall be apportioned on the basis of their time spent on the Work. Payroll costs shall include, but not be limited to, salaries and wages plus the cost of fringe benefits, which shall include social security contributions, unemployment, excise, and payroll taxes, workers' compensation, health and retirement benefits, bonuses, sick leave, vacation and holiday pay applicable thereto. The expenses of performing Work outside of regular working hours, on Saturday, Sunday, or legal holidays, shall be included in the above to the extent authorized by OWNER.~~

- ~~2. Cost of all materials and equipment furnished and incorporated in the Work, including costs of transportation and storage thereof, and Suppliers' field services required in connection therewith. All cash discounts shall accrue to CONTRACTOR unless OWNER deposits funds with CONTRACTOR with which to make payments, in which case the cash discounts shall accrue to OWNER. All trade discounts, rebates and refunds and returns from sale of surplus materials and equipment shall accrue to OWNER, and CONTRACTOR shall make provisions so that they may be obtained.~~

- ~~3. Payments made by CONTRACTOR to Subcontractors for Work performed by Subcontractors. If required by OWNER, CONTRACTOR shall obtain competitive bids from subcontractors acceptable to OWNER and CONTRACTOR and shall deliver such bids to OWNER, who will then determine, with the advice of ENGINEER, which bids, if any, will be acceptable. If any~~

~~subcontract provides that the Subcontractor is to be paid on the basis of Cost of the Work plus a fee, the Subcontractor's Cost of the Work and fee shall be determined in the same manner as CONTRACTOR's Cost of the Work and fee as provided in this paragraph 11.01.~~

~~4.—Costs of special consultants (including but not limited to engineers, architects, testing laboratories, surveyors, attorneys, and accountants) employed for services specifically related to the Work.~~

~~5.—Supplemental costs including the following:~~

~~a.—The proportion of necessary transportation, travel, and subsistence expenses of CONTRACTOR's employees incurred in discharge of duties connected with the Work.~~

~~b.—Cost, including transportation and maintenance, of all materials, supplies, equipment, machinery, appliances, office, and temporary facilities at the Site, and hand tools not owned by the workers, which are consumed in the performance of the Work, and cost, less market value, of such items used but not consumed which remain the property of CONTRACTOR.~~

~~c.—Rentals of all construction equipment and machinery, and the parts thereof whether rented from CONTRACTOR or others in accordance with rental agreements approved by OWNER with the advice of ENGINEER, and the costs of transportation, loading, unloading, assembly, dismantling, and removal thereof. All such costs shall be in accordance with the terms of said rental agreements. The rental of any such equipment, machinery, or parts shall cease when the use thereof is no longer necessary for the Work.~~

~~d.—Sales, consumer, use, and other similar taxes related to the Work, and for which CONTRACTOR is liable, imposed by Laws and Regulations.~~

~~e.—Deposits lost for causes other than negligence of CONTRACTOR, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, and royalty payments and fees for permits and licenses.~~

~~f.—Losses and damages (and related expenses) caused by damage to the Work, not compensated by insurance or otherwise, sustained by CONTRACTOR in connection with the performance of the Work (except losses and damages within the deductible amounts of property insurance established in accordance with paragraph 5.06.D), provided such losses and damages have resulted from causes other than the negligence of CONTRACTOR, any Subcontractor, or anyone~~

~~directly or indirectly employed by any of them or for whose acts any of them may be liable. Such losses shall include settlements made with the written consent and approval of OWNER. No such losses, damages, and expenses shall be included in the Cost of the Work for the purpose of determining CONTRACTOR's fee.~~

~~g.—The cost of utilities, fuel, and sanitary facilities at the Site.~~

~~h.—Minor expenses such as telegrams, long distance telephone calls, telephone service at the Site, expressage, and similar petty cash items in connection with the Work.~~

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

~~j.—When all the Work is performed on the basis of cost plus, the costs of premiums for all Bonds and insurance CONTRACTOR is required by the Contract Documents to purchase and maintain.~~

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

~~1.—Payroll costs and other compensation of CONTRACTOR's officers, executives, principals (of partnerships and sole proprietorships), general managers, engineers, architects, estimators, attorneys, auditors, accountants, purchasing and contracting agents, expeditors, timekeepers, clerks, and other personnel employed by CONTRACTOR, whether at the Site or in CONTRACTOR's principal or branch office for general administration of the Work and not specifically included in the agreed upon schedule of job classifications referred to in paragraph 11.01.A.1 or specifically covered by paragraph 11.01.A.4, all of which are to be considered administrative costs covered by the CONTRACTOR's fee.~~

~~2.—Expenses of CONTRACTOR's principal and branch offices other than CONTRACTOR's office at the Site.~~

~~3.—Any part of CONTRACTOR's capital expenses, including interest on CONTRACTOR's capital employed for the Work and charges against CONTRACTOR for delinquent payments.~~

~~4.—Costs due to the negligence of CONTRACTOR, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, including but not limited to, the correction of defective Work, disposal of materials or equipment wrongly supplied, and making good any damage to property.~~

~~5. Other overhead or general expense costs of any kind and the costs of any item not specifically and expressly included in paragraphs 11.01.A and 11.01.B.~~

~~C. *CONTRACTOR's Fee:* When all the Work is performed on the basis of cost plus, CONTRACTOR's fee shall be determined as set forth in the Agreement. When the value of any Work covered by a Change Order or when a Claim for an adjustment in Contract Price is determined on the basis of Cost of the Work, CONTRACTOR's fee shall be determined as set forth in paragraph 12.01.C.~~

~~D. *Documentation:* Whenever the Cost of the Work for any purpose is to be determined pursuant to paragraphs 11.01.A and 11.01.B, CONTRACTOR will establish and maintain records thereof in accordance with generally accepted accounting practices and submit in a form acceptable to ENGINEER an itemized cost breakdown together with supporting data.~~

11.02 Cash Allowances

A. It is understood that CONTRACTOR has included in the Contract Price all allowances so named in the Contract Documents and shall cause the Work so covered to be performed for such sums as may be acceptable to OWNER and ENGINEER. CONTRACTOR agrees that:

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

2. CONTRACTOR's costs for unloading and handling on the Site, labor, installation costs, overhead, profit, and other expenses contemplated for the allowances have been included in the Contract Price and not in the allowances, and no demand for additional payment on account of any of the foregoing will be valid.

B. Prior to final payment, an appropriate Change Order will be issued as recommended by ENGINEER to reflect actual amounts due CONTRACTOR on account of Work covered by allowances, and the Contract Price shall be correspondingly adjusted.

~~*11.03 Unit Price Work~~

~~A. Where the Contract Documents provide that all or part of the Work is to be Unit Price Work, initially the Contract Price will be deemed to include for all Unit Price Work an amount equal to the sum of the unit price for each separately identified item of Unit Price Work times the estimated quantity of each item as indicated in the Agreement. The estimated quantities of items of Unit Price Work are not guaranteed and are solely for the purpose of comparison of Bids and determining an initial Contract Price. Determinations of the actual quantities and classifications of Unit Price Work performed by~~

~~CONTRACTOR will be made by ENGINEER subject to the provisions of paragraph 9.08.~~

~~B. Each unit price will be deemed to include an amount considered by CONTRACTOR to be adequate to cover CONTRACTOR's overhead and profit for each separately identified item.~~

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

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

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

~~3. if CONTRACTOR believes that CONTRACTOR is entitled to an increase in Contract Price as a result of having incurred additional expense or OWNER believes that OWNER is entitled to a decrease in Contract Price and the parties are unable to agree as to the amount of any such increase or decrease.~~

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

12.01 Change of Contract Price

~~* A. The Contract Price may only be changed by a Change Order or by a Written Amendment. Any Claim for an adjustment in the Contract Price shall be based on written notice submitted by the party making the Claim to the ENGINEER and the other party to the Contract in accordance with the provisions of paragraph 10.05.~~

~~B. The value of any Work covered by a Change Order or of any Claim for an adjustment in the Contract Price will be determined as follows:~~

~~1. where the Work involved is covered by unit prices contained in the Contract Documents, by application of such unit prices to the quantities of the items involved (subject to the provisions of paragraph 11.03); or~~

~~2. where the Work involved is not covered by unit prices contained in the Contract Documents, by a mutually agreed lump sum (which may include an allowance for overhead and profit not necessarily in accordance with paragraph 12.01.C.2); or~~

~~3. where the Work involved is not covered by unit prices contained in the Contract Documents and agreement to a lump sum is not reached under paragraph 12.01.B.2, on the basis of the Cost of the Work (determined as provided in paragraph 11.01) plus a CONTRACTOR's fee for overhead and profit (determined as provided in paragraph 12.01.C).~~

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

~~1. a mutually acceptable fixed fee; or~~

~~2. if a fixed fee is not agreed upon, then a fee based on the following percentages of the various portions of the Cost of the Work:~~

~~a. for costs incurred under paragraphs 11.01.A.1 and 11.01.A.2, the CONTRACTOR's fee shall be 15 percent;~~

~~b. for costs incurred under paragraph 11.01.A.3, the CONTRACTOR's fee shall be five percent;~~

~~c. where one or more tiers of subcontracts are on the basis of Cost of the Work plus a fee and no fixed fee is agreed upon, the intent of paragraph 12.01.C.2.a is that the Subcontractor who actually performs the Work, at whatever tier, will be paid a fee of 15 percent of the costs incurred by such Subcontractor under paragraphs 11.01.A.1 and 11.01.A.2 and that any higher tier Subcontractor and CONTRACTOR will each be paid a fee of five percent of the amount paid to the next lower tier Subcontractor;~~

~~d. no fee shall be payable on the basis of costs itemized under paragraphs 11.01.A.4, 11.01.A.5, and 11.01.B;~~

~~e. the amount of credit to be allowed by CONTRACTOR to OWNER for any change which results in a net decrease in cost will be the amount of the actual net decrease in cost plus a deduction in CONTRACTOR's fee by an amount equal to five percent of such net decrease; and~~

~~f. when both additions and credits are involved in any one change, the adjustment in CONTRACTOR's fee shall be computed on the basis of the net change in accordance with paragraphs 12.01.C.2.a through 12.01.C.2.e, inclusive.~~

12.02 Change of Contract Times

A. The Contract Times (or Milestones) may only be changed by a Change Order or by a Written Amendment. Any Claim for an adjustment in the Contract Times (or Milestones) shall be based on written notice submitted by the party making the claim to the ENGINEER and the other party to the Contract in accordance with the provisions of paragraph 10.05.

B. Any adjustment of the Contract Times (or Milestones) covered by a Change Order or of any Claim for an adjustment in the Contract Times (or Milestones) will be determined in accordance with the provisions of this Article 12.

12.03 Delays Beyond CONTRACTOR's Control

A. Where CONTRACTOR is prevented from completing any part of the Work within the Contract Times (or Milestones) due to delay beyond the control of CONTRACTOR, the Contract Times (or Milestones) will be extended in an amount equal to the time lost due to such delay if a Claim is made therefor as provided in paragraph 12.02.A. Delays beyond the control of CONTRACTOR shall include, but not be limited to, acts or neglect by OWNER, acts or neglect of utility owners or other contractors performing other work as contemplated by Article 7, fires, floods, epidemics, abnormal weather conditions, or acts of God.

12.04 Delays Within CONTRACTOR's Control

A. The Contract Times (or Milestones) will not be extended due to delays within the control of CONTRACTOR. Delays attributable to and within the control of a Subcontractor or Supplier shall be deemed to be delays within the control of CONTRACTOR.

12.05 Delays Beyond OWNER's and CONTRACTOR's Control

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

12.06 Delay Damages

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

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

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

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

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

13.01 Notice of Defects

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

13.02 Access to Work

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

13.03 Tests and Inspections

A. CONTRACTOR shall give ENGINEER timely notice of readiness of the Work for all required inspections, tests, or approvals and shall cooperate with inspection and testing personnel to facilitate required inspections or tests.

B. OWNER shall employ and pay for the services of an independent testing laboratory to perform all inspections, tests, or approvals required by the Contract Documents except:

1. for inspections, tests, or approvals covered by paragraphs 13.03.C and 13.03.D below;
2. that costs incurred in connection with tests or inspections conducted pursuant to paragraph 13.04.B shall be paid as provided in said paragraph 13.04.B; and
3. as otherwise specifically provided in the Contract Documents.

C. If Laws or Regulations of any public body having jurisdiction require any Work (or part thereof) specifically to be inspected, tested, or approved by an employee or other representative of such public body, CONTRACTOR shall assume full responsibility for arranging and obtaining such inspections, tests, or approvals, pay all costs in connection therewith, and furnish ENGINEER the required certificates of inspection or approval.

D. CONTRACTOR shall be responsible for arranging and obtaining and shall pay all costs in connection with any inspections, tests, or approvals required for OWNER's and ENGINEER's acceptance of materials or equipment to be incorporated in the Work; or acceptance of materials, mix designs, or equipment submitted for approval prior to CONTRACTOR's purchase thereof for incorporation in the Work. Such inspections, tests, or

approvals shall be performed by organizations acceptable to OWNER and ENGINEER.

E. If any Work (or the work of others) that is to be inspected, tested, or approved is covered by CONTRACTOR without written concurrence of ENGINEER, it must, if requested by ENGINEER, be uncovered for observation.

F. Uncovering Work as provided in paragraph 13.03.E shall be at CONTRACTOR's expense unless CONTRACTOR has given ENGINEER timely notice of CONTRACTOR's intention to cover the same and ENGINEER has not acted with reasonable promptness in response to such notice.

13.04 Uncovering Work

A. If any Work is covered contrary to the written request of ENGINEER, it must, if requested by ENGINEER, be uncovered for ENGINEER's observation and replaced at CONTRACTOR's expense.

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

13.05 OWNER May Stop the Work

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

other individual or entity, or any surety for, or employee or agent of any of them.

13.06 Correction or Removal of Defective Work

A. CONTRACTOR shall correct all defective Work, whether or not fabricated, installed, or completed, or, if the Work has been rejected by ENGINEER, remove it from the Project and replace it with Work that is not defective. CONTRACTOR shall pay all Claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such correction or removal (including but not limited to all costs of repair or replacement of work of others).

13.07 Correction Period

~~* A. If within one year after the date of Substantial Completion or such longer period of time as may be prescribed by Laws or Regulations or by the terms of any applicable special guarantee required by the Contract Documents or by any specific provision of the Contract Documents, any Work is found to be defective, or if the repair of any damages to the land or areas made available for CONTRACTOR's use by OWNER or permitted by Laws and Regulations as contemplated in paragraph 6.11.A is found to be defective, CONTRACTOR shall promptly, without cost to OWNER and in accordance with OWNER's written instructions: (i) repair such defective land or areas, or (ii) correct such defective Work or, if the defective Work has been rejected by OWNER, remove it from the Project and replace it with Work that is not defective, and (iii) satisfactorily correct or repair or remove and replace any damage to other Work, to the work of others or other land or areas resulting therefrom. If CONTRACTOR does not promptly comply with the terms of such instructions, or in an emergency where delay would cause serious risk of loss or damage, OWNER may have the defective Work corrected or repaired or may have the rejected Work removed and replaced, and all Claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such correction or repair or such removal and replacement (including but not limited to all costs of repair or replacement of work of others) will be paid by CONTRACTOR.~~

B. In special circumstances where a particular item of equipment is placed in continuous service before Substantial Completion of all the Work, the correction period for that item may start to run from an earlier date if so provided in the Specifications or by Written Amendment.

C. Where defective Work (and damage to other Work resulting therefrom) has been corrected or removed and replaced under this paragraph 13.07, the correction period hereunder with respect to such Work will be extended for an additional period of one year after such correction or removal and replacement has been satisfactorily completed.

D. CONTRACTOR's obligations under this paragraph 13.07 are in addition to any other obligation or warranty. The provisions of this paragraph 13.07 shall not be construed as a substitute for or a waiver of the provisions of any applicable statute of limitation or repose.

13.08 Acceptance of Defective Work

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

13.09 OWNER May Correct Defective Work

* A. If CONTRACTOR fails within a reasonable time after written notice from ENGINEER to correct defective Work or to remove and replace rejected Work as required by ENGINEER in accordance with paragraph 13.06.A, or if CONTRACTOR fails to perform the Work in accordance with the Contract Documents, or if CONTRACTOR fails to comply with any other provision of the Contract Documents, OWNER may, after seven days written notice to CONTRACTOR, correct and remedy any such deficiency.

* B. ~~In exercising the rights and remedies under this paragraph, OWNER shall proceed expeditiously. In connection with such corrective and remedial action, OWNER may exclude CONTRACTOR from all or part of the Site, take possession of all or part of the Work and suspend CONTRACTOR's services related thereto, take possession of CONTRACTOR's tools, appliances, construction equipment and machinery at the Site, and incorporate in the Work all materials and equipment stored at the Site or for which OWNER has paid CONTRACTOR but which are stored elsewhere. CONTRACTOR shall allow OWNER, OWNER's representatives, agents and employees, OWNER's other contractors, and ENGINEER and ENGINEER's Consultants access to the Site to enable OWNER to exercise the rights and remedies under this paragraph.~~

C. All Claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) incurred or sustained by OWNER in exercising the rights and remedies under this paragraph 13.09 will be charged against CONTRACTOR, and a Change Order will be issued incorporating the necessary revisions in the Contract Documents with respect to the Work; and OWNER shall be entitled to an appropriate decrease in the Contract Price. If the parties are unable to agree as to the amount of the adjustment, OWNER may make a Claim therefor as provided in paragraph 10.05. Such claims, costs, losses and damages will include but not be limited to all costs of repair, or replacement of work of others destroyed or damaged by correction, removal, or replacement of CONTRACTOR's defective Work.

D. CONTRACTOR shall not be allowed an extension of the Contract Times (or Milestones) because of any delay in the performance of the Work attributable to the exercise by OWNER of OWNER's rights and remedies under this paragraph 13.09.

ARTICLE 14 - PAYMENTS TO CONTRACTOR AND COMPLETION

14.01 Schedule of Values

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

14.02 Progress Payments

A. Applications for Payments

1. At least 20 days before the date established for each progress payment (but not more often than once a month), CONTRACTOR shall submit to ENGINEER for review an Application for Payment filled out and signed by CONTRACTOR covering the Work completed as of the date of the Application and accompanied by such supporting documentation as is required by the Contract Documents. If payment is requested on the basis of materials and equipment not incorporated in the Work but delivered and suitably stored at the Site or at another location agreed to in writing, the Application for Payment shall also be accompanied by a bill of sale, invoice, or other documentation warranting that OWNER has received the materials and equipment free and clear of all Liens and evidence that the materials and equipment are covered by appropriate property insurance or other arrangements to protect OWNER's interest therein, all of which must be satisfactory to OWNER.

2. Beginning with the second Application for Payment, each Application shall include an affidavit of CONTRACTOR stating that all previous progress payments received on account of the Work have been applied on account to discharge CONTRACTOR's legitimate obligations associated with prior Applications for Payment.

~~* 3. The amount of retainage with respect to progress payments will be as stipulated in the Agreement.~~

B. Review of Applications

1. ENGINEER will, within 10 days after receipt of each Application for Payment, either indicate in writing a recommendation of payment and present the Application to OWNER or return the Application to CONTRACTOR indicating in writing ENGINEER's reasons for refusing to recommend payment. In the latter case, CONTRACTOR may make the necessary corrections and resubmit the Application.

2. ENGINEER's recommendation of any payment requested in an Application for Payment will constitute a representation by ENGINEER to OWNER, based on ENGINEER's observations on the Site of the executed Work as an experienced and qualified design professional and on ENGINEER's review of the Application for Payment and the accompanying data and schedules, that to the best of ENGINEER's knowledge, information and belief:

a. the Work has progressed to the point indicated;

b. the quality of the Work is generally in accordance with the Contract Documents (subject to an evaluation of the Work as a functioning whole prior to or upon Substantial Completion, to the results of any subsequent tests called for in the Contract Documents, to a final determination of quantities and classifications for Unit Price Work under paragraph 9.08, and to any other qualifications stated in the recommendation); and

c. the conditions precedent to CONTRACTOR's being entitled to such payment appear to have been fulfilled in so far as it is ENGINEER's responsibility to observe the Work.

3. By recommending any such payment ENGINEER will not thereby be deemed to have represented that: (i) inspections made to check the quality or the quantity of the Work as it has been performed have been exhaustive, extended to every aspect of the Work in progress, or involved detailed inspections of the Work beyond the responsibilities specifically assigned to ENGINEER in the Contract Documents; or (ii) that there may not be other

*See Supplementary General Conditions

matters or issues between the parties that might entitle CONTRACTOR to be paid additionally by OWNER or entitle OWNER to withhold payment to CONTRACTOR.

4. Neither ENGINEER's review of CONTRACTOR's Work for the purposes of recommending payments nor ENGINEER's recommendation of any payment, including final payment, will impose responsibility on ENGINEER to supervise, direct, or control the Work or for the means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for CONTRACTOR's failure to comply with Laws and Regulations applicable to CONTRACTOR's performance of the Work. Additionally, said review or recommendation will not impose responsibility on ENGINEER to make any examination to ascertain how or for what purposes CONTRACTOR has used the moneys paid on account of the Contract Price, or to determine that title to any of the Work, materials, or equipment has passed to OWNER free and clear of any Liens.

5. ENGINEER may refuse to recommend the whole or any part of any payment if, in ENGINEER's opinion, it would be incorrect to make the representations to OWNER referred to in paragraph 14.02.B.2. ENGINEER may also refuse to recommend any such payment or, because of subsequently discovered evidence or the results of subsequent inspections or tests, revise or revoke any such payment recommendation previously made, to such extent as may be necessary in ENGINEER's opinion to protect OWNER from loss because:

- a. the Work is defective, or completed Work has been damaged, requiring correction or replacement;
- b. the Contract Price has been reduced by Written Amendment or Change Orders;
- c. OWNER has been required to correct defective Work or complete Work in accordance with paragraph 13.09; or
- d. ENGINEER has actual knowledge of the occurrence of any of the events enumerated in paragraph 15.02.A.

C. *Payment Becomes Due*

*

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

D. *Reduction in Payment*

1. OWNER may refuse to make payment of the full amount recommended by ENGINEER because:

- a. claims have been made against OWNER on account of CONTRACTOR's performance or furnishing of the Work;
- b. Liens have been filed in connection with the Work, except where CONTRACTOR has delivered a specific Bond satisfactory to OWNER to secure the satisfaction and discharge of such Liens;
- c. there are other items entitling OWNER to a set-off against the amount recommended; or
- d. OWNER has actual knowledge of the occurrence of any of the events enumerated in paragraphs 14.02.B.5.a through 14.02.B.5.c or paragraph 15.02.A.

2. If OWNER refuses to make payment of the full amount recommended by ENGINEER, OWNER must give CONTRACTOR immediate written notice (with a copy to ENGINEER) stating the reasons for such action and promptly pay CONTRACTOR any amount remaining after deduction of the amount so withheld. OWNER shall promptly pay CONTRACTOR the amount so withheld, or any adjustment thereto agreed to by OWNER and CONTRACTOR, when CONTRACTOR corrects to OWNER's satisfaction the reasons for such action.

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

14.03 *CONTRACTOR's Warranty of Title*

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

14.04 *Substantial Completion*

A. When CONTRACTOR considers the entire Work ready for its intended use CONTRACTOR shall notify OWNER and ENGINEER in writing that the entire Work is substantially complete (except for items specifically listed by CONTRACTOR as incomplete) and request that ENGINEER issue a certificate of Substantial Completion. Promptly thereafter, OWNER, CONTRACTOR, and ENGINEER shall make an inspection of the Work to determine the status of completion. If ENGINEER does not consider the Work substantially complete, ENGINEER will notify CONTRACTOR in writing giving the reasons therefor. If ENGINEER considers the Work substantially complete,

*See Supplementary General Conditions

ENGINEER will prepare and deliver to OWNER a tentative certificate of Substantial Completion which shall fix the date of Substantial Completion. There shall be attached to the certificate a tentative list of items to be completed or corrected before final payment. OWNER shall have seven days after receipt of the tentative certificate during which to make written objection to ENGINEER as to any provisions of the certificate or attached list. If, after considering such objections, ENGINEER concludes that the Work is not substantially complete, ENGINEER will within 14 days after submission of the tentative certificate to OWNER notify CONTRACTOR in writing, stating the reasons therefor. If, after consideration of OWNER's objections, ENGINEER considers the Work substantially complete, ENGINEER will within said 14 days execute and deliver to OWNER and CONTRACTOR a definitive certificate of Substantial Completion (with a revised tentative list of items to be completed or corrected) reflecting such changes from the tentative certificate as ENGINEER believes justified after consideration of any objections from OWNER. At the time of delivery of the tentative certificate of Substantial Completion ENGINEER will deliver to OWNER and CONTRACTOR a written recommendation as to division of responsibilities pending final payment between OWNER and CONTRACTOR with respect to security, operation, safety, and protection of the Work, maintenance, heat, utilities, insurance, and warranties and guarantees. Unless OWNER and CONTRACTOR agree otherwise in writing and so inform ENGINEER in writing prior to ENGINEER's issuing the definitive certificate of Substantial Completion, ENGINEER's aforesaid recommendation will be binding on OWNER and CONTRACTOR until final payment.

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

14.05 Partial Utilization

A. Use by OWNER at OWNER's option of any substantially completed part of the Work which has specifically been identified in the Contract Documents, or which OWNER, ENGINEER, and CONTRACTOR agree constitutes a separately functioning and usable part of the Work that can be used by OWNER for its intended purpose without significant interference with CONTRACTOR's performance of the remainder of the Work, may be accomplished prior to Substantial Completion of all the Work subject to the following conditions.

1. OWNER at any time may request CONTRACTOR in writing to permit OWNER to use any such part of the Work which OWNER believes to be ready for its intended use and substantially complete. If CONTRACTOR agrees that such part of the Work is substantially complete, CONTRACTOR will certify to OWNER and ENGINEER that such part of the Work is substantially complete and request ENGINEER to issue a certificate of Substantial Completion for that part of the Work. CONTRACTOR at any time may notify

OWNER and ENGINEER in writing that CONTRACTOR considers any such part of the Work ready for its intended use and substantially complete and request ENGINEER to issue a certificate of Substantial Completion for that part of the Work. Within a reasonable time after either such request, OWNER, CONTRACTOR, and ENGINEER shall make an inspection of that part of the Work to determine its status of completion. If ENGINEER does not consider that part of the Work to be substantially complete, ENGINEER will notify OWNER and CONTRACTOR in writing giving the reasons therefor. If ENGINEER considers that part of the Work to be substantially complete, the provisions of paragraph 14.04 will apply with respect to certification of Substantial Completion of that part of the Work and the division of responsibility in respect thereof and access thereto.

2. No occupancy or separate operation of part of the Work may occur prior to compliance with the requirements of paragraph 5.10 regarding property insurance.

14.06 Final Inspection

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

14.07 Final Payment

A. Application for Payment

1. After CONTRACTOR has, in the opinion of ENGINEER, satisfactorily completed all corrections identified during the final inspection and has delivered, in accordance with the Contract Documents, all maintenance and operating instructions, schedules, guarantees, Bonds, certificates or other evidence of insurance certificates of inspection, marked-up record documents (as provided in paragraph 6.12), and other documents, CONTRACTOR may make application for final payment following the procedure for progress payments.

2. The final Application for Payment shall be accompanied (except as previously delivered) by: (i) all documentation called for in the Contract Documents, including but not limited to the evidence of insurance required by subparagraph 5.04.B.7; (ii) consent of the surety, if any, to final payment; and (iii) complete and legally effective releases or waivers (satisfactory to OWNER) of all Lien rights arising out of or Liens filed in connection with the Work.

3. In lieu of the releases or waivers of Liens specified in paragraph 14.07.A.2 and as approved by OWNER, CONTRACTOR may furnish receipts or releases in full and an affidavit of CONTRACTOR that: (i) the releases and receipts include all labor, services, material, and equipment for which a Lien could be filed; and (ii) all payrolls, material and equipment bills, and other indebtedness connected with the Work for which OWNER or OWNER's property might in any way be responsible have been paid or otherwise satisfied. If any Subcontractor or Supplier fails to furnish such a release or receipt in full, CONTRACTOR may furnish a Bond or other collateral satisfactory to OWNER to indemnify OWNER against any Lien.

B. Review of Application and Acceptance

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

C. Payment Becomes Due

1. Thirty days after the presentation to OWNER of the Application for Payment and accompanying documentation, the amount recommended by ENGINEER will become due and, when due, will be paid by OWNER to CONTRACTOR.

14.08 Final Completion Delayed

A. If, through no fault of CONTRACTOR, final completion of the Work is significantly delayed, and if ENGINEER so confirms, OWNER shall, upon receipt of CONTRACTOR's final Application for Payment and recommendation of ENGINEER, and without terminating the Agreement, make payment of the balance due for that portion of the Work fully completed and accepted. If the remaining balance to be held by OWNER for Work not fully completed or corrected is less than the retainage stipulated in the Agreement, and if Bonds have been

furnished as required in paragraph 5.01, the written consent of the surety to the payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by CONTRACTOR to ENGINEER with the Application for such payment. Such payment shall be made under the terms and conditions governing final payment, except that it shall not constitute a waiver of Claims.

14.09 Waiver of Claims

A. The making and acceptance of final payment will constitute:

1. a waiver of all Claims by OWNER against CONTRACTOR, except Claims arising from unsettled Liens, from defective Work appearing after final inspection pursuant to paragraph 14.06, from failure to comply with the Contract Documents or the terms of any special guarantees specified therein, or from CONTRACTOR's continuing obligations under the Contract Documents; and

2. a waiver of all Claims by CONTRACTOR against OWNER other than those previously made in writing which are still unsettled.

ARTICLE 15 - SUSPENSION OF WORK AND TERMINATION

15.01 OWNER May Suspend Work

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

15.02 OWNER May Terminate for Cause

A. The occurrence of any one or more of the following events will justify termination for cause:

1. CONTRACTOR's persistent failure to perform the Work in accordance with the Contract Documents (including, but not limited to, failure to supply sufficient skilled workers or suitable materials or equipment or failure to adhere to the progress schedule established under paragraph 2.07 as adjusted from time to time pursuant to paragraph 6.04);

2. CONTRACTOR's disregard of Laws or Regulations of any public body having jurisdiction;

3. CONTRACTOR's disregard of the authority of ENGINEER; or

4. CONTRACTOR's violation in any substantial way of any provisions of the Contract Documents.

*

B. If one or more of the events identified in paragraph 15.02.A occur, OWNER may, after giving CONTRACTOR (and the surety, if any) seven days written notice, terminate the services of CONTRACTOR, exclude CONTRACTOR from the Site, and take possession of the Work and of all CONTRACTOR's tools, appliances, construction equipment, and machinery at the Site, and use the same to the full extent they could be used by CONTRACTOR (without liability to CONTRACTOR for trespass or conversion), incorporate in the Work all materials and equipment stored at the Site or for which OWNER has paid CONTRACTOR but which are stored elsewhere, and finish the Work as OWNER may deem expedient. In such case, CONTRACTOR shall not be entitled to receive any further payment until the Work is finished. If the unpaid balance of the Contract Price exceeds all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) sustained by OWNER arising out of or relating to completing the Work, such excess will be paid to CONTRACTOR. If such claims, costs, losses, and damages exceed such unpaid balance, CONTRACTOR shall pay the difference to OWNER. Such claims, costs, losses, and damages incurred by OWNER will be reviewed by ENGINEER as to their reasonableness and, when so approved by ENGINEER, incorporated in a Change Order. When exercising any rights or remedies under this paragraph OWNER shall not be required to obtain the lowest price for the Work performed.

C. Where CONTRACTOR's services have been so terminated by OWNER, the termination will not affect any rights or remedies of OWNER against CONTRACTOR then existing or which may thereafter accrue. Any retention or payment of moneys due CONTRACTOR by OWNER will not release CONTRACTOR from liability.

15.03 OWNER May Terminate For Convenience

A. Upon seven days written notice to CONTRACTOR and ENGINEER, OWNER may, without cause and without prejudice to any other right or remedy of OWNER, elect to terminate the Contract. In such case, CONTRACTOR shall be paid (without duplication of any items):

1. for completed and acceptable Work executed in accordance with the Contract Documents prior to the effective date of termination, including fair and reasonable sums for overhead and profit on such Work;

2. for expenses sustained prior to the effective date of termination in performing services and furnishing labor, materials, or equipment as required by the Contract Documents in connection with uncompleted Work, plus fair and reasonable sums for overhead and profit on such expenses;

3. for all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) incurred in settlement of terminated contracts with Subcontractors, Suppliers, and others; and

4. for reasonable expenses directly attributable to termination.

B. CONTRACTOR shall not be paid on account of loss of anticipated profits or revenue or other economic loss arising out of or resulting from such termination.

15.04 CONTRACTOR May Stop Work or Terminate

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

ARTICLE 16 - DISPUTE RESOLUTION

16.01 Methods and Procedures

A. Dispute resolution methods and procedures, if any, shall be as set forth in the Supplementary Conditions. If no method and procedure has been set forth, and subject to the provisions of paragraphs 9.09 and 10.05, OWNER and CONTRACTOR may exercise such rights or remedies as either may otherwise have under the Contract Documents or by Laws or Regulations in respect of any dispute.

ARTICLE 17 - MISCELLANEOUS

17.01 Giving Notice

A. Whenever any provision of the Contract Documents requires the giving of written notice, it will be

deemed to have been validly given if delivered in person to the individual or to a member of the firm or to an officer of the corporation for whom it is intended, or if delivered at or sent by registered or certified mail, postage prepaid, to the last business address known to the giver of the notice.

17.02 Computation of Times

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

17.03 Cumulative Remedies

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

17.04 Survival of Obligations

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

17.05 Controlling Law

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

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SECTION 00800

SUPPLEMENTARY CONDITIONS

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SUPPLEMENTARY CONDITIONS

AMENDMENTS TO GENERAL CONDITIONS

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

ARTICLE 1. DEFINITIONS AND TERMINOLOGY

Add the following language at the beginning of definition 1.01 A.12 entitled "Contract Documents" in the General Conditions:

"The Advertisement for Bids, Instructions to Bidders, State Regulations, ..."

Delete the words "The individual or entity named as such in the Agreement" in 1.01.A.19, "Engineer" and insert the following in their place:

"The individual or entity duly appointed by the Owner to undertake the duties and powers herein assigned to the Engineer, acting either directly or through duly appointed representatives."

Delete the words "and who is identified as such in the Supplementary Conditions" at the end of definition 1.01 A.20, entitled "ENGINEER'S Consultant."

Delete definition 1.01 A.41 entitled "Specifications" in the General Conditions in its entirety and insert the following in its place:

"Sections included under Division 1 through Division 16 of the Contract Documents."

ARTICLE 2. PRELIMINARY MATTERS

SC-2.02

A. OWNER shall furnish to CONTRACTOR Six paper copies of the Contract Documents.

Add paragraph 2.03B:

Notwithstanding the time limitations provided in paragraph 2.03A, the OWNER may desire to commence the Contract Times later than the sixtieth day after the bid opening. The OWNER and CONTRACTOR, upon mutual agreement, may extend the commencement of the Contract Times to any date that they elect. OWNER must obtain CONTRACTOR's approval for extending the time beyond the dates/times stated in the Contract Documents.

SC-2.05

Delete paragraph 2.05C of the General Conditions in its entirety and insert the following in its place:

“C. Evidence of Insurance: CONTRACTOR shall deliver to OWNER, with a copy to the ENGINEER, Certificates of Insurance within 10 days after receipt of the notice of the acceptance of bid (and other evidence requested by OWNER) which CONTRACTOR is required to purchase and maintain in accordance with the requirements of Article 5.”

ARTICLE 3. CONTRACT DOCUMENTS: INTENT, AMENDING, REUSE

SC-3.01

Add the following sentence at the end of Paragraph 3.01A of the General Conditions:

“...by all. Each and every provision of law and clause required by law to be inserted in these Contract Documents shall be deemed to be inserted herein, and they shall be read and enforced as though it were included herein, and if through mistake or otherwise, any such provision is not inserted, or if not correctly inserted, then upon the application of either party, the Contract Documents shall forthwith be physically amended to make such insertion.”

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

SC-4.02

Delete the term “Supplementary Conditions” of paragraph 4.02 A of the General Conditions and replace it with “Contract Documents”.

SC-4.04

Change “of” to “or” on line 6 of paragraph 4.04 B.2 of the General Conditions.

Delete the following words from lines 8 and 9 of paragraph 4.04 B.2 of the General Conditions:

“...or not shown or indicated with reasonable accuracy...”

SC-4.05

Add a new paragraph immediately after paragraph 4.05A of the General Conditions which is to read as follows:

"B. ENGINEER may check the lines, elevations and reference marks set by CONTRACTOR, and CONTRACTOR shall correct any errors disclosed by such check. Such a check shall not be considered as approval of CONTRACTOR's work and shall not relieve CONTRACTOR of the responsibility for construction of the entire Work in accordance with the Contract Documents. CONTRACTOR shall furnish personnel to assist ENGINEER in checking lines and grades."

ARTICLE 5. BONDS AND INSURANCE

NOTICE TO CONTRACTOR:

1. Proof of Insurance coverage shall be furnished to the OWNER in accordance with the schedule for submittal of Bonds and Agreements.
2. Additionally, refer to Article 2. PRELIMINARY MATTERS, Paragraph SC-2.05.C

SC-5.01

Insert these sentences following SC-5.01.A: The Surety Company providing the bonds shall have a rating of A or better within the Best Key Rating Guide and be licensed by the Connecticut Insurance Department. The Contractor shall pay the premiums for such Bonds.

SC-5.03

Delete the second sentence in paragraph 5.03A of the General Conditions, which begins "OWNER shall deliver to...."

SC-5.04

The limits of liability for the insurance required by paragraph 5.04A of the General Conditions shall provide coverage for not less than the following amounts or greater where required by law:

5.04 A.1 and 5.04 A.2 Workers' Compensation.

(1)	Worker's Compensation per	Statutory Requirements
(2)	Coverage B - Employer's Liability	\$100,000/\$500,000/\$100,000

5.04 A.3, 5.04 A.4 and 5.04 A.5 Commercial General Liability Limits shall include coverage for Independent Contractors (also known as Owners and Contractors Protective Liability), explosion, collapse and underground hazard coverage (XCU), broad form property damage, blanket contractual

liability and products/completed operations. The general aggregate limits shall be endorsed so that they respond on a per project and per location basis.

Limits:

\$1,000,000 each occurrence

\$2,000,000 general aggregate

\$2,000,000 products/completed operations aggregate

5.04 A.6 Automobile Liability for owned, hired and non-owned vehicles:

(1)	Bodily injury:	\$1,000,000	Combined single limit
(2)	Property damage	\$1,000,000	Combined single limit

Revise the beginning of paragraph 5.04.B.1 to read as follows:

“with respect to insurance required by paragraphs 5.04.A.3 through 5.04.A.5 inclusive and paragraph 5.04.C, include as additional insureds...”

Delete paragraph 5.04.B.5 in its entirety and insert the following in its place:

“5. contains a provision that notice of cancellation of insurance be delivered in accordance with policy provisions. In addition, the CONTRACTOR and/or its insurance broker/agent shall immediately notify the OWNER and ENGINEER should any insurance coverage be cancelled. The CONTRACTOR shall immediately stop work on the Project and shall not resume work until the CONTRACTOR provides evidence, to the OWNER and ENGINEER, in the form of an acceptable insurance certificate, of new insurance coverage that replaces all cancelled coverage that is required for the Project.”

SC-5.04

Add two new paragraphs immediately after paragraph 5.04B of the General Conditions which are to read as follows:

“C. The CONTRACTOR shall also provide:

1. CONTRACTOR shall, as a minimum, purchase and maintain excess liability insurance in the umbrella form with a combined single limit of not less than \$5,000,000 per claim and in the aggregate. Evidence of such excess liability shall be delivered to OWNER in accordance with paragraph 2.05C in the form of a certificate indicating the policy numbers and limits of liability of all underlying insurance.

- A. General Liability, Workers' Compensation, Automobile Liability and Umbrella Liability Policies will contain waivers of subrogation in favor of the Engineer and Owner.

- 2. If the aggregate limits of liability indicated in CONTRACTOR' insurance provided in accordance with paragraphs 5.03 and 5.04 are not sufficient to cover all claims for damages arising from his operations under this Contract and from any other work performed by him or if the commercial general liability insurance policy of insurance does not provide that the general aggregate limits apply on a per project and per location basis, CONTRACTOR shall have the policy amended so that the aggregate limits of liability required by this Contract will be available to cover all claims for damages due to operations under this Contract."

SC-5.05

Delete paragraph 5.05 of the General Conditions in its entirety.

Delete Paragraph 5.06 A of the General Conditions in its entirety.

Delete paragraph 5.06B of the General Conditions in its entirety.

Delete Paragraph 5.06C of the General Conditions in its entirety and insert the following in its place:

"C. All the policies of insurance (or the certificates or other evidence thereof) required to be purchased and maintained by CONTRACTOR in accordance with paragraphs 5.06 will contain a provision or endorsement that the coverage afforded will not be canceled or materially changed or renewal refused until at least thirty days' prior written notice has been given to OWNER by certified mail and will contain waiver provisions in accordance with paragraph 5.07B. The words "**Endeavor to**" shall be struck from the Certificate Of Insurance in the Cancellation Statement"

Delete paragraph 5.06D of the General Conditions in its entirety.

Delete paragraph 5.06E of the General Conditions in its entirety.

SC-5.07

Amend the last sentence of paragraph 5.07A of the General Conditions by striking out the words "held by OWNER as trustee or." As so amended, paragraph 5.07A remains in effect.

SC-5.08

Delete paragraph 5.08A of the General Conditions in its entirety.

Delete paragraph 5.08B of the General Conditions in its entirety.

SC-5.09

Delete paragraph 5.09A of the General Conditions in its entirety and insert the following in its place:

"A. If OWNER has any objection to the coverage afforded by or other provisions of the insurance required to be purchased and maintained by CONTRACTOR in accordance with this Article 5 on the basis of its not complying with the Contract Documents, OWNER will notify CONTRACTOR in writing thereof within thirty days of the date of delivery of such certificates to OWNER in accordance with paragraph 2.05C. CONTRACTOR will provide such additional information in respect of insurance provided by him as OWNER may reasonably request."

ARTICLE 6. CONTRACTOR'S RESPONSIBILITIES

SC-6.01

Delete paragraph 6.01B of the General Conditions in its entirety and replace with the following:

"B. At the site of the Work the CONTRACTOR shall employ a full-time construction superintendent or foreman who shall have full authority to act for the CONTRACTOR. It is understood that such representative shall be acceptable to the ENGINEER and shall be one who will be continued in the capacity for the particular job involved unless the representative ceases to be on the CONTRACTOR's payroll. If at any time during the Work the representative is deemed by the ENGINEER to be no longer acceptable, the representative shall be promptly replaced by the CONTRACTOR. All communications to the superintendent or foreman shall be as binding as if given to the CONTRACTOR."

SC-6.04

Add the following paragraph after paragraph 6.04A.2 of the General Conditions:

"B. The CONTRACTOR's resident superintendent shall attend monthly progress meetings at the site of the work with the ENGINEER and others as appropriate to review schedule status and such other pertinent subjects as may be listed on the agenda by the ENGINEER."

SC-6.17

In paragraph 6.17 E.1 of the General Conditions, delete the word "timely" from the first line.

SC-6.20

Delete paragraph 6.20A of the General Conditions in its entirety and replace with the following:

"A. To the fullest extent permitted by law, the CONTRACTOR shall indemnify and hold harmless the OWNER, the ENGINEER, ENGINEER's consultants, and any of their officers, directors, employees, agents, affiliates, subsidiaries and partners from and against all claims, damages, losses and expenses, including but not limited to attorney's fees, arising out of or resulting from the performance of the Work, provided that such claim, damage, loss or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself) including loss of

use resulting therefrom, but only to the extent caused in whole or in part by acts or omissions of the CONTRACTOR, a subcontractor, anyone directly or indirectly employed by them or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss or expense is caused in part by a party indemnified hereunder. Such obligation shall apply to any such claims, damages, losses and expenses which arise and/or are incurred by any person or entity either during the performance of the Work and/or after completion of construction. Nothing in this paragraph shall be construed to negate, abridge, or reduce other rights or obligations of indemnity or contribution which would otherwise exist as to a party or person indemnified hereunder. CONTRACTOR hereby assumes the responsibility and liability for injury to or death of any and all persons, including the CONTRACTOR's employees, and for any and all damage to property caused by, resulting from, or arising out of any act, omission or neglect on the part of the CONTRACTOR, or of any Subcontractor or of anyone directly or indirectly employed by any of them or of anyone for whose acts, any of them may be liable. The Contractor hereby acknowledges its obligation under the foregoing paragraph to indemnify the Engineer and Owner against judgements suffered because of the contractor's work and to assume the cost of defending the Engineer and Owner against claims as described in the foregoing paragraph."

Delete paragraph 6.20C of the General Conditions in its entirety.

ARTICLE 8. OWNER'S RESPONSIBILITIES

SC-8.02

Delete the phrase "to whom the CONTRACTOR makes no reasonable objection."

SC-8.06

Delete paragraph 8.06A of the General Conditions in its entirety.

SC-8.09

Insert the following after the first sentence:

"However, the OWNER shall have the right to direct the CONTRACTOR to perform the Work according to any sequence schedule set forth in the Contract Documents or established pursuant thereto."

ARTICLE 9. ENGINEER'S STATUS DURING CONSTRUCTION

SC-9.01

Add a new paragraph 9.01B after paragraph 9.01A of the General Conditions, which is to read as follows:

"B. Nothing contained in the Contract Documents shall be construed to create a contractual relationship of any kind (1) between the ENGINEER and CONTRACTOR, (2) between the OWNER and a Subcontractor or Subcontractors, or (3) between any person or entities other

than the OWNER and CONTRACTOR. The ENGINEER shall, however, be entitled to performance and enforcement of obligations under the CONTRACT DOCUMENTS intended to facilitate performance of the ENGINEER'S duties."

SC-9.10

Insert the following after the first sentence on paragraph 9.10B:

““However, the ENGINEER shall have the right to direct the CONTRACTOR to perform the Work according to any sequence schedule set forth in the Contract Documents or established pursuant thereto.”

ARTICLE 11. COST OF THE WORK; CASH ALLOWANCES; UNIT PRICE WORK

Delete Article 11 of the General Conditions in its entirety and replace with the following:

"A. The unit price of an item of Unit Price work shall be subject to reevaluation and adjustment under the following conditions:

- (1) If the total extended bid price [Estimated Quantity times the Bid Unit Price] of a particular item of Unit Price Work amounts to 5 percent or more of the Original Contract Price and the variation in the quantity of the particular item of Unit Price Work performed by CONTRACTOR differs by more than 15 percent from the estimated quantity of such item indicated in the Agreement;
and
- (2) If there is no corresponding adjustment with respect to any other item of work; and
- (3) If CONTRACTOR believes that CONTRACTOR has incurred additional expense as a result thereof, CONTRACTOR may make a claim for an adjustment in the Contract Price in accordance with Article 11 if the parties are unable to agree as to the effect of any such variations in the quantity of Unit Price Work performed. If OWNER believes that the quantity variation entitles OWNER to an adjustment in the unit price, OWNER shall be entitled to an adjustment in the unit price in an amount determined by the ENGINEER. ENGINEER shall not be liable in connection with any determination relating to adjustments which is rendered in good faith."

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

SC-12.01

Delete paragraph 12.01 in its entirety.

SC-12.06

Add the following new paragraphs after paragraph 12.06 of the General Conditions:

“12.07 Liquidated Damages:

- A. If the CONTRACTOR shall neglect, fail or refuse to complete the work within the time herein specified, or any proper extension thereof granted by the OWNER, then the CONTRACTOR does hereby agree, as a part consideration for the awarding of this Contract, to pay to the OWNER the amount specified in the Contract, not as a penalty but as liquidated damages for such breach of contract as hereinafter set forth, for each and every calendar day that the Contract shall be in default after the time stipulated in the Contract for completing the work. Such damages may be retained from time to time by the OWNER from progress payments or any amounts owing to the CONTRACTOR, or otherwise collected.
- B. The said amount is fixed and agreed upon by and between the CONTRACTOR and the OWNER because of the impracticability and extreme difficulty of fixing and ascertaining the actual damages the OWNER would in such event sustain, and said amount is agreed to be the amount of damages which the OWNER would sustain and said amount shall be retained from time to time by the OWNER from current periodical estimates.
- C. It is further agreed that time is of the essence of each and every portion of this Contract and of the specifications wherein as definite and certain length of times if fixed for the performance of any act whatsoever; and where under the Contract an additional time is allowed for the completion of any work, the new time limit fixed by such extension shall be of the essence of this Contract. Provided that the CONTRACTOR shall not be charged with liquidated damages of any excess cost when the OWNER determines that the CONTRACTOR is without fault and the CONTRACTOR's reasons for the time extension are acceptable to the OWNER; Provided, further, that the CONTRACTOR shall not be charged with liquidated damages or any excess cost when the delay in completion of the work is due:
- 1) to any preference, priority or allocation order duly issued by the Government;
 - 2) to unforeseeable cause beyond the control and without the fault or negligence of the CONTRACTOR, including, but not restricted to, acts of God, or of the public enemy, acts of the OWNER, acts of another CONTRACTOR in the performance of a contract with the OWNER, fires, floods, epidemics, quarantine restrictions, strikes, freight embargoes, and severe weather; and
 - 3) to any delays of subcontractors or suppliers occasioned by any of the causes specified in subsections C(1) and C(2) above;
- D. Provided, further, that the CONTRACTOR shall, within thirty (30) days from the beginning of such delay, unless the OWNER shall grant a further period of time prior to the date of final settlement of the Contract, notify the OWNER, in writing, of the causes of the delay, who shall ascertain the facts and extent of the delay and notify the CONTRACTOR within a reasonable time of its decision in the matter."

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

SC-13.07

Delete paragraph 13.07A of the General Conditions and insert the following in its place:

- “A. If within one year after the date of Substantial Completion or such longer period of time as may be prescribed by Laws or Regulations or by the terms of any applicable special guarantee required by the Contract Documents or by any specific provision of the Contract Documents, any work is found to be defective, CONTRACTOR shall promptly, without cost to OWNER and in accordance with OWNER's written instructions: (i) correct such defective work, or, if it has been rejected by OWNER, remove it from the site and replace it with work that is not defective, and (ii) satisfactorily correct or remove and replace any damage to other work or the work of others therefrom. If CONTRACTOR does not begin the repairs within ten (10) days of receipt of written notification and promptly comply with the terms of OWNER's written instructions, or in an emergency where delay would cause serious risk, loss or damage, OWNER may have the defective work corrected or the rejected work removed and replaced, and all claims, costs, losses and damages caused by or resulting from such removal and replacement (including but not limited to all costs of repair or replacement of work of others) will be paid by CONTRACTOR.”

SC-13.09

Revise paragraph 13.09A of the General Conditions

- A. Delete the word “seven” and replace it with the word “ten” so that it reads “after ten days written notice to CONTRACTOR.”

ARTICLE 14. PAYMENTS TO CONTRACTOR AND COMPLETION

SC-14.02

Delete paragraph 14.02A.3 and insert the following in its place:

- "3. Retainage with respect to progress payments will be five percent or, if stipulated, the maximum allowed by law."

Add Paragraph 4. to read as follows:

- “4. The CONTRACTOR shall submit, on a monthly basis, certified payrolls and a Statement of Compliance verifying compliance with the Prevailing Wage Law, C.G.S. Sec. 31-53.”

SC-14.03

Delete paragraph 14.03A in its entirety and insert the following in its place:

"A. CONTRACTOR warrants and guarantees that title to all work, material and equipment covered by any Application for Payment, whether incorporated in the Project or not, will pass to OWNER no later than at the time of Application for Payment free and clear of all liens. CONTRACTOR shall provide written transfer of title and a certified paid invoice provided by the supplier."

ARTICLE 15. SUSPENSION OF WORK AND TERMINATION

SC-15.02

Add a new paragraph immediately after paragraph 15.02 A.4 of the General Conditions which is to read as follows:

"5. If the Work to be done under this Contract shall be abandoned, or if this Contract or any part thereof shall be sublet, without the previous written consent of OWNER, or if the contract or any claim thereunder shall be assigned by CONTRACTOR otherwise than as herein specified;"

ARTICLE 17. MISCELLANEOUS

SC-17.06, 17.07, 17.08, 17.09

Add the following new paragraphs after paragraph 17.05 of the General Conditions:

"17.06 Assignment:

A. The CONTRACTOR shall not assign the whole or any part of this Contract or any moneys due or to become due hereunder until thirty (30) days prior notice in writing has been given to the OWNER of the intention to assign, which notice shall state the identity and address of the prospective assignee. No assignment shall be made without the OWNER's prior written consent. Such consent shall not be unreasonably withheld. In case the CONTRACTOR assigns all or any part of the moneys due or to become due under this Contract, the instrument of assignment shall contain a clause substantially to the effect that it is agreed that the right of the assignee in and to any moneys due or to become due to the CONTRACTOR shall be subject to prior claims of all persons, firms and corporations of services rendered or materials supplied for the performance of the work called for in this Contract."

17.07 Liability

It is understood and agreed that members of the OWNER or the ENGINEER or any agent or employees of the OWNER signing this Agreement shall not be personally liable hereunder for any action incurred in connection with this Agreement.

17.08 State Statutes and Regulations

See Section 00820 for further modifications of the General Conditions due to state statutes and regulations.

17.09 Severability

If any provision of this Agreement shall be invalid or unenforceable to any extent or in any application, then the remainder of this Agreement and of such terms and conditions, except to such extent or in such application, shall not be affected thereby, and each and every term and condition of this Agreement shall be valid and enforced to the fullest extent and in the broadest application permitted by law."

END OF SECTION

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Supplemental Conditions.docx

SECTION 00820
CHANGE ORDERS

Policy:

This section supplements Article 12, Change of Contract Price, in the General Conditions and Supplementary Conditions.

All executed change orders submitted to the Engineer for review and processing must be prepared in accordance with the attached change order format with the appropriate number of copies, calculation sheet(s) (Appendix B) and all other supporting documentation necessary for evaluation. Failure to comply with these instructions will result in delays in processing the change order.

In order to avoid possible delays with approval of change orders, at the beginning of the project and as circumstances warrant, the Contractor shall submit a list of construction equipment, identifying major pieces of equipment to be utilized on the project. The list shall include the Contractor's designation, if any, the manufacturer, model, year of manufacture, serial number, size and horsepower of equipment. The Contractor shall also provide for approval a proposed bluebook equipment rental rate development that separately lists for each piece of equipment the monthly rental rate, area adjustment factor, depreciation factor, estimated operating cost per hour and total hourly rate. In the event the Contractor fails or is unable to provide appropriate rate information the Engineer may develop equipment rental rates for use on change orders.

Payment of Change Orders:

Payment of change orders shall be made in accordance with one of the following three methods:

- A. Existing unit prices as set forth in the contract; or
 - B. Agreed upon lump sum or unit prices; or
 - C. Time and materials
- A. Payment for work for which there is a unit price in the contract:

Where the contract contains a unit price for work and the Engineer orders a change for work of the same kind as other work contained in the contract and is performed under similar physical conditions, the Contractor shall accept full and final payment at the contract unit price(s) for the acceptable quantities. Under certain circumstances, the unit prices may be subject to revaluation and adjustment. See Article 11 in the Supplementary Conditions.

- B. Payment for work or materials for which no price is contained in the contract:

If the Engineer directs, the Contractor shall submit promptly in writing to the Engineer an offer to do the required work on a lump sum or unit price basis, as specified by the Engineer. The stated price, either lump sum or unit price, shall be divided so as to show that it is the sum of:

1. The estimated cost of Labor, plus
2. Direct Labor Cost, plus
3. Material and Freight Costs, plus
4. Equipment Costs, plus
5. An amount not to exceed 20% of the sum of items 1 through 4 for overhead and profit, plus (if applicable),
6. In the case of work done by a subcontractor an amount not to exceed 7 ½%, for the general contractor of the sum of the cost (not including subcontractor's overhead and profit) of items 1 through 4 for his overhead and profit (less, if applicable),
7. Credits for work deleted from the contract, including actual costs of the deleted work plus the percentage of overhead, profit, bonds and insurance attributable to such credit amount.

C. Payment for work on a time and materials basis:

Unless an agreed lump sum and/or unit price is obtained as noted above and is so stated in the change price, the Contractor shall accept as full payment for which no agreement is contained in contract, an amount equal to:

1. The estimated cost of Labor, plus
2. The Direct Labor Costs, plus
3. Equipment Costs, plus
4. Material and Freight Costs, plus
5. An amount not to exceed 20% of the sum of items 1 through 4 for overhead and profit, plus, if applicable,
6. In the case of work done by a subcontractor an amount not to exceed 7 ½%, for the general contractor of the sum of the cost (not including subcontractor's overhead and profit) of items 1 through 4 for his overhead and profit (less, if applicable),
7. Credit for work deleted from the Contract, including actual costs of the deleted work plus the percentage of overhead, profit, bonds and insurance attributable to such credit amount.

Explanation of items 1 through 7 as outlined in "B" and "C" above:

1. Labor - Only those workers employed on the project who are doing the extra work, including the foreman in charge, are allowable. General foremen, superintendents, or other supervisory personnel are considered to be included in the overhead markup as provided in items 5 and/or 6. Hourly labor rates in excess of those as listed in the contract wage

rates require documentation. As a minimum, an explanation and the appropriate copy of the certified payroll are required.

2. Direct Labor Costs - These costs are limited to those which are required in the contract document. Coverage in excess of the contract provisions, secured by the contractor/subcontractor(s) at his option, are ineligible. The following list of typical direct labor charges is provided for your assistance and is in no way intended to be complete or all encompassing:

Workman's Compensation

Federal/State: Social Security Tax and Unemployment Tax;

Health, Welfare and Pension Benefits; (this cost is included in the wage rates appearing in the Attachment A Connecticut Wage Rates.

Liability insurance:	Bodily injury; excess umbrella; property damage; public liability
Blasters insurance:	If applied to any required direct labor costs
Builders risk insurance:	If applied to any required direct labor costs
Experience modification insurance:	If applied to any required direct labor costs
Surcharges:	If applied to any required direct labor costs

Following award and prior to execution of a construction contract, the Contractor and filed subbidders (where applicable) shall submit for review by the Owner, documentation to establish the markup percentage(s).

The documented direct labor markup for this contract may be adjusted on an annual basis as measured from the date the contract is executed. The contract agreement will provide for the establishment of the Direct Labor Cost percentage.

3. Material and Freight - Only those materials required as a result of the change order and reasonable freight charges for delivery of same are allowable.
4. Equipment - Only the equipment required as a result of the change order is allowable. Equipment rental rates shall be governed by the current EquipmentWatch, division of Intertec Publishing [Formerly Nielson/Dataquest] Rental Rate Bluebook for Construction Equipment (the "Bluebook"). In determining the rental rate the following shall apply:
 - a. For equipment already on the project - the monthly prorated rental rate by the hourly use shall be applicable;

b. For equipment not on the project the daily rate, the weekly rate, or monthly rate will prevail, whichever will prove to be most cost effective. Small tools and manual equipment are examples of costs not allowable under this item. These costs are considered to be included in the overhead markup as provided in items 5 and/or 6.

(1 Month (Normal Use) = 176 hours)

5.& 6. Overhead and Profit - All other costs not previously mentioned are considered to be included in this item, be it for the general contractor or subcontractor(s).

7. Credits - Work deleted, material and equipment removed from the contract, stored and/or returned shall be credited to the cost of the change order, less documented costs.

This change order will be prepared in such manner as to clearly separate Eligible and Ineligible Costs.

The Contractor shall furnish itemized statements of the cost of the work ordered and shall give the Engineer access to all accounts, bills and vouchers relating thereto; and unless the Contractor shall furnish such itemized statements, and access to all accounts, bills and vouchers, he shall not be entitled to payment for any items of extra work for which such information is sought by the Engineer.

APPENDIX A

CHANGE ORDER
(Enter Project Name)
(Enter Location)

Sheet __ of

Date _____

Project No. _____

Contract No. _____

Change Order No. _____

Owner's Name: _____

Owner's Address: _____

Contractor's Name: _____

Contractor's Address: _____

Item 1:

Description of Change: _____

Reason for Change: _____

Backup Information: _____

Cost: \$ _____

Item 2

Description of Change: _____

Reason for Change: _____

Backup Information: _____

Cost: \$ _____

Change Order (Continued)
(Enter Project Name)
(Enter Location)

Sheet ___ of

Date _____

Project No. _____

Contract No. _____

Change Order No. _____

Contract Amount (As Bid) \$ _____

Amount of Previous Change Orders \$ _____

Net Change in Contract Price (this Change Order) \$ _____

Total Adjusted Contract Price (including this Change Order) \$ _____

This Change Order extends the time to complete the work by ___ calendar days.

The extended completion date is _____
_____.

This Change Order checked by: _____
Resident Representative Date

This Change Order is requested by: _____

This Change Order is recommended by:

Consultant Engineer P.E. # Date

The undersigned agree to the terms of the Change Order.

Contractor Date

Owner Date

Certification of Appropriation under **Insert CT General Law**: Adequate funding in an amount sufficient to cover the total cost of this change order is available.

By: _____
Certification Officer (Auditor, Accountant, Treasurer) Date

Do not write below this space: this space reserved for STATE AGENCY APPROVAL

Appendix B
Example Calculation Sheet

1.	Labor			
	Foreman	10 hours @	\$10.00/hour	\$100.00
	Engineer	10 hours @	8.80/hour	85.00
	Operator	10 hours @	9.50/hour	95.00
	Laborers	24 hours @	7.00/hour	<u>168.00</u>
				\$448.00
2.	Direct Labor Cost (use the agreed upon Direct Labor Cost)			
	*(30)% of \$448.			
	*(used for example purposes only)			\$ 134.00
3.	Materials & Freight			
	150 l.f. of 12" pipe @ \$2.00/l.f.			\$ 300.00
	15 v.f. precast SMH			1,700.00
	Freight (slip# enclosed)			<u>25.00</u>
				\$2,025.00
4.	Equipment			
	1 Backhoe	10 hours @	\$ 80.00/hour	\$ 800.00
	1 Truck-crane	10 hours @	100.00/hour	<u>1000.00</u>
				\$1800.00
	TOTAL (items 1 through 4):			\$4,407.00
5.	(20%) markup for Overhead, Profit			
	(20%) of \$4,407			\$ 881.00
6.	(7½ %) markup on subcontractor's cost for general contractor (if subcontractor is involved)			
	(7½ %) of \$4,407			\$ 331.00
7.	Credits (deductables)			-\$323.00
	TOTAL COST:			\$5,296.00

Reminder: Provide support documentation as necessary i.e. vouchers, correspondence, calculation, photographs, reports.

END OF SECTION

SECTION 00830

STATE STATUTES AND REGULATIONS

STATE OF CONNECTICUT

A. REVISIONS TO GENERAL CONDITIONS

1. Bonds and Insurance

Insert these sentences following 6.01.A:

“The Surety Company providing the bonds shall have a rating of A or better within the Best Key Rating Guide and be licensed by the Connecticut Insurance Department. The Contractor shall pay the premiums for such Bonds.”

2. Payments to Contractor – Certified Payroll Submittal Requirements

Add the following paragraph to 15.01B:

“4. The CONTRACTOR shall submit, on a monthly basis, certified payrolls and a Statement of Compliance verifying compliance with the Prevailing Wage Law, C.G.S. Sec. 31-53.”

END OF SECTION

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SECTION 00890

PERMITS

1. General Requirements

- A. The Owner has obtained or will obtain and pay for the permits listed below, which are required for this project. The Contractor shall assist in obtaining certain permits, as indicated. The Contractor shall obtain and pay for all other permits required, as defined under the Permits subsection of Section 00700, GENERAL CONDITIONS.

<u>Permits by Owner</u>	<u>Status</u>
Building Permit	*
Inland Wetlands Commission Order of Conditions	*

*Contractor shall prepare permit application and obtain the permit after contract is awarded, bearing all expenses. Owner will pay for and/or waive the permit application fee, if applicable.

- B. The Contractor shall perform the work in accordance with the Contract Documents, including the attached permits/order of conditions, and any applicable municipal requirements.

2. Inland Wetlands Commission Orders

The Inland Wetlands Commission has issued an Order of Conditions on the work under this contract. This Order is to become a part of the Contract Documents and the Contractor shall perform all work in strict conformance with said Order. A copy can be obtained from the Owner.

END OF SECTION

SECTION 01014

SCOPE AND SEQUENCE OF WORK

PART 1 – GENERAL

1.01 WORK INCLUDED:

- A. The scope of work includes furnishing all labor, materials, equipment, and incidentals to install, test, and make fully operable a new drinking water supply well of 300 gpm capacity to replace Well No. 3 at the Colchester Taintor Hill Road Wellfield in the location shown on the Drawings and as specified herein. The work also includes, but is not limited to, the installation of a submersible well pump in the new well; connecting the new well to the existing raw water main; installation of a precast pump building, flow meter, valves and instrumentation appurtenances; installation of a new Variable Frequency Drive in the new pump building; installation of new power, digital and analog wiring between controls in the existing treatment building and the new precast building and well; and other appurtenant works as required.

1.02 RELATED WORK:

- A. SECTION 01110 – CONTROL OF WORK AND MATERIALS
- B. SECTION 02520 – WATER PRODUCTION WELLS

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.01 GENERAL:

- A. The Contractor shall be responsible for scheduling its activities and the activities of any subcontractors involved, to meet the completion date, or milestones, established for the contract. Scheduling of the work shall be coordinated with the Owner and Engineer.
- B. Prior to the start of work, the Contractor shall prepare and submit to the Owner and the Engineer a project schedule and work plan that describes the proposed work sequence, methods, and timing and duration of the work, including project milestones and all anticipated pump station shutdowns. The schedule and work plan shall be approved by the Owner and Engineer prior to commencement of the work. The Contractor shall not deviate from the approved schedule and work plan without written approval from the Owner.
- C. Pump station shutdowns outside of the approved project schedule and work plan

will not be allowed unless prior approval is obtained from the Owner. Notification requests shall be submitted by the Contractor to the owner in writing a minimum of 14 days prior to the shutdown.

- D. The Owner reserves the right to reject or modify the proposed project schedule and/or work plan based on well operations and maintenance. The Contractor shall have no claim for additional compensation, by reason of delay of inconvenience, for adapting his operations to the needs of the Owner's water supply.

3.02 CONSTRUCTION SEQUENCING REQUIREMENTS:

- A. Work inside the Treatment Building shall be completed concurrently with the construction and testing of the replacement well. The Contractor shall coordinate shutdowns with the Owner.
- B. In general, the work sequence of the replacement well shall be as follows:
 - 1. Establish vertical survey control at the site. Survey shall be performed by a Connecticut Registered Land Surveyor (RLS) and shall include the entire area surrounded by compost filter tubes as shown on the Drawings. The Contractor will be required to provide well as-built drawings with elevations on NAVD88 performed by a Connecticut RLS.
 - 2. Furnish and install erosion and sedimentation controls.
 - 3. A new water supply production well has been constructed by others adjacent to test well TW-2-17 in the location indicated on the Drawings. The exact specifications of the filter pack and screen slot size will be determined by the Engineer after samples of formation material are sieved and proper screen design completed. After construction, the well shall be tested according to Section 02520.
 - 4. The Contractor shall submit pump and motor data to the Engineer for review and approval as specified herein. It is important to note that the Contractor shall not submit the new pump and motor data until the replacement well has been installed, tested, and approved by the Engineer.
 - 5. Furnish and install submersible pump, motor, and pitless well adapter for replacement well.

Concurrent with Items 1-5 above:

- 1. Furnish and install all mechanical piping and appurtenances to connect the replacement well to the existing raw water main.
- 2. Furnish and install electrical, instrumentation, and control system

improvements to connect the new motor to the existing control panel, including the installation of a Variable Frequency Drive (VFD) pump controller and all instrumentation and control wiring integrated as necessary to make fully operable.

Following Completion of Items above:

1. Furnish and install new yard piping and make final electrical, instrumentation, and control connection between the replacement Well and control panel.
2. Startup and testing of all facilities.
3. Painting.
4. Loaming and seeding, site cleanup, removal of erosion and sedimentation controls, etc.

3.03 CONTRACTOR'S USE OF PREMISES:

- A. The Contractor shall limit the use of the premises for the work required under this Contract to allow for Owner occupancy.
- B. The Contractor shall coordinate the use of the premises with the Owner.
- C. The Contractor shall assume full responsibility for all materials and equipment stored at the site and shall move any stored items that interfere with the operations of the Owner upon request of the Owner or Engineer.
- D. If additional storage or work area is required to satisfactorily complete the Work required under this contract, the Contractor shall obtain and pay for such areas at no additional cost to the Owner.

3.04 OWNER OCCUPANCY:

- A. The Owner will occupy the premises during the construction period and will be required to conduct his or her business operations without reasonable interruption. As such, all construction operations shall be coordinated with the Owner and Engineer to minimize potential conflicts.

END OF SECTION

\\wse03.local\WSE\Projects\CT\Colchester CT\Well 3A Replacement - Design Phase\Specifications\01014 Scope and Sequence of Work.doc

SECTION 01110

CONTROL OF WORK AND MATERIALS

PART 1 – GENERAL

Not Used.

PART 2 – PRODUCTS

Not Used

PART 3 - EXECUTION

3.01 HAULING, HANDLING AND STORAGE OF MATERIALS:

- A. The Contractor shall, at its own expense, handle and haul all materials furnished by it and shall remove any of its surplus materials at the completion of the work.
- B. The Contractor shall provide suitable and adequate storage for equipment and materials furnished by it that are liable to injury and shall be responsible for any loss of or damage to any equipment or materials by theft, breakage, or otherwise.
- C. All excavated materials and equipment to be incorporated in the Work shall be placed so as not to injure any part of the Work or existing facilities and so that free access can be had at all times to all parts of the Work and to all public utility installations in the vicinity of the work. Materials and equipment shall be kept neatly piled and compactly stored in such location as will cause a minimum of inconvenience to public travel and adjoining owners, tenants and occupants.
- D. The Contractor shall be responsible for all damages to the work under construction during its progress and until final completion and acceptance even though partial payments have been made under the Contract.

3.02 OPEN EXCAVATIONS:

- A. All open excavations shall be adequately safeguarded by providing temporary barricades, caution signs, lights and other means to prevent accidents to persons, and damage to property. The Contractor shall, at its own expense, provide suitable and safe means for completely covering all open excavations and for accommodating travel when work is not in progress.
- B. Bridges provided for access to private property during construction shall be removed when no longer required.
- C. The length of open trench will be controlled by the particular surrounding conditions but

shall always be confined to the limits prescribed by the Engineer.

- D. If the excavation becomes a hazard, or if it excessively restricts traffic at any point, then special construction procedures shall be taken, such as limiting the length of trench and prohibiting stocking excavated material in the street.
- E. All street excavations shall be completely closed at the end of each work day. Backfilling or use of steel plates of adequate strength to carry traffic shall be used.

3.03 MAINTENANCE OF TRAFFIC:

- A. Unless permission to close the street is received in writing from the proper authority, all excavated materials and equipment shall be placed so that vehicular and pedestrian traffic may be safely maintained at all times.
- B. Should the Chief of Police deem it necessary, uniformed officers will be assigned to direct traffic. The Contractor shall make all arrangements in obtaining uniformed officers required.
- C. The Contractor shall at its own expense, as directed by the Police Traffic Control/Safety Officer, provide and erect acceptable barricades, barrier fences, traffic signs, and all other traffic devices not specifically covered in a bid item, to protect the work from traffic, pedestrians, and animals. It shall provide sufficient temporary lighting such as lanterns/flashers (electric battery operated) or other approved illuminated traffic signs and devices to afford adequate protection to the traveling public, at no additional cost to the Owner.
- D. The Contractor shall furnish all construction signs that are deemed necessary by and in accordance with Part VI of the Manual on Uniform Traffic Control Devices as published by the U.S. Department of Transportation. In addition, the Contractor may be required to furnish up to 128 square feet of additional special construction warning signs. Size and exact wording of signs shall be determined by the Engineer during construction.
- E. The intent of policing is to ensure public safety by direction of traffic. Police officers are not to serve as watchmen to protect the Contractor's equipment and materials.
- F. Nothing contained herein shall be construed as relieving the Contractor of any of its responsibilities for protection of persons and property under the terms of the Contract.

3.04 CARE AND PROTECTION OF PROPERTY:

The Contractor shall be responsible for the preservation of all public and private property and shall use every precaution necessary to prevent damage thereto. If any direct or indirect damage is done to public or private property by or on account of any act, omission, neglect, or misconduct in the execution of the work on the part of the Contractor, such property shall be promptly restored by the Contractor, at its expense, to a condition similar or equal to that existing before the damage was done, to the

satisfaction of the Engineer.

3.05 PROTECTION AND RELOCATION OF EXISTING STRUCTURES AND UTILITIES:

- A. All existing buildings, utilities, pipes, poles, wires fences, curbing, property line markers and other structures which the Engineer decides must be preserved in place without being temporarily or permanently relocated, shall be carefully supported and protected from damage by the contractor. Should such property be damaged, it shall be restored by the Contractor, at no additional cost to the Owner.
- B. The Contractor shall determine the location of all underground structures and utilities (including existing water services, drain lines, electrical lines, and sewers). Services to buildings shall be maintained, and all costs or charges resulting from damage thereto shall be paid by Contractor.
- C. When fences interfere with the Contractor's operations, it shall remove and (unless otherwise specified) promptly restore them.
- D. On paved surfaces the Contractor shall not use or operate tractors, bulldozers, or other power-operated equipment with treads or wheels which are shaped so as to cut or otherwise damage such surfaces.
- E. All property damaged by the Contractor's operations shall be restored to a condition at least equal to that in which it was found immediately before work was begun. Suitable materials and methods shall be used for such restoration.
- F. Restoration of existing property and structures shall be carried out as promptly as practicable and shall not be left until the end of the construction period.

3.06 MAINTENANCE OF FLOW:

- A. The Contractor shall at its own cost, provide for the flow of sewers and drains interrupted during the progress of the work, and shall immediately cart away and dispose of all offensive matter. The entire procedure of maintaining existing flow shall be fully discussed with the Engineer well in advance of the interruption of any flow.
- B. All existing drainage facilities including, but not limited to; brooks, streams, canals, channels, ditches, culverts, catch basins and drainage piping shall be adequately safeguarded so as not to impede drainage or to cause siltation of downstream areas in any manner whatsoever. If the Contractor damages or impairs any of the aforesaid drainage facilities, it shall repair the same within the same day.
- C. At the conclusion of the work, the Contractor shall remove all silt in drainage structures

caused by its operations as described in Section 01740, CLEANING UP.

3.07 REJECTED MATERIALS AND DEFECTIVE WORK:

- A. Materials furnished by the Contractor and condemned by the Engineer as unsuitable or not in conformity with the specifications shall forthwith be removed from the work by the Contractor and shall not be made use of elsewhere in the work.
- B. Any errors, defects or omissions in the execution of the work or in the materials furnished by the Contractor, even though they may have been passed or overlooked or have appeared after the completion of the work, discovered at any time before the final payment is made hereunder, shall be forthwith rectified and made good by and at the expense of the Contractor and in a manner satisfactory to the Engineer.
- C. The Contractor shall reimburse the Owner for any expense, losses or damages incurred in consequence of any defect, error, omission or act of the Contractor or its employees, as determined by the Engineer, occurring previous to the final payment.

3.08 SANITARY REGULATIONS:

Sanitary conveniences for the use of all persons employed on the work, properly screened from public observation, shall be provided in sufficient numbers in such manner and at such locations as may be approved. The contents shall be removed and disposed of in a satisfactory manner as the occasion requires. The Contractor shall rigorously prohibit the committing of nuisances within, on or about the work. Any employees found violating these provisions shall be discharged and not again employed on the work without the written consent of the Engineer. The sanitary conveniences specified above shall be the obligation and responsibility of the Contractor.

3.09 SAFETY AND HEALTH REGULATIONS:

This project is subject to the Safety and Health regulations of the U.S. Department of Labor set forth in 29 CFR, Part 1926, and to the Connecticut Department of Labor Division of Occupational Safety and Health (CONN-OSHA). Contractors shall be familiar with the requirements of these regulations.

3.10 SITE INVESTIGATION:

The Contractor acknowledges that it has satisfied itself as to the conditions existing at the site of the work, the type of equipment required to perform this work, the quality and quantity of the materials furnished insofar as this information is reasonably ascertainable from an inspection of the site, as well as from information presented by the drawings and specifications made a part of this contract. Any failure of the Contractor to acquaint itself with available information will not relieve it from the responsibility for estimating properly the difficulty or cost of successfully performing the work. The Owner assumes no responsibility for any conclusion or interpretation made by the Contractor on the basis

of the information made available by the Owner.

3.11 HANGERS, PADS, AND SUPPORTS:

- A. Unless otherwise indicated, hangers and supports shall be by the trade providing the supported item.
- B. Except where detailed or specified, design of hangers and supports shall be the responsibility of the Contractor. All parts of such hangers or supports shall be designed in accordance with accepted engineering practice, using a factor of safety of at least 2½.
- C. When proprietary hangers, etc., are supplied, satisfactory evidence of the strength of such items shall be furnished.
- D. Hangers for items hung from steel and concrete shall be centered on the vertical center of gravity of the beam.
- E. Locations and sizes of openings, sleeves, concrete pads, steel frames, and other equipment supports are indicated on the drawings for bidding purposes only. Final sizes and locations of such items shall be obtained from the shop drawings.

3.12 SLEEVES, HOLES, HANGERS, INSERTS, ETC.:

- A. Except where holes and openings are dimensioned, and hangers, inserts, and supports are fully called for on the architectural and structural drawings (or reference is made thereon to drawings containing such information) to accommodate mechanical or electrical items, they shall be by the mechanical or electrical trade concerned.
- B. Sleeves, inserts, anchors, etc., supplied under the mechanical and electrical contracts in sufficient time to so permit, shall be set in concrete, masonry, etc., or fastened to steel deck, etc., by the respective architectural or structural trade. Where not supplied in sufficient time, installation of such items shall be the responsibility of the mechanical or electrical trade involved.
- C. Nothing shall be suspended from the steel roof deck and no fastenings made to it, except with the prior permission of the Engineer. Request for permission shall be accompanied by full details of the hanger or fastener, including the weight of the item to be suspended.
- D. Nailers and other wood members attached to steel or masonry, for which fasteners are not indicated on the design drawings or in the specification, shall be fastened with the equivalent of ½-inch diameter bolts at 3 feet o.c.
- E. Openings for mechanical and electrical items in finished areas of the building shall be closed off with near escutcheon plates or similar closures. These closures shall be by the

mechanical or electrical trade involved.

3.13 ROOF PROTECTION:

Where work must be performed over completed roofing, the roofing shall be protected by 2 layers of ½-inch thick plywood, laid with joints in the second layer offset 1/2 sheet width and length from joints in the first layer. No material shall be stored, or work performed on areas of roof which are not so protected.

3.14 WEATHER PROTECTION:

The Contractor shall install weather protection and shall furnish adequate heat in the area so protected during the months of November through March.

3.15 ELECTRIC SERVICE:

- A. The Contractor shall make all necessary applications and arrangements and pay for all fees and charges for electrical energy for power and light necessary for the proper completion of this contract during its entire progress. The Contractor shall provide and pay for all temporary wiring, switches, connections, and meters.
- B. There shall be sufficient electric lighting so that all work may be done in a workmanlike manner where there is not sufficient daylight.

3.16 HAZARDOUS WASTE:

Should the Contractor, while performing work under this contract, uncover hazardous materials, as defined in Connecticut Remediation Standard Regulations, it shall immediately notify the Engineer. The Contractor is not, and has no authority to act as, a handler, generator, operator or disposer of hazardous or toxic substances found or identified at the site, and the Owner shall undertake all such functions.

END OF SECTION

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SECTION 01140

SPECIAL PROVISIONS

PART 1 - GENERAL

Not used

PART 2 - PRODUCTS

Not used

PART 3 - EXECUTION

3.01 WATER FOR CONSTRUCTION PURPOSES:

- A. In locations where water is in sufficient supply, the Contractor may be allowed to use water without charge for jetting backfill and other construction purposes. The express approval of the Owner shall be obtained before water is used. Waste of water by the Contractor shall be sufficient cause for withdrawing the privilege of unrestricted use.
- B. If no water is available, the Contractor shall supply water at no additional cost to the Owner.

3.02 PIPE LOCATION:

Pipe shall be located substantially as indicated on drawings. The Owner reserves the right, acting through the Engineer, to make such modifications as may be deemed desirable to avoid interference with existing structures or for other reasons.

3.03 DIMENSIONS OF EXISTING STRUCTURES:

Where the dimensions and locations of existing structures are of critical importance in the installation or connections of new work, the Contractor shall verify such dimensions and locations in the field before the fabrication of any material or equipment that is dependent on the correctness of such information.

3.04 OCCUPYING PRIVATE PROPERTY:

The Contractor shall not enter upon nor occupy with men, equipment or materials any property outside of the public highways or Owner's easements, except with the written consent of the property owner or property owner's agent.

3.05 EXISTING UTILITY LOCATIONS – CONTRACTOR'S RESPONSIBILITY:

- A. The location of existing underground services and utilities shown on the drawings is

based on available records. It is not warranted that all existing utilities and services are shown, or that shown locations are correct. The Contractor shall be responsible for having the utility companies locate their respective utilities on the ground prior to excavating.

- B. To satisfy the requirements of Connecticut law, the Contractor shall, at least 72 hours, exclusive of Saturdays, Sundays and holidays, prior to excavation in the proximity of telephone, gas, cable television and electric utilities, notify the utilities concerned by calling "CALL BEFORE YOU DIG" at telephone number: 1-800-922-4455.
- C. The Contractor shall coordinate all work involving utilities and shall satisfy it myself as to the existing conditions of the areas in which it is to perform its work. It shall conduct and arrange its work so as not to impede or interfere with the work of other contractors working in the same or adjacent areas.

3.06 COORDINATION OF WORK:

The General Contractor shall be responsible for coordinating its own work as well as that of any subcontractors. He shall be responsible for notification of the Engineer when each phase of work is expected to begin and the approximate completion date.

3.07 TIME FOR COMPLETION OF CONTRACT:

The time for completion of this contract is stipulated in the Form of/for General Bid. The Bidder shall base its bid on completing the proposed work by the completion date stipulated in Section 00410, FORM OF GENERAL BID/FORM FOR GENERAL BID.

3.08 MAINTENANCE OF TRENCH SURFACE:

After backfilling and compacting the trench, the Contractor shall be responsible for keeping the ground surface dry and passable at all times until the surface has been restored to original conditions.

3.09 DESIGN OF EQUIPMENT:

Attention is directed to the fact that the layout of certain equipment is based on that of one manufacturer. If other equipment is submitted for approval, the Contractor shall prepare and submit for approval at its expense, detailed structural, mechanical and electrical drawings, equipment lists, maintenance requirements, and any other data required by the Engineer, showing all necessary changes and embodying all special features of the equipment he proposes to furnish. Such changes, if approved, shall be made at the expense of the Contractor.

3.10 SERVICES OF MANUFACTURER'S REPRESENTATIVE:

- A. The Contractor shall arrange for a qualified service representative, at a time suitable to the Engineer, from the company manufacturing or supplying certain equipment as

indicated on the detailed specifications, to perform the duties described herein.

- B. After installation of the listed equipment has been completed and the equipment is presumably ready for operation, but before others operate it the representative shall inspect, operate, test, and adjust the equipment. The inspection shall include, but shall not be limited to, the following points as applicable:
1. Soundness (without cracks or otherwise damaged parts); completeness in all details, as specified; correctness in setting, alignment, and relative arrangement of various parts; adequacy and correctness of packing, sealing and lubricants.
 2. The operation, testing, and adjustment shall be as required to prove that the equipment is left in proper condition for satisfactory operation under the conditions specified. Where called for in the specifications, vibration readings shall be made and the equipment balanced accordingly.
 3. On completion of its work, the Contractor shall submit in triplicate to the Engineer the manufacturer's or supplier representative's complete signed report of the results of its inspection, operation, adjustments, and test. The report shall include detailed descriptions of the points inspected, tests and adjustments made, quantitative results obtained if such are specified, and suggestions for precautions to be taken to ensure proper maintenance. The report shall also include a certificate that the equipment conforms to the requirements of the contract and is ready for permanent operation and that nothing in the installation will render the manufacturer's warranty null and void.
 4. After the Engineer has reviewed the reports from the manufacturer's representative, the Contractor shall make arrangements to have the manufacturer's representative present when the field acceptance tests are made.

3.11 COMPLIANCE WITH PERMITS:

- A. The Contractor shall perform all work in conformance with requirements of the Permits, which appear in Section 00890 – PERMITS.

3.12 CUTTING, FITTING AND PATCHING:

- A. The Contractor shall do all cutting, fitting, or patching of its work that may be required to make its several parts come together properly and fit it to receive or be received by work of other Contractors, as shown upon or reasonably implied by the drawings and the specifications for the completed structure, including all existing work.
- B. The Contractor shall not endanger any work by cutting, digging, or otherwise and shall not cut or alter the work of any other Contractor, save with the consent of the Engineer.
- C. All holes or openings required to be made in new or existing work, particularly at pipe, conduit, or other penetrations not covered by escutcheons or plates shall be neatly

patched. All such holes shall be made completely watertight as approved by the Engineer.

- D. Size and locations of holes required in steel, concrete, or other structural or finish materials for piping, wiring, ducts, etc., which have not been located and detailed on the drawings shall be approved by the Engineer prior to layout and cutting thereof. All holes shall be suitably reinforced as required by the Engineer.
- E. Workmanship and materials of patching and repair work shall match the adjacent similar work and shall conform to the applicable sections of the specification. Patches and joints with existing work shall provide, as applicable in each case, visual, structural, and waterproofing continuity.

3.13 CONNECTIONS TO EXISTING WATER SYSTEMS:

- A. The Owner will, upon 24-hour notice from the Contractor, assist the Contractor by locating and opening or closing any and all valves required for draining or admitting water to the various sections of the water main as required to perform the proposed work. No damages shall be claimed by the Contractor for delays in dewatering pipelines nor shall any damages be claimed because of water leaking through closed valves after dewatering is completed.
- B. Connections to the existing distribution system shall be made with the mains under pressure unless the lines can be temporarily taken out of service as approved by the Owner.
- C. The Contractor will be required to make test excavations to ascertain that the proposed position of the connections will be clear of joints, fittings, or other obstructions.
- D. If any failure occurs in connection to existing mains, service shall be restored in the shortest possible time, the Contractor working around the clock, if necessary. He shall cooperate with the Owner in notifying the consumers or supplying emergency water. If required by Owner, the Contractor shall make connections to water mains during night hours, on Sunday or at other times of off-peak demand for water.

3.14 PROTECTION OF AQUIFER:

The Contractor's attention is directed to the fact that the construction area is located within the watershed of the existing water supply. The Contractor shall take extra precautions to ensure that no pollutants enter the groundwater table from the construction area. The Contractor shall not store fuels or other hazardous materials or potential contaminants on the construction site. In the event of a spill, the Contractor shall immediately notify the Engineer.

3.15 CONTRACTOR'S REPRESENTATIVE:

The Contractor shall designate a representative who will be available to respond to

emergency calls by the Owner at any time day and night and on weekends and holidays should such a situation arise.

3.16 OPERATOR TRAINING:

A trained representative of the manufacturer of all equipment shall instruct the plant operating personnel on the operation and maintenance of the equipment. The Owner reserves the right to videotape all training sessions.

3.17 HOURS OF CONSTRUCTION ACTIVITY:

- A. The Contractor shall conduct all construction activity between 7:00 a.m. and 5:00 p.m., Monday through Friday. No construction work shall be allowed on Saturdays, Sundays or Holidays without written authorization from the Owner.
- B. The Owner will provide personnel for assistance in locating and operating valves at no cost to the Contractor during the Owner's normal working hours (**Monday through Friday 7:00 a.m. to 3:00 p.m.**). When this assistance is required by the Contractor outside of the Owner's normal working hours the cost will be incurred by the Contractor at the prevailing overtime rate of pay for the personnel providing the assistance. The Owner will bill the Contractor directly.

3.18 CONSTRUCTION CREWS:

The Contractor shall not increase the number of construction crews assigned to the work without providing one-week advance notice to the Engineer.

3.19 WINTER WORK:

The Owner will allow the Contractor to work within the public ways on this Project during the winter months.

The Contractor will be required to backfill all excavations at the end of each work day, or place Jersey barriers around open excavations.

The Owner has agreed to provide snow removal services on all public ways affected by this Project. The Owner will not remove snow from the Contractor's work area that the public will not be using for either driving or pedestrian activity.

The Contractor will provide snow removal services on any public way affected by its work that has been authorized by the Owner to be closed to through traffic. Snow will be plowed in accordance with the Owner's normal plowing schedule for the closed public ways.

In no event will the Owner remove snow on any private way affected by the Contractor's work on this Project. The Contractor may coordinate snow removal activities with whoever provides these services for the owners of the private way(s).

END OF SECTION

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SECTION 01270

MEASUREMENT AND PAYMENT

1. GENERAL

- A. The following sections describe the measurement and payment for the work to be done under the respective items listed in the FORM OF GENERAL BID.
- B. The lump sum price stated in the FORM OF GENERAL BID shall constitute full compensation as herein specified, for all of the work completed in accordance with the drawings and specifications. All other activities required in connection with performance of the work, including all work required under Division 1, GENERAL REQUIREMENTS, whether described in the contract documents or mandated by applicable codes, permits and laws, will not be separately paid for unless specifically provided for in the form of general bid, but will be considered to be incidental to performance of the overall project.

2. ITEM 1

The lump sum price for Item 1 shall constitute full compensation for furnishing all labor, materials, tools and equipment and constructing the project, complete, as shown on the drawings and called for in the specifications.

END OF SECTION

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SECTION 01329

SUBMITTAL OF OPERATION AND MAINTENANCE MANUALS

PART 1 - GENERAL

1.01 OPERATION AND MAINTENANCE MANUALS:

- A. As required by the General Conditions, and Section 01760 OPERATION AND MAINTENANCE MANUALS and Technical Specifications, the Contractor shall submit a schedule of Operation and Maintenance Manuals.
- B. In accordance with the schedule, the Contractor shall submit promptly to the Engineer, through its authorized resident representative at the job site, or by mail, attention: CSD, four (4) copies each of Operation and Maintenance Manual required as noted in the technical specifications sections for this Contract.
- C. The manuals shall be prepared in accordance with Specification Section 01760 - OPERATION AND MAINTENANCE MANUALS.
- D. Such manuals shall show the principal dimensions, weight, structural and operating features, space required, clearances, type and/or brand of finish or shop coat, grease fittings, etc., depending on the subject of the drawings.
- E. All manuals shall be submitted to the Engineer by and/or through the Contractor, who shall be responsible for obtaining manuals from his subcontractors and returning reviewed manuals to them. A Weston & Sampson standard shop drawing transmittal form with a description of the manual shall accompany each shipment of manuals.
- F. The Contractor shall be responsible for the prompt submittal and resubmittal, as necessary, of all manuals so that there will be no delay in the startup operation of the facility due to the absence of such manuals.
- G. The Engineer will review the manuals as to their general conformance with the design concept of the project and general compliance with the information given in the Contract Documents. Corrections of comments made in the manuals during the review does not relieve the Contractor from compliance with requirements of the Contract Documents.
- H. With few exceptions, O&M Manuals will be reviewed and returned to the Contractor within 30 days of submittal.

1.02 RELATED WORK:

- A. Section 01330 SUBMITTALS
- B. Section 01760 OPERATION AND MAINTENANCE MANUALS

C. Section 01770 PROJECT CLOSEOUT

1.03 SUBMITTAL OF OPERATION AND MAINTENANCE MANUALS AND SPARE PARTS LISTS:

- A. Where reference is made in technical specification sections to operating and maintenance manuals and/or spare parts lists, the Contractor shall submit four copies to the Engineer for review in accordance with the following instructions:
1. Four complete sets of operation and maintenance instructions covering all equipment furnished under Sections 11, 13, 14, 15 and 16 requiring operation and maintenance manuals shall be delivered directly to Weston & Sampson Engineers, Inc, Five Centennial Drive, Peabody, MA 01960, Attention: CSD.
 2. Submission and approval of each set of manuals is considered an integral part of furnishing and installing respective equipment or systems. Measurement for payment of equipment requiring an operation and maintenance manual will not exceed 92 percent, until the manuals meet the requirements of the contract documents.
 3. Submit four copies of first draft volumes as required in Specification Sections 01329 and 01760. This first draft shall contain all currently available product data. One copy will be returned with comments.
 4. Submit four copies of completed second draft volumes in final form 90 days prior to startup and after Physical checkout to include the additional requirements set forth in paragraph 1.07.R of Section 01760 OPERATION AND MAINTENANCE MANUALS.
 5. Submit four copies of the Final Operation and Maintenance Manuals as required in Section 01770 PROJECT CLOSEOUT.
- B. If the submittal is complete and does not require any changes, an acknowledgement (copy of transmittal) will be returned noting status. If the submittal is incomplete or does require changes, corrections, additions, etc., one copy of the submittal will be returned with a copy of transmittal noting status.
- C. For systems requiring field adjustment and balancing, such as heating and ventilating, the Contractor shall submit separate test results and adjustment data on completion of the work, to be incorporated into the system manual.
- D. The information included in the manual shall be as described in the individual specification sections, but as a minimum shall contain clear and concise instructions for operating, adjusting, lubricating and maintaining the equipment, an exploded assembly drawing, identifying each part by number and a listing of all parts of the equipment, with part

numbers and descriptions required for ordering spare parts. Spare parts lists shall include recommended quantity and price.

PART 2 – PRODUCTS

Not used.

PART 3 – EXECUTION

Not used

END OF SECTION

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SECTION 01330

SUBMITTALS

PART 1 - GENERAL

1.01 WORK INCLUDED:

- A. The Contractor shall provide the Engineer with submittals as required by the contract documents.

1.02 RELATED WORK:

- A. Divisions 1 – 16 of these specifications that require submittals.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

3.01 GENERAL:

- A. As required by the General Conditions, Contractor shall submit a schedule of shop and working drawing submittals.
- B. The Contractor shall submit the shop and working drawing submittals either electronically or hard copy.

3.02 ELECTRONIC SUBMITTALS:

- A. In accordance with the accepted schedule, the Contractor shall submit promptly to the Engineer by email (davida@wseinc.com) or on Compact Disc (mail to Weston & Sampson Engineers, attention: CSD), one electronic copy in Portable Document Format (PDF) of shop or working drawings required as noted in the specifications, of equipment, structural details and materials fabricated especially for this Contract.
- B. Each electronic copy of the shop or working drawing shall be accompanied by the Engineer's standard shop drawing transmittal form, included as Exhibit 1 of this section (use only for electronic submittals), on which is a list of the drawings, descriptions and numbers and the names of the Owner, Project, Contractor and building, equipment or structure.
- C. The Contractor shall receive a shop drawing memorandum with the Engineer's approval or comments via email.

3.03 HARD COPY SUBMITTALS:

- A. In accordance with the accepted schedule, the Contractor shall submit promptly to the Engineer, by mail (to Weston & Sampson Engineers, attention: CSD), six (6) copies each of shop or working drawings required as noted in the specifications, of equipment, structural details and materials fabricated especially for this Contract.
- B. Each shipment of drawings shall be accompanied by the Engineer's (if applicable) standard shop drawing transmittal form on which is a list of the drawings, descriptions and numbers and the names of the Owner, Project, Contractor and building, equipment or structure.

3.04 SHOP AND WORKING DRAWINGS:

- A. Shop and working drawings shall show the principal dimensions, weight, structural and operating features, space required, clearances, type and/or brand of finish of shop coat, grease fittings, etc., depending on the subject of the drawings. When it is customary to do so, when the dimensions are of particular importance, or when so specified, the drawings shall be certified by the manufacturer or fabricator as correct for this Contract.
- B. All shop and working drawings shall be submitted to the Engineer by and/or through the Contractor, who shall be responsible for obtaining shop and working drawings from his subcontractors and returning reviewed drawings to them. All shop and working drawings shall be prepared on standard size, 24-inch by 36-inch sheets, except those, which are made by changing existing standard shop or working drawings. All drawings shall be clearly marked with the names of the Owner, Project, Contractor and building, equipment or structure to which the drawing applies, and shall be suitably numbered. Each shipment of drawings shall be accompanied by the Engineer's (if applicable) standard shop drawing transmittal form on which is a list of the drawings, descriptions and numbers and the names mentioned above.
- C. Only drawings that have been prepared, checked and corrected by the fabricator should be submitted to the Contractor by his subcontractors and vendors. Prior to submitting drawings to the Engineer, the Contractor shall check thoroughly all such drawings to satisfy himself that the subject matter thereof conforms to the Contract Documents in all respects. Shop drawings shall be reviewed and marked with the date, checker's name and indication of the Contractor's approval, and only then shall be submitted to the Engineer. Shop drawings unsatisfactory to the Contractor shall be returned directly to their source for correction, without submittal to the Engineer. Shop drawings submitted to the Engineer without the Contractor's approval stamp and signature will be rejected. Any deviation from the Contract Documents indicated on the shop drawings must be identified on the drawings and in a separate submittal to the Engineer, as required under subsection 6.17 Shop Drawings and Samples; D. Submittal Procedures, Paragraph 3 of the 1996 General Conditions.
- D. The Contractor shall be responsible for the prompt submittal and resubmittal, as necessary, of all shop and working drawings so that there will be no delay in the work due to the absence of such drawings.

- E. The Engineer will review the shop and working drawings as to their general conformance with the design concept of the project and general compliance with the information given in the Contract Documents. Corrections of comments made on the drawings during the review do not relieve the Contractor from compliance with requirements of the Contract Documents. The Contractor is responsible for: confirming and correlating all quantities and dimensions; selecting fabrication processes and techniques of construction; coordinating his work with that of all other trades; and performing his work in a safe and satisfactory manner. The review of the shop drawings is general and shall not relieve the Contractor of the responsibility for details of design, dimensions, code compliance, etc., necessary for interfacing with other components, proper fitting and construction of the work required by the Contract and for achieving the specified performance. The Engineer will review submittals two times: once upon original submission and a second time if the Engineer requires a revision or corrections. The Contractor shall reimburse the Owner amounts charged to the Owner by the Engineer for performing any review of a submittal for the third time or greater.
- F. With few exceptions, shop drawings will be reviewed and returned to the Contractor within 30 days of submittal.
- G. No material or equipment shall be purchased or fabricated especially for this Contract nor shall the Contractor proceed with any portion of the work, the design and details of which are dependent upon the design and details of equipment or other features for which review is required, until the required shop and working drawings have been submitted and reviewed by the Engineer as to their general conformance and compliance with the project and its Contract Documents. All materials and work involved in the construction shall then be as represented by said drawings.
- H. Two copies of the shop and working drawings and/or catalog cuts will be returned to the Contractor. The Contractor shall furnish additional copies of such drawings or catalog cuts when he needs more than two copies or when so requested.

3.05 SAMPLES:

- A. Samples specified in individual Sections include, but are not necessarily limited to, physical examples of the work such as sections of manufactured or fabricated work, small cuts or containers of materials, complete units of repetitively-used products, color/texture/pattern swatches and range sets, specimens for coordination of visual effect, graphic symbols, and units of work to be used by the Engineer or Owner for independent inspection and testing, as applicable to the work.
- B. The number of samples submitted shall be as specified. Submittal and processing of samples shall follow the procedures outlined for shop and working drawings unless the specifications call for a field submittal or mock-up.
- C. Acceptance of samples will be acknowledged via a copy of the transmittal noting status. When samples are not acceptable, prompt resubmittal will be required.

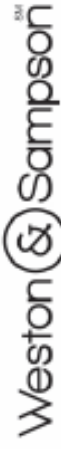
3.06 OPERATING AND MAINTENANCE MANUALS AND SPARE PARTS LISTS:

- A. Where reference is made in technical specification sections to operating and maintenance manuals and/or spare parts lists, the Contractor shall submit four copies to the Engineer for review in accordance with the instructions furnished under "Shop and Working Drawings." If the submittal is complete and does not require any changes, an acknowledgement (copy of transmittal) will be returned noting status. If the submittal is incomplete or does require changes, corrections, additions, etc., two copies of the submittal will be returned with a copy of transmittal noting status. Four copies of the final operating and maintenance manuals and/or spare parts list shall be delivered to the Engineer prior to or with the equipment when it is delivered to the job site. For systems requiring field adjustment and balancing, such as heating and ventilating, the Contractor shall submit separate test results and adjustment data on completion of the work, to be incorporated into the system manual.
- B. The information included in the manual shall be as described in the specification sections, but as a minimum shall contain clear and concise instructions for operating, adjusting, lubricating and maintaining the equipment, an exploded assembly drawing identifying each part by number and a listing of all parts of the equipment, with part numbers and descriptions required for ordering spare parts. Spare parts lists shall include recommended quantity and price.
- C. Operating and maintenance manuals shall be in durable loose-leaf binders, on 8½-inch by 11-inch paper, with diagrams and illustrations either on 8½-inch by 11 inch or multiple foldouts. The instructions shall be annotated to indicate only the specific equipment furnished. Reference to other sizes or models of similar requirement shall be deleted or neatly lined out.

END OF SECTION

EXHIBIT 1 TO SECTION 01330 SUBMITTALS
SHOP DRAWING TRANSMITTAL FORM

Shop Drawing Transmittal



Instruction for Preparing Transmittal

No action will be taken on any item unless accompanied by this form.
 TRANSMITTAL NOS. to be consecutive (1, 2, 3, etc.).
 Each resubmittal of same item shall use same number with suffix letter (A, B, etc.).
 SPEC. SECT. NO: Only one spec. section no. to each transmittal.
 DESCRIPTION: Complete identification of document or group of documents.
 SOURCE: Originator of document(s) being submitted.

DRAWING NO: Identification of document(s).
 CONTRACT DRAWING REFERENCE: Contract drawing number(s) showing details of document(s).
 SPECIAL INSTRUCTIONS: Special cases and emergencies, changes in distribution and special handling requests, etc. should be entered here.
 SIGNATURE OF CONTRACTOR: Signature of individual who reviews and approves material prior to submittal to engineer.

THIS SECTION TO BE COMPLETED BY CONTRACTOR

TRANSM. NO.	SPEC. SECT. NO.	DATE	CONTRACTORS JOB NO.	W&S JOB NO.
PROJECT NAME & CONTRACT NO.				
LOCATION				

Attention: CSD (David@wseinc.com)
 Weston & Sampson Engineers, Inc.
 5 Centennial Drive
 Peabody, MA 01960-7985

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ITEM NO.	DESCRIPTION	SOURCE	DRAWING NO. CATALOG NO. BROCHURE, ETC	NO. OF COPIES	CONTRACT DRAWING REF.	By W&S	
						ACTION CODE	REVIEWED BY
1							
2							
3							
4							

THIS CERTIFIES THAT ALL ITEMS SUBMITTED HEREWITH HAVE BEEN CHECKED BY THE CONTRACTOR, ARE IN CONFORMANCE WITH THE REQUIREMENTS OF THE CONTRACT DOCUMENTS, EXCEPT AS NOTED, AND ARE APPROVED BY THE CONTRACTOR FOR THIS PROJECT.

SIGNATURE & TITLE

THIS SECTION TO BE COMPLETED BY WESTON & SAMPSON

ACTION CODE:

- NO EXCEPTIONS TAKEN
- MAKE CORRECTIONS NOTED
- AMEND AND RESUBMIT
- REJECTED-SEE REMARKS
- ACKNOWLEDGEMENT
- SUBMITTAL NOT REQUIRED, RETURNED WITHOUT REVIEW

- INSTALLATION SHALL PROCEED ONLY WHEN ACTION CODE IS 1 OR 2
- ACTION CODED 3 SHALL BE RESUBMITTED WITHIN TIME LIMIT SET IN CONTRACT
- REVIEW DOES NOT RELIEVE CONTRACTOR FROM RESPONSIBILITY OF COMPLIANCE WITH ALL REQUIREMENTS OF THE CONTRACT DOCUMENTS

Weston & Sampson

SECTION 01570

ENVIRONMENTAL PROTECTION

PART 1 – GENERAL

1.01 DESCRIPTION:

- A. The work covered by this section of the specifications consists of furnishing all labor, materials, tools and equipment and performing all work required for the prevention of environmental pollution during and as a result of construction operations under this contract.
- B. The requirements set forth in this section of the specifications apply to cross-country areas, river and stream crossings, and construction in and adjacent to wetlands, unless otherwise specifically stated.
- C. All work under this Contract shall be in accordance with the requirements of the Inland Wetlands and Water Course Commission and any conditional requirements applied, all of which are attached to Section 00890, PERMITS.
- D. Prior to commencement of work, the Contractor shall meet with representatives of the Engineer to develop mutual understandings relative to compliance of the environmental protection program.

1.02 RELATED WORK:

- A. Section 00890, PERMITS
- B. Section 01330, SUBMITTALS
- C. Section 02230, CLEARING AND GRUBBING
- D. Section 02240, DEWATERING
- E. Section 02252, SUPPORT OF EXCAVATION
- F. Section 02300, EARTHWORK

1.03 SUBMITTALS:

- A. The Contractor shall submit for approval six sets of details and literature fully describing environmental protection methods to be employed in carrying out construction activities within 100 feet of wetlands or across areas designated as wetlands.

PART 2 - PRODUCTS

2.01 SILT FENCE:

- A. The silt fence shall consist of a 3-foot wide continuous length sediment control fabric, stitched to a mesh backing, and stapled to preweathered oak posts installed as shown on the drawings. The oak posts shall be 1-1/4-inches by 1-1/4-inches (Minimum Dimension) by 48-inches and shall be tapered. The bottom edge of the silt fence shall be buried as shown on the drawings.
- B. The silt fence shall be DOT Silt Fence PPDM3611, as manufactured by U.S. Silt & Site Supply/Getsco, Concord, NH, or approved equal.
- C. Silt fence properties:

<u>Physical Properties</u>	<u>Test Method</u>	<u>Minimum Value</u>
Grab Strength, lbs.	ASTM-D-4632	124
Grab Elongation, %	ASTM-D-4632	15
Mullen burst, psi	ASTM-D-3786	300
Puncture, lbs.	ASTM-D-4833	65
Trapezoidal Tear, lbs.	ASTM-D-4833	65
UV Resistance ² , % ³	ASTM-D-4355	80@500 hrs.
AOS, US Sieve No.	ASTM-D-4751	30
Flow Rate, gal/min/sq ft	ASTM-D-4491	10
Permittivity, (1/sec) gal/min/sq ft	ASTM-D-4491	0.05 sec ⁻¹

2.02 STRAW BALES:

- A. Straw bales shall consist of certified seed free stems of agricultural grain and cereal crops and shall be free of grasses and legumes. Standard bales shall be 14-inches high, 18- inches wide and 36- to 40-inches long tied with polypropylene twine and weigh within 5 percent of 7 lbs. per cubic ft.

2.03 STRAW WATTLES:

- A. Straw Wattles shall consist of a 100% biodegradable exterior jute or coir netting with 100% wheat straw interior filling as manufactured by Granite Environmental, Inc., Sebastian, Florida (Phone: 888-703-9889; website: www.GraniteEnvironmental.com) or approved equal.

2.04 SILT CURTAIN:

- A. The silt curtain shall be a Type-1-Silt-Barrier consisting of 18-ounce vinyl fabric skirt with a 6-inch marine quality floatation device. The skirt shall be ballasted to hang vertical in the water column by a minimum 3/16-inch galvanized chain. The silt curtain shall extend into the water as shown on the drawings. If necessary, join adjacent ends

of the silt curtain by connecting the reinforcing grommets and shackling ballast lines.

PART 3- EXECUTION

3.01 NOTIFICATION AND STOPPAGE OF WORK:

The Engineer will notify the Contractor in writing of any non-compliance with the requirements of the Inland Wetlands and Water Course Commission. The Contractor shall, after receipt of such notice, immediately take corrective action. Such notice, when delivered to the Contractor or his authorized representative at the site of the work, shall be deemed sufficient for the purpose. If the Contractor fails to act promptly, the Owner may order stoppage of all or part of the work through the Engineer until satisfactory corrective action has been taken. No claim for an extension of time or for excess costs or damage incurred by the Contractor as a result of time lost due to any stop work orders shall be made unless it was later determined that the Contractor was in compliance.

3.02 AREA OF CONSTRUCTION ACTIVITY:

- A. Insofar as possible, the Contractor shall confine his construction activities to those areas defined by the plans and specifications. All land resources within the project boundaries and outside the limits of permanent work performed under this contract shall be preserved in their present condition or be restored to a condition after completion of construction at least equal to that which existed prior to work under this contract.

3.03 PROTECTION OF WATER RESOURCES:

- A. The Contractor shall not pollute streams, lakes or reservoirs with fuels, oils, bitumens, calcium chloride, acids or other harmful materials. It is the Contractor's responsibility to comply with all applicable Federal, State, County and Municipal laws regarding pollution of rivers and streams.
- B. Special measures should be taken to insure against spillage of any pollutants into public waters.

3.04 CONSTRUCTION IN AREAS DESIGNATED AS WETLANDS ON THE DRAWINGS:

- A. Insofar as possible, the Contractor shall make every effort to minimize disturbance within areas designated as wetlands. Total easement widths shall be limited to the widths shown.
- B. The Contractor shall perform his work in such a way that these areas are left in the condition existing prior to construction.
- C. The elevations of areas designated as wetlands shall not be unduly disturbed by the Contractor's operations outside of the trench limits. If such disturbance does occur, the Contractor shall take all measures necessary to return these areas to the elevations

which existed prior to construction.

- D. In areas designated as wetlands, the Contractor shall carefully remove and stockpile the top 24 inches of soil. This topsoil material shall be used as backfill for the trench excavation top layer. The elevation of the trench shall be restored to the preconstruction elevations wherever disturbed by the Contractor's operation.
- E. The Contractor shall use a trench box, sheeting or bracing to support the excavation in areas designated as wetlands.
- F. Excavated materials shall not be permanently placed or temporarily stored in areas designated as wetlands. Temporary storage areas for excavated material shall be as required by the Engineer.
- G. The use of a temporary gravel roadway to construct the pipeline in the wetlands area is not acceptable. The Contractor will be required to utilize timber or rubber matting to support his equipment in these areas. The timber or rubber matting shall be constructed in such a way that it is capable of supporting all equipment necessary to install the pipeline. The timber or rubber matting shall be constructed of materials and placed in such a way that when removed the material below the matting will not be unduly disturbed, mixed or compacted so as to adversely affect recovery of the existing plant life.
- H. Bentonite dams shall be placed in wetlands to prevent drainage. Locations for dams are as indicated on the drawings or as required by the Engineer.
- I. During construction, easements within wetlands shall be lined with a continuous straw bale/siltation fence barrier or line of straw wattles (aka compost filter tube, silt/filter sock).

3.05 PROTECTING AND MINIMIZING EXPOSED AREAS:

- A. The Contractor shall limit the area of land which is exposed and free from vegetation during construction. In areas where the period of exposure will be greater than two (2) months, temporary vegetation, mulching or other protective measures shall be provided as specified.
- B. The Contractor shall take account of the conditions of the soil where temporary cover crop will be used to insure materials used for temporary vegetation are adaptive to the sediment control. Materials to be used for temporary vegetation shall be approved by the Engineer.

3.06 LOCATION OF STORAGE AREAS:

- A. The location of the Contractor's storage areas for equipment and/or materials shall be upon cleared portions of the job site or areas to be cleared as a part of this project and shall require written approval of the Engineer. Plans showing storage facilities for equipment and materials shall be submitted for approval of the Engineer.

- B. No excavated materials or materials used in backfill operations shall be deposited within a minimum distance of one hundred (100) feet of any watercourse or any drainage facility. Adequate measures for erosion and sediment control such as the placement of baled straw around the downstream perimeter of stockpiles shall be employed to protect any downstream areas from siltation.
- C. There shall be no storage of equipment or materials in areas designated as wetlands.
- D. The Engineer may designate a particular area or areas where the Contractor may store materials used in his operations.
- E. Storage areas in cross-country locations shall be restored to pre-construction conditions with the planting of native species of trees and shrubs.

3.07 PROTECTION OF LANDSCAPE:

- A. The Contractor shall not deface, injure, or destroy trees or shrubs nor remove or cut them without written authority from the Owner. No ropes, cables, or guys shall be fastened to or attached to any existing nearby trees for anchorages unless specifically authorized by the Engineer. Excavating machinery and cranes shall be of suitable type and be operated with care to prevent injury to trees which are not to be removed, particularly overhanging branches and limbs. The Contractor shall, in any event, be responsible for any damage resulting from such use.
- B. Branches, limbs, and roots shall not be cut except by permission of the Engineer. All cutting shall be smoothly and neatly done without splitting or crushing. When there is unavoidable injury to branches, limbs and trunks of trees, the injured portions shall be neatly trimmed and covered with an application of grafting wax or tree healing paint as directed.
- C. Where, in the opinion of the Engineer, trees may possibly be defaced, bruised, injured, or otherwise damaged by the Contractor's equipment or by his blasting or other operations, the Engineer may require the Contractor to adequately protect such trees by placing boards, planks, poles or fencing around them. Any trees or landscape feature scarred or damaged by the Contractor's equipment or operations shall be restored as nearly as possible to its original condition at the expense of the Contractor. The Engineer will decide what method of restoration shall be used, and whether damaged trees shall be treated and healed or removed and disposed of under the provisions of Section 02230, CLEARING AND GRUBBING.
- D. Cultivated hedges, shrubs, and plants which could be injured by the Contractor's operations shall be protected by suitable means or shall be dug up, balled and temporarily replanted and maintained. After construction operations have been substantially completed, they shall be replanted in their original positions and cared for until growth is re-established. If cultivated hedges, shrubs, and plants are injured to such a degree as to affect their growth or diminish their beauty or usefulness, they shall be replaced by items of a kind and quality at least equal to that existing at the start of

the work.

3.08 DISCHARGE OF DEWATERING OPERATIONS:

- A. Any water that is pumped and discharged from the trench and/or excavation as part of the Contractor's water handling shall be filtered by an approved method prior to its discharge into a receiving water or drainage system.
- B. Under no circumstances shall the Contractor discharge water to the areas designated as wetlands. When constructing in a wetlands area, the Contractor shall discharge water from dewatering operations directly to the nearest drainage system, stream, or waterway after filtering by an approved method.
- C. The pumped water shall be filtered through filter fabric and baled hay/ straw, a vegetative filter strip or a vegetated channel to trap sediment occurring as a result of the construction operations. The vegetated channel shall be constructed such that the discharge flow rate shall not exceed a velocity of more than 1 foot per second. Accumulated sediment shall be cleared from the channel periodically.

3.09 DUST CONTROL:

- A. During the progress of the work, the Contractor shall conduct his operations and maintain the area of his activities, including sweeping and sprinkling of streets as necessary, to minimize creation and dispersion of dust. If the Engineer decides it is necessary to use calcium chloride for more effective dust control, the Contractor shall furnish and spread the material, as directed.
- B. Calcium Chloride shall not be used for dust control within a drainage basin or in the vicinity of any source of potable water.

3.10 SEPARATION AND REPLACEMENT OF TOPSOIL:

- A. Topsoil shall be carefully removed from cross-country areas where excavations are to be made, and separately stored to be used again as required. The topsoil shall be stored in an area acceptable to the Engineer and adequate measures shall be employed to prevent erosion of said material.

3.11 BALED HAY OR STRAW:

- A. To trap sediment and to prevent sediment from clogging drainage systems, baled hay or straw shall be used where shown on the drawings. Care shall be taken to keep the bales from breaking apart. The bales should be securely staked to prevent overturning, flotation, or displacement. All deposited sediment shall be removed periodically. Hay bales shall not be placed within a waterway during construction of the pipeline crossing.

3.12 ERECTION AND MAINTENANCE OF SILT FENCE:

- A. Where indicated on the drawings or where required by the Engineer, the Contractor shall erect and maintain a temporary silt fence. In areas designated as wetlands, the Contractor shall line the limits of the construction easement with a silt fence. The silt fence shall be used specifically to contain sediment from runoff water and to minimize environmental damage caused by construction.

3.13 SURFACE RESTORATION OF CROSS-COUNTRY AREAS:

- A. Planting shall be conducted when construction of the pipeline has been completed within the areas designated. A one-year guarantee of maintenance will be required on these plantings to ensure that they establish in the area.

3.14 CATCH BASIN PROTECTION:

- A. Catch basin protection shall be used for every catch basin, shown on the plans or as required by the Engineer, to trap sediment and prevent it from clogging drainage systems and entering wetlands. Siltation fabric shall be securely installed under the catch basin grate. Care shall be taken to keep the siltation fabric from breaking apart or clogging. All deposited sediment shall be removed periodically and at times prior to predicted precipitation to allow free drainage flow. Prior to working in areas where catch basins are to be protected, each catch basin sump shall be cleaned of all debris and protected. The Contractor shall properly dispose of all debris at no additional cost to the Owner.

3.15 STRAW WATTLES:

- A. The wattles will be placed in a shallow trench (2-3 inches deep) and staked in the ground using wooden stakes driven at 4-foot intervals. The wooden stakes will be placed at a minimum depth of 24-inches into the ground.

END OF SECTION

SECTION 01735

CUTTING, CORING AND PATCHING

PART 1 - GENERAL

1.01 WORK INCLUDED:

This Section covers the cutting, coring, rough and finish patching of holes and openings in existing structures.

1.02 RELATED WORK:

A. SECTION 03302 FIELD CONCRETE

PART 2 - PRODUCTS

2.01 SEALING MATERIALS:

- A. Mechanical seals shall be modular, adjustable, bolted, mechanical type consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe and sleeve. The seal shall be rated by the manufacturer for 40 feet of head or 20 psig. Mechanical seals shall be Link-Seal, manufactured by Thunderline Corp., Wayne, MI., or approved equal.
- B. Sealant shall be a two-part foamed silicone elastomer as manufactured by Dow Corning Co., product No. 3-6548 silicone R.T.V.; 3M brand fire barrier products caulk C.P. 25 and 3M brand putty 303; Flame-Safe fire stop systems Fig. No. FS-500 by Thomas & Betts Corporation, or approved equal. Packing shall be a fire-retardant pliable material, Fig. 310 by Sealtite Co.; White Oakum W.S.-600 by American Manufacturing Co., or approved equal. Sealant bead configuration, depth and width shall be in accordance with manufacturer's recommendations.

2.02 MISCELLANEOUS MATERIALS:

- A. Bonding compound shall be Sikadur Hi-Mod epoxy by Sika Corporation, or equivalent by Euclid Chemical Corporation, Master Builders Company, or approved equal.
- B. Non-shrink grout shall be Masterflow 713 by Master Builders Company; Euco N-S by Euclid Chemical Co.; Five Star Grout by U.S. Grout Corp. or approved equal.
- C. Materials for finish patching shall be equal to those of adjacent construction.

PART 3 - EXECUTION

3.01 GENERAL:

- A. The Contractor shall leave all chases or openings for the installation of his own or any other contractor's or subcontractor's work, or shall cut the same in existing work, and shall see that all sleeves or forms are at the work and properly set in ample time to prevent delays. He shall see that all such chases, openings, and sleeves are located accurately and are of proper size and shape and shall consult with the Engineer and the contractors and subcontractors concerned in reference to this work.
- B. In case of his failure to leave or cut all such openings or have all such sleeves provided and set in proper time, Contractor shall cut them or set them afterwards at his own expense, but in so doing he shall confine the cutting to the smallest extent possible consistent with the work to be done. In no case shall piers or structural members be cut without the written consent of the Engineer.
- C. The Contractor shall not cut or alter the work of any subcontractor or any other contractor, nor permit any of his subcontractors to cut or alter the work of any other contractor or subcontractor, except with the written consent of the contractor or subcontractor whose work is to be cut or altered or with the written consent of the Engineer. All cutting and patching or repairing made necessary by the negligence, carelessness, or incompetence of the Contractor or any of his subcontractors shall be done by or at the expense of the Contractor and shall be the responsibility of the Contractor.
- D. All cutting and coring shall be performed in such a manner as to limit the extent of patching.
- E. All holes cut through concrete and masonry walls, slabs or arches shall be core drilled unless otherwise approved. No structural members shall be cut without the approval of the Engineer and all such cutting shall be done in a manner required by him. No holes may be drilled in beams or other structural members without obtaining prior approval. All work shall be performed by mechanics skilled in this type of work.

3.02 CORING:

- A. Coring shall be performed with an approved non-impact rotary tool with diamond core drills. Size of holes shall be suitable for pipe, conduit, sleeves, equipment or mechanical seals to be installed.
- B. If holes are cored through floor slabs they shall be drilled from below.
- C. All equipment shall conform to OSHA standards and specifications pertaining to plugs, noise and fume pollution, wiring and maintenance.
- D. Provide protection for existing equipment, utilities and critical areas against water or other damage caused by drilling operation.

- E. Slurry or tailings resulting from coring operations shall be vacuumed or otherwise removed from the area following drilling.

3.03 CUTTING:

- A. Cutting shall be performed with a concrete saw and diamond saw blades of proper size and application.
- B. Provide for control of slurry generated by sawing operation on both sides of wall or slab.
- C. When cutting a reinforced concrete wall, the cutting shall be done so as not to damage bond between the concrete and reinforcing steel left in the structure. Cut shall be made so that steel neither protrudes nor is recessed from the face of the cut.
- D. Adequate bracing of area to be cut shall be installed prior to start of cutting. Check area during sawing operations for partial cracking and provide additional bracing as required to prevent a partial release of cut area during sawing operations.
- E. Provide equipment of adequate size to remove cut panel.
- F. For cutting a trench in a floor slab, a full-depth cut shall be made using a concrete saw for the desired width of the trench. A partial-depth cut shall be made to expose the reinforcing bars. The width of the partial cut shall be to the required lap length of the reinforcing bars. Care shall be taken not to cut exposed reinforcing bars but if any are cut, dowel holes shall be drilled and dowels epoxied in. Reinforcing of the same size, as the existing shall be tied to the existing exposed reinforcing and/or dowels with the proper lap length.

3.04 PATCHING:

Rough patching shall be such as to bring the cut or cored area flush with existing construction unless otherwise shown. Finish patching shall match existing surfaces as approved.

Trenches in floor slabs shall be repaired as described in 3.03F above and concrete meeting the requirements of Section 03302 FIELD CONCRETE shall be poured and cured.

END OF SECTION

SECTION 01740

CLEANING UP

PART 1 - GENERAL

1.01 DESCRIPTION:

The Contractor must employ at all times during the progress of its work adequate cleanup measures and safety precautions to prevent injuries to persons or damage to property. The Contractor shall immediately, upon request by the Engineer provide adequate material, equipment and labor to cleanup and make safe any and all areas deemed necessary by the Engineer.

1.02 RELATED WORK:

- A. Section 00700 GENERAL CONDITIONS
- B. Section 01110 CONTROL OF WORK AND MATERIALS
- C. Section 01140 SPECIAL PROVISIONS
- D. Section 01570 ENVIRONMENTAL PROTECTION

PART 2 - PRODUCTS

Not applicable

PART 3 - EXECUTION

2.01 DAILY CLEANUP:

- A. The Contractor shall clean up, at least daily, all refuse, rubbish, scrap and surplus material, debris and unneeded construction equipment resulting from the construction operations and sweep the area. The site of the work and the adjacent areas affected thereby shall at all times present a neat, orderly and workmanlike appearance.
- B. Upon written notification by the Engineer, the Contractor shall within 24 hours clean up those areas, which in the Engineer's opinion are in violation of this section and the above referenced sections of the specifications.
- C. If in the opinion of the Engineer, the referenced areas are not satisfactorily cleaned up, all other work on the project shall stop until the cleanup is satisfactory.

2.02 MATERIAL OR DEBRIS IN DRAINAGE FACILITIES:

- A. Where material or debris has washed or flowed into or has been placed in existing watercourses, ditches, gutters, drains, pipes, structures, such material or debris shall be entirely removed and satisfactorily disposed of during progress of the work, and the ditches, channels, drains, pipes, structures, and work shall, upon completion of the work, be left in a clean and neat condition.

2.03 REMOVAL OF TEMPORARY BUILDINGS, STRUCTURES AND EQUIPMENT:

- A. On or before completion of the work, the Contractor shall, unless otherwise specifically required or permitted in writing, tear down and remove all temporary buildings and structures it built; shall remove all temporary works, tools and machinery or other construction equipment it furnished; shall remove all rubbish from any grounds which it has occupied; shall remove silt fences and hay bales used for trapping sediment; and shall leave the roads and all parts of the property and adjacent property affected by its operations in a neat and satisfactory condition.

2.04 RESTORATION OF DAMAGED PROPERTY:

- A. The Contractor shall restore or replace, when and as required, any property damaged by its work, equipment or employees, to a condition at least equal to that existing immediately prior to the beginning of operations. To this end the Contractor shall do as required all necessary highway or driveway, walk and landscaping work. Materials, equipment, and methods for such restoration shall be as approved by the Engineer.

2.05 FINAL CLEANUP:

- A. Before acceptance by the Owner, the Contractor shall perform a final cleanup to bring the construction site to its original or specified condition. This cleanup shall include removing all trash and debris off of the premises. Before acceptance, the Engineer shall approve the condition of the site.
- B. Before acceptance by the Owner, the Contractor shall perform a final cleanup to bring the building to a "like new" condition. This cleanup shall include removing all trash and debris from the premises; sweeping and mopping of all floors; washing of all walls, windows and doors; cleaning and polishing of all finish metal surfaces; cleaning of all equipment, utilizing proper solvents for removal of oil and grease; cleaning of dirt and debris out of all mechanical and electrical cabinets; and all other related work required to render the building suitable for use. Before acceptance, the Engineer shall approve the condition of the building.

END OF SECTION

SECTION 01750

EQUIPMENT CHECKOUT AND TESTING

PART 1 - GENERAL

1.01 DESCRIPTION:

- A. The physical checkout and testing requirements in this Section are in addition to those requirements defined in the technical specifications.

1.02 RELATED WORK:

- A. Division 11 through Division 16.

1.03 DEFINITIONS:

- A. Shop Testing is defined as testing that is performed by the manufacturer either at the place of manufacture, or the place of assembly, for the purpose of proving that the equipment meets the requirements of the technical specification(s).
- B. Physical Checkout is defined as the process whereby the Contractor physically inspects products after they have been installed in the work and certifies that the products have been properly and completely installed and are ready for field testing.
- C. Field Testing is defined as testing that is performed on products by the Contractor with the assistance of the manufacturer's representative, after the performance of physical checkout, for the purpose of proving that the tested products meet the specifications. While field testing can be described as "shop testing in the field", it may be required whether or not shop testing was performed on the product.
- D. System Testing is defined as testing performed on a "system" normally comprised of two or more pieces of equipment, after physical checkout and field testing have been completed, for the purpose of proving that the system meets specifications. System testing is described in Section 01752, STARTUP AND TESTING.
- E. Manufacturer's representative, sometimes referred to as the Factory-Trained Service Technician, is defined as a person provided by the manufacturer, who is qualified by training and experience to provide technical and process related advice, and/or assistance, relating to the installation or utilization of the products provided by the manufacturer. Minimum training and experience shall include not less than three years participation in similar work, including no less than three similar projects during this three-year period.

1.04 SHOP TESTING:

- A. When required by the specifications, shop testing shall be performed prior to delivery of the equipment or material. If shop testing is not required by the technical specifications, provide shop testing as detailed in Paragraph 1.06. Provide a minimum of fifteen days written notice, indicating the time and place of testing. Submit the following to the Engineer for approval not less than fifteen days prior to this notice.
1. Description of the test - Outline how the tests will conform to the requirements of the specifications.
 2. Testing devices that will be used in the tests - description must state how the devices will perform or what they will measure, and the device accuracy. Submit sample measurement results and catalog cuts.
 3. Schedule for testing - schedule shall include frequency of measurements, personnel present, and contingency plans for equipment and/or test failure.
 4. Test forms - submit samples of all forms used to record and report on shop test data. Forms shall include description of test, test date, equipment used, equipment tested, personnel present, equipment tag ID numbers, and measurements made. Forms shall have a place for signature by the chief testing person, and an officer of the manufacturer certifying that the tests results shown are true, accurate, have met the required criteria, and that the equipment will operate as indicated.
- B. Submit the following to the Engineer within one week after completion of the tests.
1. Completed test forms for each device tested.
 2. Completed certification.
 3. A written summary of testing, reporting results.
 4. A schedule for retesting, if necessary. Perform any retesting required to fulfill the specification test requirements at no additional cost to the Owner.

1.05 PHYSICAL CHECKOUT:

- A. Physical checkout shall include the following, where applicable:
1. Verify exterior areas for backfill, grading, surfacing, drainage, landscaping, roadways, fencing, and gates.
 2. Verify buildings for structure, masonry, architectural, mechanical systems, electrical/lighting, communications, and HVAC.
 3. Verify concrete structures for structural integrity, finish tolerance, durability, appearance, embedded and inserted items, painting and surface applications.

4. Verify steel structures for member alignment, connection bolts torque, connection welds integrity, painting, fire proofing and surface applications.
5. Verify mechanical systems and items for setting, alignment and securing, check and adjust packing and seals, lubrication, drying out, drive connection and alignment including rotation and belt/chain tension, painting or surface applications, and tagging for project system.
6. Verify piping systems for material, size, components, direction, alignment of joints and bolts/welding, packing and seals, screens and filters and strainers, leak and pressure hydro tests, painting and color coding, hangers and anchors and expansion provision and supports, clean out of foreign matter and tagging for project system.
7. Verify electrical and control/instrumentation systems for conduit and tray installation, wire/cable material and size, circuit continuity and identification, voltage testing, ground continuity and testing, terminal installation and identification, jar switches and circuit breakers and transformers tested, substation operation tested, and tagging for project system.
8. Verify communication system including telephone, fire/smoke alarm, security, paging, closed circuit TV similar to electrical above.
9. Verify computer systems by station, function, network interface.
10. Each piece of equipment and system must be certified by the manufacturer's representative as described in subsection 1.07.

1.06 MINIMUM SHOP AND FIELD-TESTING REQUIREMENTS:

If the technical specifications do not define shop and field-testing requirements, the following requirements shall be acceptable.

- A. Measurement of wearing ring clearances for all pumps requiring assembly, so equipped:
 1. Take a minimum of two readings, 90 degrees apart.
 2. All measured clearances shall be within supplier's specifications for new installations. Replace and recheck rings found to be out-of-round or out-of-specified tolerance.
- B. Measurement of impeller bore for all pumps requiring assembly:
 1. Take a minimum of two readings, 90 degrees apart.
 2. All measured clearances shall be within supplier's specifications for new installations. Replace and recheck impellers found to be out of round or out of

specified tolerance.

C. Measurement of shaft run out for all rotating equipment requiring assembly:

1. Remove bearings from the shaft. Support shaft on pedestal rollers or in a lathe.
2. Check each shoulder on the shaft.
3. Take a minimum of two readings for each shoulder, 90 degrees apart.
4. All measured clearances shall be within supplier's specifications for new installations. Replace and recheck shafts found to be out of round or out of specified tolerance.

D. Vibration Measurements

1. Provide vibrational signature testing and documentation for each piece of direct drive or close coupled rotating equipment with a motor HP of 50 or above and a rated operating speed in excess of 999 RPM.
2. Unless specified otherwise, the current edition of the Hydraulic Institute Standard, "Acceptable Field Vibration Limits" shall be the standard for vibrational testing.
3. Take all specified vibrational readings in three directions; vertical, horizontal, and axial.
4. Provide vibrational measurements in the following engineering units:
 - a. Displacement in thousandths of an inch (mils), peak to peak.
 - b. Velocity in inches per second (ips), peak to peak.
 - c. Acceleration in feet per second, zero to peak.
 - d. Spike energy in g-SE.
5. The vibrational reading shall be less than the allowable maximum for the device rotating frequency and within the operating band specified by the supplier.
6. Amplitude Allowable Maximums:

<u>RPM</u>	<u>Amplitude Inches Peak to Peak</u>
3,000 and above	0.001
1,500 - 2,999	0.002
1,000 - 1,499	0.0025

999 and below

0.003

7. Utilize a Bently Nevada Dual Path Monitor, or equal for all vibrational measurements.

E. Belt Drives

All belts shall be in accordance with supplier's recommendations.

F. Gear Drives and Reducers

1. Check gears for lash at no less than three points around the gear.
2. Rotate a full 360 degrees while checking alignment.

G. Coupling/Shaft Alignment

1. Perform all final alignments and checks with a dial indicator or a laser device. Feeler gauges and straight edges are not acceptable.
2. Eliminate soft foot conditions prior to aligning.
3. When checking for final soft foot any displacement readings in excess of 0.002-in. must be corrected.
4. When checking for pipe strain, any displacement in excess of 0.002-in. requires piping realignment.
5. Alignments will not be regarded as final until the grout is set, and all piping has been attached. Demonstrate that alignment is not changed by attachment of piping.
6. Shim the driving element; never the driven element.
7. Take bracket sag corrections into account when using a dial indicator. Bracket sag shall be determined on rigid pipe.
8. Mount a dial indicator to the driven element so that it can be rotated. Rotate both elements while aligning.
9. When aligning three coupled elements, align gear reduction elements with the driven element first, then align the driver to the gear reduction elements.
10. Check all four alignments: i.e. angular alignment in the vertical and horizontal planes, and parallel alignment in vertical and horizontal planes.
11. The minimum acceptable alignment accuracy for flexible couplings is +/- 0.005-in.,

or the supplier's specifications, whichever is more stringent.

12. The dial indicator must be perpendicular to the alignment surface.
13. Number hold down nuts prior to tightening. Loosen in reverse order. Tighten in ascending order.
14. Use only clean, deburred shims. Clean the machine base and remove rust or burrs prior to alignment.

H. Measurement of Noise (dB)

1. Eliminate noise sources generated by adjacent construction activity prior to testing.
2. Establish a background noise level prior to testing.
3. Perform noise level testing on each installation device as required by the technical specifications.
4. The maximum acceptable noise level exposure is 85 dBA over eight hours continuous for office, shop, and other areas where the Owner's personnel will be performing their assigned duties.

I. Hydrostatic Testing

1. AWWA C600 standards are the minimum acceptable standards for all hydrostatic testing.
2. Visually inspect all welds prior to testing, for cracks, undercut on surfaces greater than 1/32-in deep, lack of fusion on surface, reinforcement greater than Table 127.2.2 located in ANSI B31.1, Power Piping, and incomplete penetration (when accessible). Repair or rework as required by the Engineer.
3. At no time during hydrostatic testing shall any part of the piping system be subjected to a stress greater than 90% of its yield strength at test temperature.
4. After at least 10 minutes of full hydrostatic test procedures, make an examination for leakage of all joints, connections, and all regions of high stress, such as around openings and thickness transition sections.
5. Unless otherwise specified, the minimum required hydrostatic test pressure shall be 1.5 times the design pressure as specified and as indicated.
6. Unless otherwise specified, the minimum pressure holding time shall be 10 minutes plus the time required to inspect for leakage.

7. Maximum pressure shall not exceed the maximum rated pressure for any component in the system being tested.

J. Electrical Equipment

1. The testing standards for electrical components are those contained in Division 16 and in the pertinent technical specification(s).

1.07 SERVICES OF THE MANUFACTURER'S REPRESENTATIVE:

- A. Services of manufacturer's representatives shall be provided for equipment and systems specified in Divisions 11 through 16.
- B. Contractor shall coordinate services of the various representatives to avoid overlap, thereby ensuring all work may be observed by the Engineer, and the Owner's operating personnel may receive all required training.
- C. Contractor shall notify the Engineer in writing not less than ten working days prior to the visit of each manufacturer's representative.
- D. Manufacturer's representative shall provide services specified in Divisions 11 through 16. As a minimum, the services shall include the following:
 1. When each piece of equipment or system has been installed, including connection of permanent power and control, the equipment or system shall be started up and fully inspected, aligned and adjusted, including provision of lubrication and all pre-operative maintenance.
 2. Each piece of equipment or system shall be complete in all respects. Omission of any required items shall be corrected. Lack of discussion in the specifications of components which are necessary to equipment operation will not be accepted as the basis for an extra charge.
 3. At the time of the inspection the representative shall provide a minimum of two additional hours to train the Owner's operations personnel in the operation and maintenance of the equipment or system.
 4. Upon completion of this work the manufacturer's representative shall forward a copy of the report of his inspection to the Engineer via the Contractor. The report shall be on a form suitable to the Engineer and shall detail the work completed, deficiencies noted and/or corrected, any special instructions, and the names of Owner's personnel who received training. It shall also certify that the installation of the equipment or system is complete, ready for permanent operation, and free from any defects that would void the warranty.
 5. Satisfactory certification of all individual equipment and systems must be received

by the Engineer prior to the authorization to proceed with the overall start-up operation.

6. The manufacturer's representative shall return at a later date to supervise field tests, assist in start-up and perform any additional training required. Reports of these visits, specifically detailing the results of all field tests, shall be forwarded to the Engineer within 7 days of completion of the services.

1.08 CORRECTIONS TO THE WORK:

Correct any items of work failing to meet the specifications at no additional cost to the Owner. Correct the nonconforming items by re-work, modification, or replacement, at the option of the Engineer. Provide all required labor, materials, and retesting as specified herein, to verify that the equipment or system conforms to the specifications.

1.09 SAFETY:

Conduct all test procedures in compliance with all applicable safety standards and regulations.

END OF SECTION

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SECTION 01752

STARTUP AND TESTING

PART 1 - GENERAL

1.01 WORK INCLUDED:

This Section includes the startup and testing services required for the pump station(s) during system startup.

1.02 SYSTEM DESCRIPTION:

- A. The Contractor shall perform pump station startup to the satisfaction of the Engineer and Owner. Startup and testing shall not be initiated until all required certifications and other required documentation has been submitted, as described herein.
- B. The purpose of the startup test is to provide a final operational checkout of all equipment prior to beneficial use by the Owner.
- C. As most components of each pump station are interrelated, Substantial Completion of the project shall not be certified until successful completion of startup.

1.03 RELATED WORK:

- A. Section 01750, EQUIPMENT CHECKOUT AND TESTING
- B. Divisions 11 through 16

1.04 SEQUENCING:

Testing, operator training and other like services to be provided under the technical sections of the specifications are not to be performed during startup without written authorization from the Engineer.

1.05 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF THE GENERAL SPECIFICATIONS, SUBMIT THE FOLLOWING:

- A. Three copies of the following shall be forwarded to the Engineer for review two (2) weeks prior to commencement of startup:
 - 1. Certification by a representative of the manufacturer that each piece of equipment has been installed properly and is ready for operation.
 - 2. Certification by a representative of the equipment manufacturer that all equipment requiring calibration has been properly calibrated.

3. A schedule of the testing, including staffing, and specific testing and operation of individual equipment items.
- B. At the conclusion of the test, all information recorded during the test shall be forwarded to the Engineer.
- C. This test is not to be utilized as a general debugging of the system. All equipment shall be started, tested and calibrated prior to this test. This includes automatic and manual operation as well as instrumentation interfacing.

PART 2 - PRODUCTS - NOT APPLICABLE

PART 3 - EXECUTION

3.01 PREPARATION:

- A. Prior to commencement of testing, the Engineer shall be given three (3) days' written notice.
- B. The Contractor shall complete final debugging prior to startup.
- C. All telemetry equipment shall be operational prior to testing.
- D. The test shall be performed.
- E. Part of the test shall be accomplished on standby power.

3.02 TEST PROCEDURES:

- A. It is the general responsibility of the Contractor to insure that all equipment is completely operational throughout the test; provide the Engineer with proper technical assistance as required to completely test all equipment and alarms; provide adequately trained personnel who can operate the pump station on an on/off basis so that the equipment is not damaged, whether the Engineer or Owner is present or not during that portion of the test.
- B. It is the general responsibility of the Engineer and Owner during the test period to supervise the testing of all equipment, associated alarms and devices; to vary the operation of the equipment as necessary, and to pump as required.

3.03 STOPPING OF TEST:

- A. The Engineer shall stop the testing for any of the following reasons:
 1. Failure of critical system, including:
 - a. Pumps

- b. Telemetry Equipment
- c. Instrumentation
- d. Standby Generating System

2. Failure of any of the above systems to operate on standby power.

- B. If the test is stopped for any reason, the test shall be restarted from the beginning. The Contractor shall pay all costs associated with the Owner and Engineer supervising additional testing as required.

3.04 EXPENDABLES:

Unless otherwise indicated, the General Contractor shall be responsible for providing all fuel during construction and providing a full tank of fuel oil at no additional cost to the Owner, at beneficial occupancy.

END OF SECTION

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SECTION 01760

OPERATION AND MAINTENANCE MANUALS

PART 1 - GENERAL

1.01 SCOPE OF WORK:

- A. This section includes procedural requirements for compiling and submitting operation and maintenance data required to complete the project.

1.02 RELATED WORK:

- A. General Requirements in their entirety (Section 00700 through Section 01770)
- B. Individual Technical Specification Sections Specific for Operation and Maintenance Data.
- C. Section 01330, SUBMITTALS

1.03 FORMAT:

- A. Prepare data in form of an instructional manual.
- B. Binders: Commercial quality, 8 1/2 x 11 inch three-ring binders with hardback, washable, plastic covers; two-inch maximum ring size. When multiple binders are used, correlate data into related, consistent groupings. Provide a table of contents in each binder.
- C. Cover: Identify each binder cover and spine with typed or printed title OPERATION AND MAINTENANCE INSTRUCTION; list title of Project facility; identify subject matter of contents.
- D. Arrange contents by systems under section numbers and sequence of Table of Contents.
- E. Provide tabbed flyleaf for each separate product and system, with typed description of product and major component parts of equipment.
- F. Text: Manufacturer's printed data, or typewritten data - on 20-pound paper.
- G. Drawings: Provide with reinforced punched, binder tab. Bind in with text; fold larger drawings to size of text pages.
- H. Submit certification that the data and drawings provided pertain exactly to the model, size, and series product and equipment installed in the work.
- I. All documents will be electronically scannable.

- J. All products, systems, and drawings must be cross-referenced with tag ID numbers.
- K. The manual for each piece of equipment shall be a separate document with the following specific requirement:
1. Contents:
 - Table of Contents and Index
 - Brief description of each system and components
 - Starting and stopping procedures
 - Special operating instructions
 - Routine maintenance procedures
 - Manufacturer's printed operating and maintenance instructions, parts list, illustrations, and diagrams
 - One copy of each wiring diagram
 - One copy of each approved shop drawing and each Contractor's coordination and layout drawing
 - List of spare parts, manufacturer's price, and recommended quantity
 - Name, address and telephone number of local service representatives.
 2. Material
 - Loose leaf on 60-pound, punched paper
 - Holes reinforced with plastic cloth or metal
 - Page size, 8 ½ x 11 inches
 - Diagrams, illustrations and attached foldouts as required, of original quality, reproduced by dry copy method
 - Covers: oil, moisture and wear resistant 9 x 12 size

1.04 QUALITY ASSURANCE:

- A. Prepare instructions and data by personnel experienced in maintenance and operations of described products.

1.05 CONTENTS, EACH VOLUME (BINDER):

- A. Table of Contents: Provide title of Contract, schedule of products and systems, indexed to content of the volume. A listing of all relevant tag ID numbers for each volume shall be placed immediately after the Table of Contents.
- B. For each product or systems: List names, addresses, and telephone numbers of subcontractors and suppliers, including local source of suppliers and replacement parts.
- C. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.
- D. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.
- E. Text: As required to supplement product data, provide logical sequence of instructions for each procedure incorporating manufacturer's instructions.
- F. Warranties, Guarantees, and Bonds: Bind copy of each
- G. See O&M Manual Review Checklist at end of this specification section.

1.06 MANUAL FOR MATERIALS AND FINISHES:

- A. Building Products, Applied Materials, and Finishes: Include product data with catalog number, size composition, and color and texture designations. Provide information for re-ordering custom manufactured products.
- B. Instructions for Care and Maintenance: Include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
- C. Moisture Protection and Weather Exposed Products: Include product data listing applicable reference standards, chemical composition, and details of installation. Provide recommendations for inspections, maintenance, and repair.
- D. Additional Requirements: As specified in individual product specification sections.

1.07 MANUAL FOR EQUIPMENT AND SYSTEMS:

- A. Each Item of Equipment and Each System: Include description of unit or system and component parts. Identify function, normal operating characteristics and limiting conditions. Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.
- B. Data submitted on all equipment shall include complete maintenance instructions (including preventive and corrective maintenance) and parts lists in sufficient detail to facilitate ordering replacements.
- C. All products, systems, equipment, electrical wiring, instrumentation wiring, personnel protection systems wiring, presented in this manual will have tag numbers corresponding to contract drawings and specifications. In the event, numbers do not exist; the Engineer will specify a series of numbers.
- D. Panelboard Circuit Directories: Provide electrical service characteristics, controls and communications.
- E. Include color-coded wiring diagrams as installed.
- F. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequence. Include regulation, control, stopping, shutdown, and emergency instructions. Include summer, winter and any special operating instructions.
- G. Provide servicing and lubrication schedule, and list of lubricants required. Cross-reference lubricants to products offered by at least three major lubricant suppliers.
- H. Include manufacturer's printed operation and maintenance instructions.
- I. Include sequence of operation by controls manufacturer.
- J. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- K. Provide control diagrams by controls manufacturer as installed.
- L. Provide Contractor's coordination drawings, with color-coded piping diagrams as installed.
- M. Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
- N. Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
- O. Include test and balancing reports, calibration data, alignment records, and other information.

- P. Additional Requirements: as specified in individual product specification sections.
- Q. Provide a listing in table of Contents for design data with tabbed flysheet and space for insertion of data.
- R. Incorporation of all Physical Checkout information obtained through the field-testing and correction phases of the Work. Input must be specific to the actions and information obtained during those phases.

1.08 SUBMITTALS:

- A. Four complete sets of operation and maintenance instructions covering all equipment furnished under Sections 11, 13, 14, 15 and 16 requiring operation and maintenance manuals shall be delivered directly to Weston & Sampson Engineers, Inc, Five Centennial Drive, Peabody, MA 01960, Attention: CSD.
- B. Submission and approval of each set of manuals is considered an integral part of furnishing and installing respective equipment or systems. Measurement for payment of equipment requiring an operation and maintenance manual will not exceed 92 percent, until the manuals meet the requirements of the contract documents.
- C. Submit four copies of first draft volumes as required in Specification Section 01750. This first draft shall contain all currently available product data. The submittal shall be in accordance with Paragraphs 1.04 and 1.05. One copy will be returned with comments.
- D. Submit four copies of completed second draft volumes in final form 90 days prior to startup and after Physical checkout to include the additional requirements set forth in paragraph 1.07.R, above.
- E. Submit four copies of the Final Operation and Maintenance Manuals as required in Section 01770 PROJECT CLOSEOUT.

PART 2 – PRODUCTS

Not used.

PART 3 – EXECUTION

Not used.

**OPERATION AND MAINTENANCE MANUAL
REVIEW CHECKLIST**

1. Name, address, telephone/fax number of the manufacturer
2. Name, address, contact name, telephone/fax of local representative
3. Name, address, telephone/fax number of the contractor
4. Exploded view/general arrangement of materials of construction
5. Description of operation/operating principal
6. Project specific Operating parameters
7. Wiring Diagrams (If Applicable)
8. Troubleshooting checklist
9. Recommended spare parts list with prices, and ordering instructions
10. Model number and the serial number of the model provided
11. Performance curves or tabulated data
12. Routine Maintenance instructions/service instructions with recommended Intervals
13. Assembly and disassembly instructions
14. Recommended lubricates and lubrication schedule.
15. Approved copies of Shop Drawings are to be included in the manual
16. Startup/break-in and adjustment instructions
17. Warranty information

Reviewed By: _____ Date: _____
Weston & Sampson Engineers

END OF SECTION

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SECTION 01765

PROJECT AS-BUILT RECORD DRAWINGS

PART 1 - GENERAL

1.01 WORK INCLUDED:

This Section covers the Contractors As-Built Record drawings for the project. The As-Built Record drawings for the project shall include, but are not limited to:

A. Draft Record Documents Review

Upon completion of the project construction the Contractor shall submit a complete well diagram to the Owner and the Engineer for review. The well diagram shall provide depths/heights to all well components, referenced to a point on the well above grade with a verified elevation on NAVD88 performed by a Connecticut RLS. The Contractor shall also furnish an As-Built Record Site Drawing accurately showing the final location of underground piping, conduits and appurtenances. The Owner and the Engineer shall jointly review the Record Drawings and provide comments to the Contractor. The Contractor shall modify the Record Drawings as necessary based on the comments provided by the Owner and the Engineer.

B. Final Record Documents

Upon incorporation and acceptance of the Draft Record Drawings comments from the Owner and the Engineer, the Contractor shall submit the Final Record Drawings and documentation. The Contractor shall submit two sets of 24- by 36-inch Record Drawings to the Owner and an additional two sets of 24- by 36-inch Record Drawings to the Engineer for their records. The Contractor shall also submit to the Engineer a flash drive with the electronic Record Drawing files. The electronic Record Drawing files shall be obtained from the Owner (the Engineer shall provide on behalf of the Owner if the Engineer was the project designer) and developed in AutoCAD 2010 (or later) and the submittal shall include the Final AutoCAD DWG file documents, drawing line types, blocks, etc. The actual version of AutoCAD shall be coordinated with the Engineer.

1.02 RELATED WORK:

A. General Requirements in their entirety.

B. Division 2 through Division 16.

1.03 AS-BUILT DOCUMENTS:

A. Contractor shall maintain on site, separate from the documents used for construction,

one complete set of the documents listed below, and as construction progresses, shall legibly record on these documents all changes made during construction.

1. Contract Drawings.
2. Specifications.
3. Addenda.
4. Change Orders and other Modifications to the Contract.
5. Reviewed shop drawings, product data, and samples.
6. Written interpretations and clarifications.
7. Field Orders.
8. Field test reports properly verified.

B. The completed set of documents shall include but are not limited to:

1. Significant deviations of any nature made during construction.

C. The completed set of as-built documents shall be submitted to the Engineer with the final Application for Payment.

PART 2 - MATERIALS

Not Used

PART 3 - EXECUTION

Not Used

END OF SECTION

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SECTION 01770

PROJECT CLOSEOUT

PART 1 - GENERAL

1.01 WORK INCLUDED:

- A. This Section covers administrative and procedural requirements for closing out the project, including, but not limited to:
 - 1. Project as-built documents
 - 2. Checkout and Certification
 - 3. Startup and Testing
 - 4. Final Cleaning
 - 5. Substantial Completion
 - 6. Closeout Procedures
 - 7. Final Completion
 - 8. Correction/Warranty Period
- B. Closeout checklist to be completed by the Engineer.

1.02 RELATED WORK:

- A. General Requirements in their entirety.
- B. Section 01740, CLEANING UP
- C. Section 01750, EQUIPMENT CHECKOUT AND TESTING
- D. Section 01752, STARTUP AND TESTING
- E. Division 2 through Division 16.

1.03 AS-BUILT DOCUMENTS:

- A. Contractor shall maintain on site, separate from the documents used for construction, one set of the documents listed below, and as construction progresses, shall legibly record on these documents all changes made during construction.

1. Contract Drawings.
2. Specifications.
3. Addenda.
4. Change Orders and other Modifications to the Contract.
5. Reviewed shop drawings, product data, and samples.
6. Written interpretations and clarifications.
7. Field Orders.
8. Field test reports properly verified.

B. The completed set of as-built documents shall be submitted to the Engineer with the final Application for Payment.

1.04 CHECKOUT AND CERTIFICATIONS:

A. Prior to checkout and certifications, the following tasks shall be completed:

1. Construction shall be complete. For this purpose, completion of construction is defined as follows:
 - a. The Contractor has completed construction and erection of the work in conformance with the Contract Drawings and Specifications.
 - b. The Contractor has installed and adjusted operating equipment, systems, or facilities, as applicable, as defined by the manufacturers' erection, installation, operation and maintenance instructions.
2. All shop drawings shall have final approval.
3. All shop tests shall be complete and approved test results submitted to the Engineer.

B. Refer to Section 01750 for requirements regarding equipment checkout and certification.

1.05 START-UP AND TESTING:

A. Prior to start-up the following tasks shall be complete:

1. All checkout and certifications shall be satisfactorily completed,
2. All operations and maintenance manuals shall be approved,

3. All preliminary training by the manufacturer's representative shall be completed,
4. An approved start-up procedure shall be in place.

B. Refer to Section 01752.

1.06 FINAL CLEANING:

- A. Complete the following cleaning operations before requesting inspection for Certification of Substantial Completion.
 1. Clean the site, including landscape development areas of rubbish, litter and other foreign substances. Sweep paved areas broom clean; remove stains, spills and other foreign deposits. Rake grounds that are neither paved nor planted, to smooth, even textured surfaces.
 2. Remove waste and surplus materials, rubbish, fencing equipment, temporary utilities and construction facilities from the site, unless otherwise required by the Engineer.
 3. Comply with requirements of Section 01740 CLEANING UP.

1.07 SUBSTANTIAL COMPLETION:

- A. Substantial Completion is officially defined in the General and Supplementary Conditions. The date of substantial completion will be certified by the Engineer. This date will not be certified until the following requirements have been satisfied by the Contractor:
 1. All Contract requirements are coordinated into a fully operational system. All individual units of equipment and treatment are fully operative and performing at specified efficiencies. Where efficiencies are not specified, performance shall meet acceptable standards for the particular unit.
 2. All field tests have been satisfactorily completed and reports forwarded to the Engineer.
 3. All final training has been completed by the manufacturers' representatives.
 4. All spare parts and lubricants have been satisfactorily delivered to the Owner. Spare parts are for the exclusive use of the Owner when the facility has been turned over. Contractor is responsible for all maintenance and repair materials required until the facility is accepted by the Owner.

1.08 CLOSEOUT PROCEDURES:

- A. Submit written certification that Contract Documents have been reviewed, Work has been inspected, and is complete in accordance with Contract Documents and ready for Engineer's and Owner's inspection.
- B. Accompany Engineer and Owner on inspection to verify conformance with the Contract Documents. Prepare a punch list of work items that have been determined by inspection to not conform to Contract Documents. Punch list items shall include work items that are missing, incomplete, damaged, incorrect items, or improperly installed or constructed. The Contractor shall correct the punch list deficiencies by re-work, modifications, or replacement, as appropriate, until the items conform to the Contract Documents. The initial punch list shall be produced by the Contractor, with copies to the Engineer and Owner. When the Contractor has reduced the number of deficient items to a reasonable level, the Engineer will develop a definitive punch list for the use of the Contractor.
- C. Provide submittals to Engineer that are required by governing or other authorities.
- D. Submit final Application for Payment identifying total adjusted Contract Sum, previous payments, and sum remaining due. The Contractor shall submit the following documents with or prior to Final Application for Payment: Set of as-built documents, Contract Completion and Acceptance Certificate, Consent of Surety to Final Payment, Release and Waiver of Liens and Claims, Affidavit of Payment of Debts and Claims, and remaining releases, waivers, warranties/guarantees, and all other data required by the Contract Documents.

1.09 FINAL COMPLETION:

- A. Prior to final completion, the following tasks shall be completed:
 - 1. All items in the punch list shall be completed.
 - 2. All Contract closeout documentation shall be submitted to and accepted by the Engineer.

1.10 CORRECTION/WARRANTY PERIOD:

- A. During the correction period, the Contractor shall correct all deficiencies in equipment and materials.
- B. During the warranty period, the Contractor shall perform all corrective work on warranty deficiencies.
- C. Corrective work will be identified by the Engineer or Owner, as appropriate. The Contractor will be notified of the item(s) requiring corrective work.
- D. The Contractor shall begin work on all corrective work within ten days of being notified of the deficiency by the Engineer and shall then work continuously until the deficiency is

corrected. Upon completion of the corrective work, the Contractor shall submit a letter report to the Engineer describing the deficiency and the corrective action that was taken.

- E. The Contractor shall coordinate all corrective work with the Engineer and/or the Owner.

1.11 COMPLETION CHECKLIST:

- A. The Project Completion Checklist, which follows, shall be modified and shall be completed as the project nears completion. When the project has been fully completed, Final Payment can be approved.

PROJECT COMPLETION CHECKLIST

Owner _____ Job No.

Project _____

As part of the project closeout, all items listed below must be checked off as being complete or otherwise accounted for. The person verifying completion of the item shall list the completion date and his/her initials.

Project Closeout Checklist		
	Date Completion Verified	Verified by
AS-BUILT DOCUMENTS HANDED OVER		
1. Contract Drawings		
2. Specifications		
3. Addenda		
4. Change Orders/Contract Modifications		
5. Reviewed Shop Drawings, Product Data and Samples		
6. Written Interpretations/Clarifications		
7. Field Orders		
8. Field Test Reports		
EQUIPMENT CHECKOUT AND CERTIFICATIONS		
1. Construction Complete per Drawings/Specifications		
2. Equipment Installed and Adjusted		
3. All Shop Drawings have Final Approval		
4. All Shop Tests Complete and Results Submitted		

Project Closeout Checklist		
	Date Completion Verified	Verified By
START-UP AND TESTING		
1. All Checkout and Certifications Complete		
2. All O&M Manuals Approved		
3. All Preliminary Training by Manufacturers Rep. Completed		
FINAL CLEANING		
1. All Construction Facilities Removed		
2. All Construction Debris Removed		
3. All Areas Swept/Cleared		
SUBSTANTIAL COMPLETION		
1. All Items Coordinated into a Fully Operational System		
2. All Equipment Units Operational at Specified Efficiencies		
3. All Field Tests Completed and Reports Submitted		
4. All Final Training by Manufacturer's Rep. Completed		
5. All Spare Parts and Lubricants Provided		
CLOSEOUT PROCEDURES		
1. Written Certification Submitted that Work is Ready for Owner & Engineer Inspector		
2. Inspection by Owner, Engineer, Contractor completed		
3. Punch List of Nonconforming Items Prepared		
4. Documents Required by Governing or Other Authorities Submitted (List Them)		
5. Final Application for Payment Received		
6. Contact Completion and Acceptance Certificate Submittal		
7. Consent of Surety to Final Payment Submittal		
8. Release and Waiver of Liens and Claims Submitted		
9. Affidavit of Payment of Debts and Claims Submitted		

Project Closeout Checklist

	Date Completion Verified	Verified By				
10. Warranties/Guarantees Submitted						
11. Other Required Releases and Waivers Submitted (List Them)						
12. Permits Submitted (List Them)						
13. Weekly Payrolls Submitted as Required by Law						
FINAL COMPLETION						
1. All Items in Punch List Completed						
2. All Other Required Documentation Submitted (List It)						
CORRECTION/WARRANTY PERIOD						
1. Correction Period Start Date: _____ End Date: _____						
2. Specific Warranties Provided						
<table border="0" style="width: 100%;"> <tr> <td style="text-align: center;"><u>Item</u></td> <td style="text-align: center;"><u>Warranty Duration</u></td> </tr> <tr> <td style="height: 150px;"></td> <td></td> </tr> </table>	<u>Item</u>	<u>Warranty Duration</u>				
<u>Item</u>	<u>Warranty Duration</u>					

Full name of persons signing their initials on this checklist:

END OF SECTION

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SECTION 02080

DUCTILE IRON PIPE AND FITTINGS FOR WATER MAINS

PART 1 - GENERAL

1.01 WORK INCLUDED:

This Section covers the furnishing, handling, hauling, laying, jointing, testing and disinfecting of all below ground mechanical joint ductile iron pipe, including fittings and appurtenant work as indicated on the drawings and as specified. All materials shall conform to the Colchester Sewer and Water Material Specifications.

1.02 RELATED WORK:

- A. Section 02300, EARTHWORK
- B. Section 02513, INSULATION FOR PIPELINES
- C. Section 02514, HYDRANTS AND VALVES
- D. Section 02516, CONNECTIONS TO EXISTING WATER MAINS

1.03 QUALITY ASSURANCE:

- A. All pipe and fittings shall be inspected and tested at the foundry as required by the standard specifications to which the material is manufactured. The Contractor shall furnish in duplicate to the Engineer sworn certificates of such tests.
- B. In addition, the Owner reserves the right to have any or all pipe, fittings and special castings inspected and/or tested by an independent service at either the manufacturer's plant or elsewhere. Such inspection and/or tests shall be at the Owner's expense.

1.04 REFERENCES:

- A. The following standards, latest revision thereof, form a part of this specification as referenced:

American Water Works Association (AWWA)

AWWA	C104	Cement-Mortar Lining for Ductile- Iron Pipe and Fittings
AWWA	C105	Polyethylene Encasement for Ductile Iron Pipe Systems
AWWA	C110	Ductile-Iron and Gray-Iron Fittings

AWWA	C111	Rubber Gasket Joints for Ductile- Iron Pressure Pipe and Fittings
AWWA	C116	Protective Fusion-Bonded Epoxy Coatings for the Interior and Exterior Surfaces of Ductile-Iron and Gray-Iron Fittings
AWWA	C150	Thickness Design of Ductile-Iron Pipe
AWWA	C151	Ductile-Iron Pipe, Centrifugally Cast
AWWA	C153	Ductile-Iron Compact Fittings for Water Service.
AWWA	C600	Installation of Ductile-Iron Water Mains and Their Appurtenances
AWWA	C651	Disinfecting Water Mains

1.05 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF GENERAL SPECIFICATIONS, SUBMIT THE FOLLOWING:

- A. Six sets of all shop drawings shall be submitted to the Engineer for review.
- B. Shop drawings shall consist of manufacturer's scale drawings, cuts or catalogs including descriptive literature and complete characteristics and specifications, and code requirements. Shop drawings shall be submitted for the ductile iron pipe, type of joint, fittings, couplings, filling rings, restrained joints, and lining and coating in accordance with specifications.

PART 2 - PRODUCTS

2.01 PIPE:

- A. The Contractor shall use push-on joint type ductile iron pipe unless otherwise indicated on the plans or specified herein.
- B. All ductile iron pipe shall be designed in accordance with AWWA C150 and shall be manufactured in accordance with AWWA C151.
- C. Unless otherwise indicated or specified, ductile iron pipe shall be Thickness Class 52.

2.02 JOINTS:

- A. Joints for ductile iron pipe shall conform to AWWA C111.
- B. Pipe and fittings shall be furnished with approved joint restraining appurtenances as specified herein, or within the limits as indicated on the drawings, to keep the piping

from pulling apart under pressure.

2.03 FITTINGS:

- A. Fittings shall conform to the requirements of AWWA C110 or C153 as appropriate and shall be of a pressure classification at least equal to that of the pipe with which they are used.
- B. The Contractor shall use ductile iron fittings. Cast-iron, Class 250 fittings may be substituted, upon approval of the Engineer, for ductile iron fittings.
- C. Unless otherwise indicated, fittings shall have all bell mechanical joint ends.

2.04 GASKETS, GLANDS, NUTS AND BOLTS:

- A. Gaskets, glands, nuts, bolts and accessories shall conform to AWWA C111 or C153 as appropriate.
- B. Gaskets shall be of plain tipped rubber, suitable for exposure to the liquid within the pipe.
- C. Glands shall be ductile or cast iron.
- D. Bolts and nuts shall be high strength alloy.

2.05 LINING AND COATING:

- A. The inside of pipe and fittings shall be given a cement lining and asphaltic seal coat in accordance with AWWA C104. The thickness of the lining shall be double that specified in AWWA C104.
- B. The outside of pipe and fittings shall be coated with the standard asphaltic coating specified under the appropriate AWWA Standard Specification for pipe and fittings.
- C. Machined surfaces shall be cleaned and coated with a suitable rust preventative coating at the shop immediately after being machined.

2.06 FLEXIBLE COUPLINGS:

- A. The Contractor shall use solid sleeve coupling fittings for joining pipe. Sleeve-type flexible couplings may be substituted only with the approval of the Engineer.
- B. All couplings and accessories shall be of a pressure rating at least equal to that of the pipeline in which they are to be installed.
- C. Couplings shall be cast or ductile iron and shall be provided with gaskets of a composition suitable for exposure to the liquid within the pipe.

- D. Sleeve-type couplings shall be made by Dresser Mfg. Div., Bradford, PA; Smith-Blair, Inc., San Francisco, CA; Romac Industries Inc., Seattle, WA; Ford Meter Box Co., Wabash, IN; or be an approved equal.
- E. Couplings for buried pipe shall be Dresser 153; Smith-Blair Type 441 or 443; Romac Style 501; Ford Style FC1 or FC2; or approved equal.

2.07 JOINT RESTRAINTS:

- A. Where indicated or necessary to prevent joints or sleeve couplings from pulling apart under pressure, anchoring and joint restraint methods shall be utilized. Methods shall be restrained joint systems. The number of joints to be restrained shall be determined in accordance with Table 1, as shown on the construction plans or provided by the Engineer.
- B. Restrained joint systems for standard mechanical joint fittings or push on joint pipe shall be restraining glands (Megalug by EBAA Iron Sales Inc., Eastland, TX; StarGrip by Star Pipe Products, Houston, TX; RomaGrip by Romac Industries, Inc., Sultan, WA; Sigma One-Lok by Sigma Corporation, Cream Ridge, NJ; or approved equal) and restraining gaskets (Fast-grip joint by American Cast Iron Pipe Company, Birmingham, AL; Field Lok 350 Gasket by United States Pipe and Foundry Company, Birmingham, AL; Sure Stop 350 Restrained Joint Gaskets by McWane Ductile, Phillipsburg, NJ; or approved equal). Methods that rely on the use of friction clamps and/or retainer glands with set screws alone are not acceptable.
- C. Restrained joint systems for non-standard or modified joints shall be Flex-Ring or Lok-Ring by American Cast Iron Pipe Company, Birmingham, AL; T.R. Flex Joint by McWane Ductile, Phillipsburg, NJ; TR-Flex Joint by United States Pipe and Foundry Company, Birmingham, AL; Snap-Lok or Bolt-Lok by United States Pipe and Foundry Company, Birmingham, AL; or approved equal.
- D. Concrete thrust blocks may only be used for 6-inch, 8-inch, 10-inch, or 12-inch pipe where use of a joint restraint system is not feasible. Use of concrete thrust blocks shall be installed with the minimum bearing area (in square feet) against undisturbed material in accordance with the following:

Size of Main	90° Bends, Tees, Caps and Plugs	45° Bends and Wyes	22-1/2° Bends	11-1/4° Bends
6- & 8-inch	5	4	2	2
10- & 12-inch	12	9	5	2

- D. Tie rods may only be used for 6-inch, 8-inch, 10-inch, or 12-inch pipe where use of a joint restraint system is not feasible. Bolts shall have adequate length to allow nuts on both sides of the gland. Tie bolts shall have the same diameter as the tie rods and be in accordance with the following:

Pipe Size	Tie Rod	
	Number	Diameter
6	2	1/2"
8	2	3/4"
10	2	3/4"
12	4	3/4"

- E. Location of restrained joints shall be based on Table 1, as shown on the construction plans or provided by the Engineer. All joints that occur within the restrained length listed in Table 1, for the specific application, shall be restrained. For example, for a 90° bend, 8-inch unwrapped pipe, the restrained length required is 33 feet. Therefore, all joints within 33 feet of the 90° bend must be restrained.

PART 3 - EXECUTION

3.01 INSPECTION BEFORE INSTALLATION:

Pipes and fittings shall be subjected to a careful inspection just before being laid or installed.

3.02 HANDLING AND CUTTING:

- A. Any pipe or fitting which has a damaged lining, scratched or marred machine surface and/or abrasion of the pipe coating or lining shall be rejected and removed from the job-site.
- B. Any fitting showing a crack and any fitting or pipe which has received a severe blow that may have caused incipient fracture, even though no such fracture can be seen, shall be marked as rejected and removed at once from the work.
- C. In any pipe showing a distinct crack and in which it is believed there is no incipient fracture beyond the limits of the visible crack, the cracked portions, if so approved, may be cut off by and at the expense of the Contractor before the pipe is laid so that the pipe used will be perfectly sound. The cut shall be made in the sound barrel at a point at least 12-inches from the visible limits of the crack.
- D. Except as otherwise approved, all cutting shall be done with a machine suitable for cutting ductile iron pipe. Hydraulic squeeze cutters are not acceptable for cutting ductile iron pipe. Travel type cutters or rotary type abrasive saws may be used. All cut ends shall be examined for possible cracks caused by cutting.
- E. Lined and coated pipe and fittings shall be assembled and installed with approved packing or gaskets of the type recommended by the pipe manufacturer for the particular lining used.

3.03 INSTALLATION:

A. DEPTH:

1. The pipe shall be installed with a minimum of 5'-0" of cover, unless specifically indicated otherwise on the plans or required by the Engineer.
2. Where pipe is installed at less than the required cover, the Contractor shall furnish and install insulation in accordance with Section 02513, INSULATION FOR PIPELINES, or as required by the Engineer.

B. PIPE AND FITTINGS:

1. No defective pipe or fittings shall be laid or placed in the piping, and any piece discovered to be defective after having been laid or placed shall be removed and replaced by a sound and satisfactory piece.
2. Each pipe and fitting shall be cleared of all debris, dirt, etc., before being laid and shall be kept clean until accepted in the complete work.
3. Pipe and fittings shall be laid accurately to the lines and grades indicated on the drawings or as required. Care shall be taken to ensure good alignment both horizontally and vertically.
4. In buried pipelines, each pipe shall have firm bearing along its entire length.
5. Castings to be encased in masonry shall be accurately set, with the bolt holes, if any, carefully aligned.
6. Immediately prior to being set, castings shall be thoroughly cleaned of all rust, scale and other foreign material.
7. Fittings shall not be used to clear beneath or above an existing structure or pipeline unless approved by the Engineer. The water main shall be brought to a depth sufficient to clear the structure or pipeline without the use of bends.

C. TEMPORARY PLUGS:

At all times when pipe laying is not actually in progress, the open ends of pipe shall be closed by temporary watertight plugs or by other approved means. If water is in the trench when work is resumed, the plug shall not be removed until all danger of water entering the pipe has passed.

D. PUSH ON JOINTS:

1. Joining of push-on joint pipe shall conform to AWWA C600.

2. If effective sealing of the joint is not attained, the joint shall be disassembled, thoroughly cleaned, a new gasket inserted and joint reassembled.
3. Deflection of alignment at a joint shall not exceed the appropriate permissible deflection as specified in AWWA C600. The tables in AWWA C600 indicate the maximum permissible deflection for 18 and 20-foot pipe lengths. Maximum permissible deflections for other lengths shall be in proportion to such lengths.

E. MECHANICAL JOINTS:

1. Assembling of fittings with mechanical joint ends shall conform to AWWA C600.
2. If effective sealing of the joint is not attained at the maximum torque indicated in the above standard, the joint shall be disassembled and thoroughly cleaned, then reassembled. Bolts shall not be overstressed to tighten a leaking joint.
3. The deflection of alignment at a joint shall not exceed the appropriate permissible deflection as specified in the following table. These values indicate the maximum permissible deflection for 18-foot lengths. Maximum permissible deflections for other lengths shall be in proportion to such lengths.

Pipe Deflection Allowances	
Maximum permissible deflection, inches	
<u>Diameter of Pipe (inches)</u>	<u>Mechanical-Joint</u>
6	27
8-12	20
16	13.5
20	11
24	9

F. RESTRAINED JOINTS:

1. Joining of restrained joint piping shall conform to the manufacturer's recommendations.
2. If effective sealing of the joint is not attained, the joint shall be disassembled, thoroughly cleaned, a new gasket inserted and joint reassembled.
3. Deflection of alignment at a joint shall not exceed the appropriate permissible deflection recommended by the manufacturer.
4. All restraining appurtenances (and tie rods) shall be coated with an approved bituminous paint after assembly. The completed joint shall be inspected and the

paint repaired/touched-up as necessary.

G. SLEEVE-TYPE COUPLINGS:

1. Pipe ends shall be cleaned thoroughly prior to installation. After the bolts have been inserted and all nuts have been made up finger tight, diametrically opposite nuts shall be progressively and uniformly tightened all around the joint, preferable by use of a torque wrench of the appropriate size and torque for the bolts. The correct torque as indicated by a torque wrench shall not exceed 90 foot-lb. for joints up to 24-inches.

3.04 TESTING:

- A. Prior to the hydrostatic pressure test, the piping shall be thoroughly flushed clean of all dirt, dust, oil, grease and other foreign material. This work shall be done with care to avoid damage to linings and coatings. Flushing velocity shall be a minimum of 2.5 ft./sec.
- B. The installed pipe shall be pressure tested in accordance with AWWA Standard C600.

C. HYDROSTATIC PRESSURE TEST:

1. Unless otherwise approved, all pipelines shall be given a hydrostatic pressure test between line valves. The Contractor shall furnish and install suitable temporary testing plugs or caps; all necessary pressure pumps, pipe connections, meters, gates, and other necessary equipment; and all labor required. The Owner or Engineer shall have the privilege of using its own gauges.
2. Subject to approval and provided that the tests are made within a reasonable time considering the progress of the project as a whole, and the need to put the section into service, the Contractor may make the tests when desired.
3. Pipelines intended for buried service shall be tested after backfill and compaction of the trench.
4. The section of pipe to be tested shall be filled with water of approved quality and all air shall be expelled from the pipe. The Contractor shall follow established procedures for filling the pipe and expelling trapped air to avoid exposing the piping system to water-hammer. If blowoffs are not available at high points for releasing air, the Contractor shall excavate as required and install the necessary taps. If the Contractor changes the grade of pipe installation, he will be responsible for locating the taps at the correct location in the system for testing. Taps shall be installed at the beginning and end of each disinfection run. After completion of the test, if so required by the Engineer, the Contractor shall remove corporations used for testing; plug the holes; and backfill as necessary.

5. The section under test shall be maintained full of water at working pressure for a period of 24 hours prior to the hydrostatic pressure test being applied to stabilize the pipeline with respect to movement under pressure, water absorption by the lining, etc. The pipeline may require several cycles of pressurizing and bleeding trapped air prior to beginning the test.
6. When hydrants are in the pipeline test section, the hydrostatic test shall be made against the main valve in the hydrant. The hydrostatic test shall not be conducted against the branch valve.
7. The hydrostatic test shall consist of raising the water pressure within the test section to a pressure not less than 1.25 times the working pressure of the pipeline measured at the highest elevation along the test section and not less than 1.5 times the working pressure of the lowest elevation of the test section. The specified test pressure shall be corrected to the elevation of the test gauge.
8. The hydrostatic test shall be of at least a 2-hour duration. The test pressure shall not vary by more than +/- 5 psi for the duration of the test. Test pressure shall be maintained within this tolerance by adding makeup water through the pressure test pump into the pipeline test section.
9. The amount of makeup water (testing allowance) added to the test section shall be accurately measured by suitable methods and shall not exceed the maximum allowable quantity of makeup water. No pipe installation will be accepted if the quantity of makeup water is greater than that determined by the following formula:

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

Where:

- L = makeup water, in gallons per hour
- S = length of test section, in feet
- D = nominal diameter of pipe, in inches
- P = average test pressure, in psi (gauge)

10. If the section fails to pass the hydrostatic pressure test, the Contractor shall do everything necessary to locate, uncover, and repair or replace the defective pipe, fitting, or joint, all at his own expense and without extension of time for completion of the work. Additional tests and repairs shall be made until the section passes the specified hydrostatic test.

3.05 DISINFECTION AND FLUSHING:

- A. The Contractor shall disinfect the lines carrying potable water.
- B. The Contractor shall furnish all equipment and materials necessary to do the work of

disinfecting and shall perform the work in accordance with the procedure outlined in AWWA C651 and all amendments thereto.

- C. In general, the procedure of disinfecting the main shall be to apply the chlorine through a tap in one end of the section and bleed it off through a tap at the other end. Powdered chlorine placed in each length of pipe during installation is not an acceptable method of disinfection.
- D. The applied dosage shall be such as to produce a chlorine concentration of not less than 10 mg/l after a contact time of not less than 24 hours.
- E. During the disinfection period, care shall be exercised to prevent contamination of water in existing mains.
- F. Any temporary connection to the mains or other facilities required to accomplish the disinfection of the mains shall be at the Contractor's expense.
- G. After treatment, the main shall be flushed with clean water until the residual chlorine concentration is less than 0.2 mg/l. The flushing rate shall be 3.0 ft. /sec to achieve full scour of sand particles.
- H. Before disposing of the water used in disinfecting and flushing water mains the Contractor shall thoroughly neutralize it through the application of a reducing agent, as referenced in AWWA C651 and C655.
- I. Bacteriological sampling and testing shall be done in accordance with AWWA C651 (Option A – One sample taken after flushing is complete followed by another sample taken 16 hours after the first sample or Option B – Two samples taken 15 minutes apart after a 16 hour post flushing rest period) for each main and each branch. Sampling shall be accomplished with sterile bottles treated with sodium thiosulfate, as required by Standard Methods. No hose or fire hydrants shall be used in collection of samples. A corporation stop installed on the main, with a removable copper tube gooseneck assembly, is the recommended method.
- J. Bacteriological sampling and testing shall be conducted by a state certified laboratory certified for total and fecal coliform analyses of potable water.
- K. Testing shall be done by a laboratory approved by the Engineer, in accordance with Standard Methods, and shall show the absence of coliform organisms. A standard plate count may be required at the option of the Engineer.

**COLCHESTER WATER DEPARTMENT
MATERIAL SPECIFICATION**

SHUTOFF BOX-2 ½ INCH

Type: Heavy Duty Buffalo Slip Type, Made in North America., 2 piece with "WATER"
cover

Extension: 42-60 inch

Note: If Extension exceeds 50 inches an extension rod and ring may be required by the
Water Department.

Approved Manufacturers: Bibby Ste-Croix Tyler, QWP, Tyler/Union or approved equal.

**COLCHESTER WATER DEPARTMENT
MATERIAL SPECIFICATION**

MECHANICAL JOINT RESTRAINT (RETAINER GLAND)

Type: Wedge Action Type, High Strength Ductile Iron per ASTM A536, Grade 65-45-12. All mechanical points conform to ANSI/AWWA C111/A21.11, UL Listed and FM approved.

Working Pressure: 350 PSI

Wedge Bolts: Ductile Iron with torque actuated breakaway bolts

Approved Manufacturers: EBBA Megalug. 1100 Series
 Ford Uni-Flange Series 1400
 Wedge Action Retainer
 RomaGrip

**COLCHESTER WATER DEPARTMENT
MATERIAL SPECIFICATION**

RESTRAINED FLANGED COUPLING ADAPTER

Type: Ductile Iron to meeting or exceeding ASTM A 536, Grade 65-45-12 and ANSI Class 125 and 150 Class 150 Bolt Circles.

Gaskets: Comply with ASTM D 2000

Restraining Bolts: 7/8 -9 roll thread. Ductile Iron meeting ASTM A 536

Restraining Lugs: Ductile iron meeting ASTM A 536. Heat treated.

T-bolts and Nuts: High Strength, low alloy steel T-head bolt. National coarse rolled thread and heavy hex head. Steel meets AWWA C111 composition specifications.

Flange: Compatible with ANSI Class 125 and 150 bolt circles.

Pressure: Rated for 275 PSI working pressure.

Approved Manufacturers: Romac Industries Inc., Smith Blair or approved Equal.
Union MJ x Flanged Coupling with Ford Series Wedge
Action Restrainer
JCM Industries #301R

**COLCHESTER WATER DEPARTMENT
MATERIAL SPECIFICATION**

MECHANICAL JOINT (MJ) FITTINGS

Type: Cast Iron or ductile iron class 53 compact fittings to comply with ANSI/AWWA C 153/A2 1.53 ANSI/AWWA C111/A21.11. Fittings are to be manufactured in North America.

Coatings: Interior shall be cement lined and seal coated in accordance with ANSI/AWWA C104/A21.4. The exterior coating shall be seal coated.

Approved Manufacturers: Tyler, Union, US Pipe

COLCHESTER WATER DEPARTMENT MATERIAL SPECIFICATION

HYDRANTS

Type: Dry Barrel Compression hydrant, dry top design, traffic break-a-way feature, 200 PSI maximum working pressure rating to comply with AWWA C502 Standard, UL listed and FM approved

Stem Seals: O-ring type.

Operating Nut: Open left

Nozzles: three (3) way, two hose, one pumper, field replaceable, chains, NST threads

Body: Cast iron

Maximum Working Pressure: 250 PSI

Valve size: 5.25 inch main valve opening

Color: Bright Yellow with White nozzle caps

Sealed Lubricant Reservoir: oil

Warranty: 10 year

Approved Hydrants: Mueller A-423 Super Centurion, Clow Medallion

Depth of Bury: 5.5 Feet

**COLCHESTER WATER DEPARTMENT
MATERIAL SPECIFICATION**

GATE BOXES/COVERS - 5 ¼ INCH

Type: Box shall be two piece cast iron slip box type, North American made.
Cover shall be cast iron with "WATER", 26 inch top, 36 inch bottom

Approved Manufacturers: Tyler, QWP, Bibby, Ste-Croix

**COLCHESTER WATER DEPARTMENT
MATERIAL SPECIFICATION**

FLANGED FITTINGS

Type: Cast Iron or ductile iron to comply with ANSI/AWWAC 110/A2 1.10 and 125# ANSI B16.1 faced and drilled. To be manufactured in U.S.A.

Coatings: Interior shall be cement lined and seal coated. The exterior coating shall be red primer.

Approved Manufacturers: Union/Tyler, US Pipe or Napac

**COLCHESTER WATER DEPARTMENT
MATERIAL SPECIFICATION**

DUCTILE IRON PIPE

Type: Class 52 Ductile Iron Pipe to comply with ANSI/AWWA C151/A21.51 Standards

Cement Lining: Double cement lining

Bituminous Coating: Internal and external

Approved Ductile Iron Pipe: Atlantic States, Griffin, US Pipe

**COLCHESTER WATER DEPARTMENT
MATERIAL SPECIFICATION**

SERVICE LINE-COPPER TUBING

Type: TYPE K Soft, to comply with ASTM B-75, B-88, and B-68 specifications

Wall Thickness: 0.065 inches

Length: 100 Feet- ¾ and 1 inch
 60 Feet- 1 ½ inch
 40 Feet- 2 inch

**COLCHESTER WATER DEPARTMENT
MATERIAL SPECIFICATION**

BUTTERFLY VALVES (UNDERGROUND)

Type: Butterfly Valve, NRS, OR, permanently lubricated., meeting AWWA C 504.

Shafts: 18-8 type 304 stainless steel meeting AWWA Standard C-504.

Shaft Seals: O-ring type, (Underground application)

Coatings: Interior epoxy coating

Approved Manufacturers: Clow 4500, Mueller, Pratt 2FH

**COLCHESTER WATER DEPARTMENT
MATERIAL SPECIFICATION**

SADDLES

Type: Ductile Iron Body with stainless steel bands and hardware

Approved Manufacturers: Smith Blair style 317 or approved equal

**COLCHESTER WATER DEPARTMENT
MATERIAL SPECIFICATION**

REPAIR CLAMPS (WRAP-AROUND)

Type: Stainless steel body with malleable iron lugs

Approved Manufacturers: Smith Blair style 226 or approved equal

**COLCHESTER WATER DEPARTMENT
MATERIAL SPECIFICATION**

PUSH ON (TYTON) JOINT RESTRAINT

Approved Manufacturers: EBBA Series 1700, U. S. Pipe Field Lock Gaskets

**COLCHESTER WATER DEPARTMENT
MATERIAL SPECIFICATION**

BRASS FITTINGS-CURB STOP VALVES

Inlet: Compression for Type "K" Copper, similar to Mueller 110 compression connection

Outlet: Compression for Type "K" Copper

Approved Manufacturers: Mueller H15209 1 - 2 inch
 Ford B44-444Q 1 inch
 B44-666Q 1 ½ inch
 B44-777Q 2 inch

**COLCHESTER WATER DEPARTMENT
MATERIAL SPECIFICATION**

BRASS FITTINGS-COUPPLERS

Type: Comp X Comp

Nut: Bottoms out on shoulder of coupling. Similar to Mueller 110 compression connection

Body: Cast From 85-5-5-5 ASTM B62 Brass alloy.

Inlet: Comp

Outlet: Comp For Type K Copper. Tubing

Approved Manufacturers: Mueller H-15403
Ford C44Q 1-2 inch

**COLCHESTER WATER DEPARTMENT
MATERIAL SPECIFICATION**

BRASS FITTINGS-CORPS

Type: Ground Key Corporation Stop, meeting ANSI/AWWA C 800

Body: Cast From 85-5-5-5 ASTM B62 Brass alloy.

Inlet: "CC" Thread

Outlet: Compression Connection for CTS O.D. Tubing, similar to Mueller 110
compression connection

Approved Manufacturers: Mueller H-15008 one inch
 Mueller H-15013 1 1/2 and 2 inch
 Ford FB1000-4Q 1 inch
 FB1000-6Q 1 1/2 inch
 FB 1000-7Q 2 inch

**COLCHESTER WATER DEPARTMENT
MATERIAL SPECIFICATION**

BOLTED (DRESSER) COUPLINGS

Type: Ductile iron, epoxy coated, stainless bolts

Approved Manufacturers: Smith Blair 441 or approved equal

**COLCHESTER WATER DEPARTMENT
MATERIAL SPECIFICATION**

TAPPING SLEEVE

Type: Iron Body, Mechanical joint ends comply with ANSI/AWWA Standard C111

Coatings: Asphalt tar varnish

Maximum Working Pressure: 200 PSIG

Outlet Flange: Dimensions and drilling that comply with ANSI B16.1, class 125 and with MSS SP-60

Approved Valves: Mueller-H615

**COLCHESTER WATER DEPARTMENT
MATERIAL SPECIFICATION**

NRS GATE VALVES/TAPPING VALVES

Type: Resilient Wedge, Open right, fully unobstructed flow way, comply with AWWA Standard C509 (Full Wall)

Coatings: The gate valve shall both interior and exterior epoxy coated. The coating shall comply with AWWA Standard C550 and shall be certified to NSF standard 61.

Stem Seals: Stem seals shall be O-ring type.

Stem/Thrust Collar: The Stem and Thrust Collar shall be forged bronze or stainless steel.

Operating Nut Retainer: The cap screw shall be stainless steel to resist corrosion.

Body: Iron

Maximum Working Pressure: 250 PSI

Actuating Nut: 2 inch square nut

Approved Valves: AVK

Clow

Mueller-A2360 Series

-T2360 Series (Tapping Valve)

Kennedy

American Flow Control Series 2500

**COLCHESTER WATER DEPARTMENT
MATERIAL SPECIFICATION**

BLOWOFF/YARD HYDRANT

Type: Post Hydrant, compression type, non freezing, positive automatic drain.

Valve: Brass

Inlets: Male IP

Depth of bury: 3 foot

Approved Manufacturers: Eclipse No.2

END OF SECTION

SECTION 02240

DEWATERING

PART 1 - GENERAL

1.01 WORK INCLUDED:

This section specifies designing, furnishing, installing, maintaining, operating and removing temporary dewatering systems as required to lower and control water levels and hydrostatic pressures during construction; disposing of pumped water; constructing, maintaining, observing and, except where indicated or required to remain in place, removing of equipment and instrumentation for control of the system.

1.02 RELATED WORK:

- A. Section 00890, PERMITS
- B. Section 01570, ENVIRONMENTAL PROTECTION
- C. Section 02252, SUPPORT OF EXCAVATION
- D. Section 02300, EARTHWORK

1.03 SYSTEM DESCRIPTION:

- A. Dewatering includes lowering the water table and intercepting seepage which would otherwise emerge from the slopes or bottom of the excavation; increasing the stability of excavated slopes; preventing loss of material from beneath the slopes or bottom of the excavation; reducing lateral loads on sheeting and bracing; improving the excavation and hauling characteristics of sandy soil; preventing rupture or heaving of the bottom of any excavation; and disposing of pumped water.
- B. Normal dewatering is defined as using conventional pumps installed in open excavations, ditches, or sumps. Special dewatering is defined as using single or two stage wellpoints, deep wells, or eductor and ejector systems installed in drilled holes or jetted in place.

1.04 QUALITY ASSURANCE:

- A. The Contractor is responsible for the adequacy of the dewatering systems. He shall retain the services of a Professional Engineer registered in the state where the project is located, experienced in dewatering systems, to independently evaluate the boring logs and any other soils information available to determine those areas that will require special dewatering techniques and to design the required system. The Contractor's Professional

Engineer shall provide sufficient on-site inspection and supervision to assure that the dewatering is carried out in accordance with his design.

- B. The dewatering systems shall be capable of effectively reducing the hydrostatic pressure and lowering the groundwater levels to a minimum of 2 feet below excavation bottom, unless otherwise required by the Engineer, so that all excavation bottoms are firm and dry.
- C. The dewatering system shall be capable of maintaining a dry and stable subgrade until the structures, pipes and appurtenances to be built therein have been completed to the extent that they will not be floated or otherwise damaged.
- D. The dewatering system and excavation support (see Section 02252) shall be designed so that lowering of the groundwater level within the work area does not adversely affect structures, utilities or wells outside of the work area.
- E. Where special dewatering is used, the Contractor shall obtain at his expense the services of a registered professional engineer to investigate, design and monitor the dewatering system. The Contractor shall also furnish materials and install at least two observation wells at each excavation area. The location of the wells shall be determined in the field by the Contractor's engineer.

1.05 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF GENERAL SPECIFICATIONS, SUBMIT THE FOLLOWING:

- A. At least two weeks prior to installing his dewatering system, Contractor shall submit the attached Certificate of Design completed and signed by Contractor, identifying the engineer responsible for design of the dewatering system. He shall also submit a schedule showing the timing of installation and operation of the dewatering system.
- B. The Contractor shall submit to the Engineer for record purposes only, the following items bearing the Contractor's Engineer's stamp and signature, and identifying the codes and specifications followed in the design.
 - 1. Plans and description of the dewatering system, including the number, location and depth of wells, wellpoints or sumps; designs of filters to prevent pumping of fine soil; method and location for filtering and disposal of pumped water; and flow capacity of proposed system.
 - 2. Locations of observation wells.
- C. The Contractor shall submit records of pump operation and groundwater elevations as required by the Owner's Engineer.

PART 2 - PRODUCTS NOT APPLICABLE

PART 3 - EXECUTION

3.01 DEWATERING OPERATIONS:

- A. All water pumped or drained from the work shall be disposed of in a manner which will not result in undue interference with other work or damage to adjacent properties, pavements and other surfaces, buildings, structures and utilities. Suitable temporary pipes, flumes or channels shall be provided for water that may flow along or across the site of the work. All disposal of pumped water shall conform to the provisions of Section 01570 ENVIRONMENTAL PROTECTION and Section 00890 PERMITS.
- B. Dewatering facilities shall be located where they will not interfere with utilities and construction work to be done by others.
- C. Dewatering procedures to be used shall be as described below:
 - 1. Crushed stone shall encapsulate the suction end of the pump to aid in minimizing the amount of silt discharged.
 - 2. For dewatering operations with relatively minor flows, pump discharges shall be directed into straw bale sedimentation traps lined with filter fabric. Water is to be filtered through the straw bales and filter fabric prior to being allowed to seep out into its natural water course.
 - 3. For dewatering operations with larger flows, pump discharges shall be into a steel dewatering basin. Steel baffle plates shall be used to slow water velocities to increase the contact time and allow adequate settlement of sediment prior to discharge into waterways.
 - 4. Where indicated on the contract drawings or in conditions of excess silt suspended in the discharge water, silt control bags are to be utilized in catchbasins.
- D. The Contractor shall be responsible for repair of any damage caused by his dewatering operations, at no cost to the Owner.

3.02 SPECIAL DEWATERING:

- A. If conventional dewatering methods are inadequate to ensure dry and stable conditions for structural foundations, the Contractor shall be required to use special dewatering as necessary.
- B. Special dewatering techniques may consist of one or two stage wellpoint systems, deep wells, or eductor and ejector type systems. The Contractor shall utilize a system which provides proper construction conditions and prevents settlement at time of installation and upon backfilling.

- C. In areas requiring special dewatering, the Contractor shall lower the groundwater level to a minimum of 2 feet below the bottom of the final excavation grade prior to any installation and maintain that groundwater level until the excavation has been backfilled. The groundwater levels shall be monitored by the Contractor's engineer to ensure conformance with the requirements of these specifications. Construction will not be allowed until the Owner's Engineer is satisfied that the above provisions are met.

3.03 NOISE LEVEL REQUIREMENTS:

- A. All primary dewatering equipment shall be electrically operated and shall run on commercial power. Standby equipment shall be independent of commercial power and shall provide dewatering upon primary pump or power failure.
- B. All operations by the Contractor must meet local noise ordinances, as applicable.

END OF SECTION

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CERTIFICATE OF DESIGN

Re: Contract Between:

OWNER: _____
(Name)

and

CONTRACTOR: _____
(Name)

on

CONTRACT: _____
(Number)

Date: _____

Title: _____

Contractor hereby certifies that _____:
(Engineer)

1. Is licensed or registered to perform professional engineering work in the state of _____;
(Location of Project)
2. Is qualified to design the _____
(Item)
specified in Section _____ of subject contract;
3. Has designed _____ before;
(Item)
4. Has prepared the design in full compliance with the applications and requirements of Section _____ of subject contract including all applicable laws, regulations, rules, and codes; and
5. The work has been signed and sealed pursuant to applicable state law.

FOR: _____
(Contractor)

BY: _____
(Signature)

(Name and Title)

Dated: _____

SECTION 02252

SUPPORT OF EXCAVATION

PART 1 - GENERAL

1.01 WORK INCLUDED:

- A. This section covers wood and steel sheeting or soldier piles and lagging with internal bracing for support of excavations. The requirements of this section shall also apply, as appropriate, to any methods of excavation support and underpinning which the Contractor elects to use to complete the work.
- B. The Contractor shall furnish and place timber or steel sheeting or soldier piles and lagging of the kinds and dimensions required, complying with these specifications, where required by regulation, indicated on the drawings or required by the Engineer.
- C. Vibration monitoring shall be provided during installation and extraction of sheeting whenever the braced excavation is adjacent to existing structures, in critical areas as noted in the contract documents, or as requested by the Engineer.
- D. Routine monitoring of the in-place excavation support system shall be provided.

1.02 RELATED WORK:

- A. Section 02240, DEWATERING
- B. Section 02300, EARTHWORK

1.03 QUALITY ASSURANCE:

- A. This project is subject to the Safety and Health regulations of the U.S. Department of Labor set forth in 29 CFR, Part 1926, and to the Connecticut Occupational Safety and Health Act (Chapter 571 of the Connecticut General Statutes). Contractors shall be familiar with the requirements of these regulations.
- B. The Contractor is responsible for the adequacy of the excavation support system and shall retain the services of a Professional Engineer registered in the State of Connecticut, hereinafter referred to as the "Contractor's Engineer", shall design the required excavation support systems. The Contractor's Professional Engineer shall practice in a discipline applicable to excavation work, shall have experience in the design of excavation support systems and shall design in conformance with OSHA requirements. The Contractor's Professional Engineer shall provide sufficient on-site inspection and supervision to assure that the excavation support system is installed and functions in accordance with his design. Criteria listed herein defining the responsibilities of the Contractor's Professional Engineer are minimum requirements.

1.04 REFERENCES:

The following standards form a part of this specification as referenced herein.

American Society for Testing and Materials (ASTM)

ASTM A6 General Requirements for Rolled Steel Plates, Shapes, Sheet Piling, and Bars for Structural Use

ASTM A328 Steel Sheet Piling

1.05 SUBMITTALS:

- A. At least three weeks before starting installation of the excavation support system, the Contractor shall submit the attached Certificate of Design completed and signed by the Contractor and the Professional Engineer, identifying the Contractor's Professional Engineer who will be responsible for design of the excavation support system, and including, for record purposes only:
1. An overall time schedule for construction of the braced excavation system.
 2. A description of the anticipated sequence of construction.
 3. Three (3) copies each of:
 - a. Complete details of braced excavation methods, equipment and sizes and lengths of materials proposed to be used.
 - b. Details of vibration monitoring devices and reports.
 - c. Details of the means and methods that will be used in monitoring the integrity of the support system during its entire period of use to insure the safety of the excavation.
 - d. Complete computations for the design of the braced excavation system bearing the seal of the responsible Professional Engineer duly registered licensed to practice within a discipline applicable to excavation work, in the state where the project is located.
 - e. Any other pertinent data required for record purposes by the Engineer.
- B. Receipt of the information by the Engineer will not relieve the Contractor of the sole responsibility for the adequacy of the braced excavation system, and for assuring that there will be no resulting damage to adjacent pavement, utilities or structures, and for providing safe conditions within the sheeted areas.

- C. Further for the record, upon completion of the work of this section, the Contractor shall submit 3 copies of all records of survey, vibration monitoring and inspection of existing structures to the Owner's Engineer.

PART 2 - PRODUCTS

2.01 MATERIALS:

- A. Timber sheeting shall be sound spruce, pine, or hemlock, and either tongue and grooved or splined. Timber sheeting shall not be less than nominal 2-inches thick.
- B. Where steel sheet piling is indicated on the drawings or installation is ordered by the Engineer or required by OSHA standards, the material shall be of such size and strength as required by the excavation support design prepared and submitted by the Contractor's Professional Engineer. Steel sheet piling may be new or used material but shall not contain splices, cutouts, patches, or other alterations which would impair its integrity or strength. Steel sheeting shall be an approved standard section, weighing not less than 22 pounds per square foot of wall and conforming to ASTM A6 and A328.
- C. Where soldier piles and lagging are used, the steel piles shall conform to ASTM A6, and the lagging shall meet the requirements for timber sheeting, as defined above.
- D. Timber and steel used for bracing shall be of such size and strength as required in the excavation support design prepared and submitted by the Contractor's Professional Engineer. Timber or steel used for bracing shall be new or undamaged used material which does not contain splices, cutouts, patches, or other alterations which would impair its integrity or strength.

PART 3 - EXECUTION

3.01 INSTALLATION:

- A. Work shall not be started until all materials and equipment necessary for construction are either on the site of the work or satisfactorily available for immediate use as required.
- B. The sheeting/lagging shall be sufficiently tight to minimize any resulting lowering of the groundwater level outside the excavation, as required in Section 02240, DEWATERING.
- C. The sheeting/piling shall be driven by approved means to the design elevation. No ends or edges of sheeting/piling shall be left exposed in a manner which could create a possible hazard to safety of the public or a hindrance to traffic of any kind.
- D. If boulders or very dense soils are encountered, making it impractical to drive a sheeting/piling section to the desired depth, the section shall be treated as directed by the Contractor's Engineer.
- E. Within seven days of completing the initial installation of the earth support system, the Contractor shall submit a certification from his Professional Engineer, stating that the

excavation support system as installed is in general compliance with the design or approved modifications thereto.

- F. The sheeting/piling shall be left in place where indicated on the drawings or required by the Engineer in writing. At all other locations, the sheeting/piling may be left in place or salvaged at the option of the Contractor. Wood or steel sheeting/piling permanently left in place shall be cut off at a depth of not less than two feet below finish grade unless otherwise required.
- G. All cut-off material are the property of the Contractor and shall be promptly removed by it from the site.
- H. The satisfactory construction and maintenance of the excavation support system, complete in place, shall be the responsibility of the Contractor.
- I. The Contractor shall be responsible for promptly repairing all damage to adjacent structures caused by the installation, performance, or removal of the excavation support system.

END OF SECTION

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CERTIFICATE OF DESIGN

RE: Contract between

OWNER:

and

CONTRACTOR:

on

CONTRACT:

_____	(Name)
_____	(Name)
_____	(Title)
_____	(Date)
(Number)	(Date)

The undersigned hereby certify that the engineer listed below:

1. Is a licensed or registered to perform professional engineering work in the State of Connecticut.
2. Is qualified by education and training to design the _____ specified in Section _____ of subject contract;
3. Has previously designed comparable excavation support systems;
4. Has prepared the design in full compliance with the requirements of subject contract, including all applicable laws, regulations, rules, and codes; and
5. Will inspect and supervise installation of the excavation support system and will monitor the in-place system to confirm that the system is installed and functions in accordance with the design.

CONTRACTOR

ENGINEER

By: _____
(Signature)

By: _____
(Signature)

(Name)

(Name)

(Title)

(Engineering Discipline)

(Date)

(Date)

SECTION 02300

EARTHWORK

PART 1 - GENERAL

1.01 WORK INCLUDED:

The Contractor shall make excavations of normal depth in earth for trenches and structures, shall backfill and compact such excavations to the extent necessary, shall furnish the necessary material and construct embankments and fills, and shall make miscellaneous earth excavations and do miscellaneous grading.

1.02 RELATED WORK:

- A. Section 00890, PERMITS
- B. Section 01110, CONTROL OF WORK AND MATERIALS
- C. Section 01570, ENVIRONMENTAL PROTECTION
- D. Section 02230, CLEARING AND GRUBBING
- E. Section 02240, DEWATERING
- F. Section 02252, SUPPORT OF EXCAVATION
- G. Section 02745, PAVING

1.03 REFERENCES:

American Society for Testing and Materials (ASTM)

ASTM	C131	Test Method for Resistance to Degradation of Small Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
ASTM	C136	Method for Sieve Analysis of Fine and Coarse Aggregates.
ASTM	C330	Specification for Lightweight Aggregate for Structural Concrete.
ASTM	D1556	Test Method for Density of Soil in Place by the Sand Cone Method.
ASTM	D1557	Test Methods for Moisture-density Relations of Soils and Soil Aggregate Mixtures Using Ten-pound (10 Lb.) Hammer and Eighteen-inch (18") Drop.

ASTM D2922 Test Methods for Density of Soil and Soil-aggregate in Place by Nuclear Methods (Shallow Depth).

Connecticut Department of Transportation Standard Specification for Highways and Bridges (Form 817).

1.04 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF GENERAL SPECIFICATIONS, SUBMIT THE FOLLOWING:

Samples of all materials proposed for the project shall be submitted to the Engineer for review. Size of the samples shall be as approved by the Engineer.

1.05 PROTECTION OF EXISTING PROPERTY:

- A. The work shall be executed in such manner as to prevent any damage to facilities at the site and adjacent property and existing improvements, such as but not limited to streets, curbs, paving, service utility lines, structures, monuments, bench marks, observation wells, and other public or private property. Protect existing improvements from damage caused by settlement, lateral movements, undermining, washout and other hazards created by earthwork operations.
- B. In case of any damage or injury caused in the performance of the work, the Contractor shall, at its own expense, make good such damage or injury to the satisfaction of, and without cost to, the Owner. Existing roads, sidewalks, and curbs damaged during the project work shall be repaired or replaced to at least the condition that existed at the start of operations. The Contractor shall replace, at his own cost, existing benchmarks, observation wells, monuments, and other reference points which are disturbed or destroyed.
- C. Buried drainage structures and pipes, observation wells and piezometers, including those which project less than eighteen inches (18") above grade, which are subject to damage from construction equipment shall be clearly marked to indicate the hazard. Markers shall indicate limits of danger areas, by means which will be clearly visible to operators of trucks and other construction equipment and shall be maintained at all times until completion of project.

1.06 DRAINAGE:

- A. The Contractor shall provide, at its own expense, adequate drainage facilities to complete all work items in an acceptable manner. Drainage shall be done in a manner so that runoff will not adversely affect construction procedures nor cause excessive disturbance of underlying natural ground or abutting properties.

1.07 FROST PROTECTION AND SNOW REMOVAL:

- A. The Contractor shall, at its own expense, keep earthwork operations clear and free of accumulations of snow as required to carry out the work.

- B. The Contractor shall protect the subgrade beneath new structures and pipes from frost penetration when freezing temperatures are expected.

PART 2 - PRODUCTS

2.01 MATERIAL:

A. GRAVEL BORROW:

Gravel Borrow shall satisfy the requirements listed in CONN DOT Article M. 02.01-2, Grading A.

B. SAND BORROW:

Sand borrow shall satisfy the requirements listed for fine aggregate in CONN DOT Article M.03.01-2.

C. CRUSHED STONE:

Crushed stone shall satisfy the requirements listed in CONN DOT Article M.02.06, Grading "C".

D. PEASTONE:

Peastone shall be smooth, hard, naturally occurring, rounded stone meeting the following gradation requirements:

Passing 5/8-inch square sieve opening	-	100%
Passing No. 8 sieve opening	-	0%

E. BACKFILL MATERIALS:

1. Class B Backfill:

Class B backfill shall be granular, well graded friable soil; free of rubbish, ice, snow, tree stumps, roots, clay and organic matter; with 30 percent or less passing the No. 200 sieve; no stone greater than two-third (2/3) loose lift thickness, or six inches, whichever is smaller.

2. Select Backfill:

Select backfill shall be granular, well graded friable soil, free of rubbish, ice, snow, tree stumps, roots, clay and organic matter, and other deleterious or organic material; graded within the following limits:

<u>Sieve Size</u>	<u>Percent Finer by Weight</u>
3"	100
No. 10	30-95
No. 40	10-70
No. 200	0-10

F. PROCESSED GRAVEL:

1. Processed gravel shall consist of inert material that is hard, durable stone and coarse sand, free from loam and clay, surface coatings and deleterious materials. The coarse aggregate shall have a percentage of wear, by the Los Angeles Abrasion Test, of not more than 50.

2. The gradation shall meet the following requirements:

<u>Sieve Designation</u>	<u>Percentage Passing</u>
3 in.	100
1 1/2 in.	70-100
3/4 in.	50-85
No. 4	30-60
No. 200	0-10

3. The approved source of bank-run gravel material shall be processed by mechanical means. The equipment for producing crushed gravel shall be of adequate size with sufficient adjustments to produce the desired materials. The processed material shall be stockpiled in such a manner to minimize segregation of particle sizes. All processed gravel shall come from approved stockpiles.

PART 3 - EXECUTION

3.01 DISTURBANCE OF EXCAVATED AND FILLED AREAS DURING CONSTRUCTION:

A. Contractor shall take the necessary steps to avoid disturbance of subgrade during excavation and filling operations, including restricting the use of certain types of construction equipment and their movement over sensitive or unstable materials, dewatering and other acceptable control measures.

B. All excavated or filled areas disturbed during construction, all loose or saturated soil, and other areas that will not meet compaction requirements as specified herein shall be removed and replaced with a minimum 12-inch layer of compacted crushed stone wrapped all around in non-woven filter fabric. Costs of removal and replacement shall be borne by the Contractor.

- C. The Contractor shall place a minimum of 12-inch layer of special bedding materials and crushed stone wrapped in filter fabric over the natural underlying soil to stabilize areas which may become disturbed as a result of rain, surface water runoff or groundwater seepage pressures, all at no additional cost to the Owner. The Contractor also has the option of drying materials in-place and compacting to specified densities.

3.02 EXCAVATION:

A. GENERAL:

1. The Contractor shall perform all work of any nature and description required to accomplish the work as shown on the Drawings and as specified.
2. Excavations, unless otherwise required by the Engineer, shall be carried only to the depths and limits shown on the Drawings. If unauthorized excavation is carried out below required subgrade and/or beyond minimum lateral limits shown on Drawings, it shall be backfilled with gravel borrow and compacted at the Contractor's expense as specified below, except as otherwise indicated. Excavations shall be kept in dry and good conditions at all times, and all voids shall be filled to the satisfaction of the Engineer.
3. In all excavation areas, the Contractor shall strip the surficial topsoil layer and underlying subsoil layer separate from underlying soils. In paved areas, the Contractor shall first cut pavement as specified in paragraph 3.02 B.1 of this specification, strip pavement and pavement subbase separately from underlying soils. All excavated materials shall be stockpiled separately from each other within the limits of work.
4. The Contractor shall follow a construction procedure, which permits visual identification of stable natural ground. Where groundwater is encountered, the size of the open excavation shall be limited to that which can be handled by the Contractor's chosen method of dewatering and which will allow visual observation of the bottom and backfill in the dry.
5. The Contractor shall excavate unsuitable materials to stable natural ground where encountered at proposed excavation subgrade, as required by the Engineer. Unsuitable material includes topsoil, loam, peat, other organic materials, snow, ice, and trash. Unless specified elsewhere or otherwise required by the Engineer, areas where unsuitable materials have been excavated to stable ground shall be backfilled with compacted special bedding materials or crushed stone wrapped all around in non-woven filter fabric.

B. TRENCHES:

1. Prior to excavation, trenches in pavement shall have the traveled way surface cut in a straight line by a concrete saw or equivalent method, to the full depth of pavement. Excavation shall only be between these cuts. Excavation support shall

be provided as required to avoid undermining of pavement. Cutting operations shall not be done by ripping equipment.

2. The Contractor shall satisfy all dewatering requirements specified in Section 02240 DEWATERING, before performing trench excavations.
3. Trenches shall be excavated to such depths as will permit the pipe to be laid at the elevations, slopes, and depths of cover indicated on the Drawings. Trench widths shall be as shown on the Drawings or as specified.
4. Where pipe is to be laid in bedding material, the trench may be excavated by machinery to, or just below, the designated subgrade provided that the material remaining in the bottom of the trench is not disturbed.
5. If pipe is to be laid in embankments or other recently filled areas, the fill material shall first be placed to a height of at least 12-inches above the top of the pipe before excavation.
6. Pipe trenches shall be made as narrow as practicable and shall not be widened by scraping or loosening materials from the sides. Every effort shall be made to keep the sides of the trenches firm and undisturbed until backfilling has been completed.
7. If, in the opinion of the Engineer, the subgrade, during trench excavation, has been disturbed as a result of rain, surface water runoff or groundwater seepage pressures, the Contractor shall remove such disturbed subgrade to a minimum of 12 inches and replace with crushed stone wrapped in filter fabric. Cost of removal and replacement shall be borne by the Contractor.

C. BUILDING AND FOUNDATION EXCAVATION:

1. Excavations shall not be wider than required to set, brace, and remove forms for concrete, or perform other necessary work.
2. After the excavation has been made, and before forms are set for footings, mats, slabs, or other structures, and before reinforcing is placed, all loose or disturbed material shall be removed from the subgrade. The bearing surface shall then be compacted to meet the requirements of this specification.
3. If, in the opinion of the Engineer, the existing material at subgrade elevation is unsuitable for structural support, the Contractor shall excavate and dispose of the unsuitable material to the required width and depth as required by the Engineer. If, in the opinion of the Engineer, filter fabric is required; the Contractor shall place filter fabric, approved by the Engineer, as per manufacturer's recommendations. Crushed stone shall then be placed in lifts and compacted to required densities. Backfill shall be placed to the bottom of the proposed excavation.

D. EXCAVATION NEAR EXISTING STRUCTURES:

1. Attention is directed to the fact that there are pipes, manholes, drains, and other utilities in certain locations. An attempt has been made to locate all utilities on the drawings, but the completeness or accuracy of the given information is not guaranteed.
2. As the excavation approaches pipes, conduits, or other underground structures, digging by machinery shall be discontinued and excavation shall be done by means of hand tools, as required. Such manual excavation, when incidental to normal excavation, shall be included in the work to be done under items involving normal excavation.
3. Where determination of the exact location of a pipe or other underground structure is necessary for properly performing the work, the Contractor shall excavate test pits to determine the locations.

3.03 BACKFILL PLACEMENT AND COMPACTION:

A. GENERAL:

1. Prior to backfilling, the Contractor shall compact the exposed natural subgrade to the densities as specified herein.
2. After approval of subgrade by the Engineer, the Contractor shall backfill areas to required contours and elevations with specified materials.
3. The Contractor shall place and compact materials to the specified density in continuous horizontal layers, not to exceed nine (9) inches in uncompacted lifts. The degree of compaction shall be based on maximum dry density as determined by ASTM Test D1557, Method C. The minimum degree of compaction for fill placed shall be as follows:

<u>Location</u>	<u>Percent of Maximum Density</u>
Below pipe centerline	95
Above pipe centerline	92
Below pavement (upper 3 ft.)	95
Embankments	95
Below pipe in embankments	95
Adjacent to structures	92
Below structures	95

4. The Engineer reserves the right to test backfill for conformance to the specifications and Contractor shall assist as required to obtain the information. Compaction testing will be performed by the Engineer or by an inspection laboratory designated

by the Engineer, engaged and paid for by the Owner. If test results indicate work does not conform to specification requirements, the Contractor shall remove or correct the defective Work by recompacting where appropriate or replacing as necessary and approved by the Engineer, to bring the work into compliance, at no additional cost to the Owner. All backfilled materials under structures and buildings shall be field tested for compliance with the requirements of this specification.

5. Where horizontal layers meet a rising slope, the Contractor shall key each layer by benching into the slope.
6. If the material removed from the excavation is suitable for backfill with the exception that it contains stones larger than permitted, the Contractor has the option to remove the oversized stones and use the material for backfill or to provide replacement backfill at no additional cost to the Owner.
7. The Contractor shall remove loam and topsoil, loose vegetation, stumps, large roots, etc., from areas upon which embankments will be built or areas where material will be placed for grading. The subgrade shall be shaped as indicated on the Drawings and shall be prepared by forking, furrowing, or plowing so that the first layer of the fill material placed on the subgrade will be well bonded to the subgrade.

B. TRENCHES:

1. Bedding as detailed and specified shall be furnished and installed beneath the pipeline prior to placement of the pipeline. A minimum bedding thickness shall be maintained between the pipe and undisturbed material, as shown on the Drawings.
2. As soon as practicable after pipes have been laid, backfilling shall be started.
3. Unless otherwise indicated on the Drawings, select backfill shall be placed by hand shovel in 6-inch thick lifts up to a minimum level of 12-inches above the top of pipe. This area of backfill is considered the zone around the pipe and shall be thoroughly compacted before the remainder of the trench is backfilled. Compaction of each lift in the zone around the pipe shall be done by use of power-driven tampers weighing at least 20 pounds or by vibratory compactors. Care shall be taken that material close to the bank, as well as in all other portions of the trench, is thoroughly compacted to densities required.
4. Class B backfill shall be placed from the top of the select backfill to the specified material at grade (loam, pavement subbase, etc.). Fill compaction shall meet the density requirements of this specification.
5. Water Jetting:

- a. Water jetting may be used when the backfill material contains less than 10 percent passing the number 200 sieve, but shall be used only if approved by the Engineer.
 - b. Contractor shall submit a detailed plan describing the procedures he intends to use for water jetting to the Engineer for approval prior to any water jetting taking place.
 - c. Compaction of backfill placed by water jetting shall conform to the requirements of this specification.
6. If the materials above the trench bottom are unsuitable for backfill, the Contractor shall furnish and place backfill materials meeting the requirements for trench backfill, as shown on the drawings or specified herein.
 7. Should the Engineer order crushed stone for utility supports or for other purposes, the Contractor shall furnish and install the crushed stone as required.
 8. In shoulders of streets and roads, the top 12-inch layer of trench backfill shall consist of crushed or uncrushed gravel, satisfying the requirements listed in CONN DOT standard specification M02.04.
 9. Subbase shall consist of bank or crushed gravel meeting the requirements of CONN DOT standard specification M.02.02.

C. BACKFILLING UNDER BUILDINGS AND FOUNDATIONS:

Material to be used as structural fill under structures shall be special bedding material or gravel borrow, as shown on the Drawings or as required by the Engineer. Where gravel borrow fill is required to support proposed footings, walls, slabs, and other structures, the material shall be placed in a manner accepted by the Engineer. Compaction of each lift shall meet the density requirements of this specification.

D. BACKFILLING ADJACENT TO STRUCTURES:

1. The Contractor shall not place backfill against or on structures until they have attained sufficient strength to support the loads to which they will be subjected. Excavated material approved by the Engineer may be used in backfilling around structures. Backfill material shall be thoroughly compacted to meet the requirements of this specification.
2. Contractor shall use extra care when compacting adjacent to pipes and drainage structures. Backfill and compaction shall proceed along sides of drainage structures so that the difference in top of fill level on any side of the structure shall not exceed two feet (2') at any stage of construction.

3. Where backfill is to be placed on only one side of a structural wall, only hand-operated roller or plate compactors shall be used within a lateral distance of five feet (5') of the wall for walls less than fifteen feet (15') high and within ten feet (10') of the wall for walls more than fifteen feet (15') high.

3.04 DISPOSAL OF SURPLUS MATERIALS:

- A. No excavated material shall be removed from the site of the work or disposed of by the Contractor unless approved by the Engineer.
- B. Surplus excavated materials, which are acceptable to the Engineer, shall be used to backfill normal excavations in rock or to replace other materials unacceptable for use as backfill. Upon written approval of the Engineer, surplus excavated materials shall be neatly deposited and graded so as to make or widen fills, flatten side slopes, or fill depressions; or shall be neatly deposited for other purposes as indicated by the Owner, within its jurisdictional limits; all at no additional cost to the Owner.
- C. Surplus excavated material not needed as specified above shall be hauled away and disposed of by the Contractor at no additional cost to the Owner, at appropriate locations, and in accordance with arrangements made by him. Disposal of all rubble shall be in accordance with all applicable local, state and federal regulations.

END OF SECTION

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SECTION 02513

INSULATION FOR PIPELINES

PART 1 - GENERAL

1.01 WORK INCLUDED:

This Section covers the furnishing of all material, accessories, labor, and equipment necessary to insulate the pipelines where shown on the drawings and where so required by the Engineer.

1.02 RELATED WORK:

- A. Section 02080, DUCTILE IRON PIPE AND FITTINGS
- B. Section 02300, EARTHWORK

1.03 REFERENCES:

- A. The following standards form a part of this specification as referenced:

American Society for Testing and Materials (ASTM)

ASTM C552 Specification for Cellular Glass Block and Pipe Thermal Insulation

1.04 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF GENERAL SPECIFICATIONS, SUBMIT THE FOLLOWING:

- A. Six sets of manufacturer's literature of the materials of this section and installation instructions for the products being provided for the project shall be submitted to the Engineer for review.
- B. A sample of the insulation shall be submitted to the Engineer.

PART 2 - PRODUCTS

2.01 INSULATION: DIRECT BURIED PIPE

- A. Insulation shall be cellular glass type. The insulation shall be a cellular glass product that is made specifically for thermal insulation of piping and is compatible with the piping material. Insulation shall be a minimum of 2 inches thick, unless otherwise shown on the drawings.

- B. Insulation shall be composed of all glass sealed cells having no binders or fillers. The completed product shall be rigid and impermeable, with an ultimate compressive strength of at least 90 psi. The thermal conductivity of the cellular glass shall be no higher than 0.29 BTU-in./hr • ft² • °F @ 75°F and 0.28 BTU-in./hr • ft² • °F @ 50°F.
- C. The cellular glass insulation shall comply with all requirements of ASTM C552. The cellular glass shall be fabricated in half sections whenever possible.
- D. Bands for securing the insulation to the pipe shall be 0.5 inches wide by 0.020 inches thick made of stainless steel.
- E. The jacketing for the insulation shall be one of the following methods:
 1. A 125 mil (3mm) thick, heat sealed high polymer asphaltic membrane with an integral glass scrim and integral 1 mil (.02mm) aluminum foil and a thin Mylar film on the surface, equal to Pittwrap Jacketing as manufactured by Pittsburgh Corning or equal.
 2. Mastic - asphalt cutback mastic, equal to Pittcote 300 Finish, as manufactured by Pittsburgh Corning or equal.
 3. Reinforcing fabric - an open mesh polyester fabric with a 6 x 5.5 mesh/inch configuration, equal to PC Fabric 79, as manufactured by Pittsburgh Corning or equal.
- F. The insulation shall be "Foamglass" with jacketing as manufactured by Pittsburgh Corning Corporation, Pittsburgh, PA, or an approved equal. A minimum of 6" layer of fine sand shall surround the insulated pipe before rock free backfill is used in the trench.
- G. The Foamglass and jacketing shall be installed per the manufacturer instructions included in the approved shop drawings.
- H. Tees, valves, and bends shall be covered with form fitting factory made sections.

PART 3 - EXECUTION

3.01 INSTALLATION:

- A. Cellular glass shall not be applied to the piping until the piping has been wiped clean and supported so that there is adequate space to apply the full thickness of insulation and the covering completely around the pipe. The Contractor must obtain the Engineer's approval before the installation begins.
- B. Cellular glass insulation and jacketing shall be applied in accordance with the manufacturers installation procedures included in the approved shop drawings.
- C. There shall be at least three 0.50-inch wide stainless-steel bands secured around each joint and these bands shall be placed not over 9 inches on center on straight sections of pipe.

- D. Tees, valves, and bends shall be covered with form fitting factory made sections.
- E. All testing of the piping system, such as hydrostatic, x-ray or other such testing, shall be accomplished prior to application of insulation.

END OF SECTION

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SECTION 02514

HYDRANTS AND VALVES

PART 1 - GENERAL

1.01 WORK INCLUDED:

- A. This Section covers the furnishing and installation of all outside hydrants, valves and appurtenances as indicated on the drawings and as specified herein.
- B. Pipe and couplings shall be specified under the appropriate pipe sections.

1.02 RELATED WORK:

- A. Section 02080, DUCTILE IRON PIPE AND FITTINGS FOR WATER MAINS
- B. Section 02300, EARTHWORK
- C. Section 02516, CONNECTIONS TO EXISTING WATER MAINS

1.03 REFERENCES:

- A. The following standards form a part of this specification:

American Society for Testing and Materials (ASTM)

ASTM	A48	Gray Iron Castings
ASTM	A126	Gray Iron Castings for Valves, Flanges, and Pipe Fittings
ASTM	A536	Ductile Iron Castings
ASTM	B62	Composition Bronze or Ounce Metal Castings
ASTM	D429	Test Method for Rubber Property Adhesion to Rigid Substrate.

American Water Works Association (AWWA)

AWWA	C500	Metal Seated Gate Valves for Water Supply Service
AWWA	C502	Dry-Barrel Fire Hydrants
AWWA	C504	Rubber-Seated Butterfly Valves

AWWA	C509	Resilient-Seated Gate Valves for Water Supply Service
AWWA	C515	Reduced Wall, Resilient-Seated Gate Valves for Water Supply Service
AWWA	C550	Protective Interior Coatings for Valves and Hydrants
		Federal Specifications (FS)
FS	TT-V-51F	Varnish, Asphalt

1.04 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF THE GENERAL SPECIFICATIONS, SUBMIT THE FOLLOWING:

- A. Shop drawings shall be submitted for the hydrants, valves and appurtenances indicating type of joint, and lining and coating, etc., in accordance with the specifications.
- B. Shop drawings shall consist of manufacturer's scale drawings, cuts or catalogs including descriptive literature and complete characteristics and specifications, and code requirements.
- C. Refer to Paragraph 3.01.A for Affidavit of Compliance required to be submitted.

PART 2 - PRODUCTS

2.01 GENERAL:

- A. Valves shall open right (clockwise).
- B. Hydrants shall open right (clockwise).

2.02 HYDRANTS:

- A. Hydrants shall conform to the requirements of AWWA C502. They shall be equipped with a 5-1/4-inch main valve and 6-inch mechanical joint inlet.
- B. Hydrants shall have one 4-1/2-inch pumper and two 2-1/2- inch hose connections. Threads shall be NST.
- C. Hydrant operating and nozzle cap nuts shall be of pentagonal shape and measure one and one half inches from flat to point. The height of the nut shall not be less than one inch.
- D. Hydrants shall be equipped with O-ring packing. Each nozzle cap shall be provided with a Buna-N rubber washer.

- E. All internal operating parts including main valve, main valve seat, drain valve mechanism, operating rod, etc., shall be removable without excavating.
- F. Main valve seats shall be made of brass or bronze and shall screw into a seat ring or sub-seat, which shall also be made of brass or bronze.
- G. Hydrants shall be traffic models with frangible bolts or breakaway couplings. Details of hydrant design shall meet the requirements of the Owner.
- H. For purposes of standardization, hydrants shall be Mueller "Centurion," Model A-423 as manufactured by Mueller Co., Decatur, IL; or "Clow Medallion" Clow Valve Co., Oskaloosa, IA.

2.03 HYDRANT PAINT:

- A. Hydrants shall be thoroughly cleaned and given two shop or field coats of paint in accordance with AWWA C502 and the instructions of the paint manufacturer. Paint color shall be the standard hydrant color of the Owner as follows:
 - 1. Barrel – Bright Yellow
 - 2. Nozzle Caps - White
- B. If the hydrants are delivered with the Owner's standard color, they shall be given one matching field coat of an alkyd gloss enamel. If the hydrants are not delivered with the Owner's standard color, they shall be given two coats of an alkyd gloss enamel, colors as indicated above.
- C. Hydrant paint shall be as manufactured by Sherwin-Williams, Cleveland, OH; Tnemec Company, Inc., Kansas City, MO; or Minnesota Mining and Manufacturing Co. (3M), St. Paul, MN; or approval equal.
- D. Alkyd gloss enamel shall be 801 DTM by Sherwin-Williams, 2H-Tneme by Tnemec; or approved equal. Reflective paint shall be Scotchlite #7211 by 3M.

2.04 RESILIENT SEAT GATE VALVES:

- A. Resilient seat, wedge type gate valves shall be manufactured to meet all applicable requirements of AWWA C509 or AWWA C515. All valves shall be bubble-tight at 400 psi water working pressure, tested in both directions.
- B. Valve bodies shall be of cast or ductile iron and shall have non-rising threaded bronze stems acting through a bronze stem nut. Opening nuts shall be 2-inches square and shall open as specified above. All buried valves shall have mechanical joint ends.
- C. Valve wedges shall be of ductile iron with resilient seating surfaces permanently bonded to the wedges in strict accordance with ASTM D429 or attached to the face of the wedges

with stainless steel screws. Each valve shall have a smooth, unobstructed water way free from sediment pockets.

- D. Valves shall have low friction, torque-reduction thrust bearings. All O-rings and gaskets located above the stem collar shall be removable without taking the valves out of service.
- D. The interior and exterior surfaces of the valves shall have a non-toxic fusion bonded epoxy coating, which is NSF 61 approved and safe for potable water in accordance with AWWA C550.
- F. Valves for horizontal applications shall have Delrin wedge covers and be specifically designed for horizontal installation.
- G. Resilient seat gate valves shall be as manufactured by Clow Valve Co., Oskaloosa, IA; Mueller Co., Decatur, IL; Waterous Co., S. St. Paul, MN; MH Valve, Anniston, AL; Kennedy Valve, Elmira, NY; or approved equal.

2.05 TAPPING SLEEVES AND VALVES:

- A. Tapping sleeves and valves shall consist of a split cast iron or ductile iron sleeve tee with mechanical joint ends on the main and a flange on the branch. Tapping-type gate valves shall have one flange and one mechanical joint end. The valves shall conform to the requirements hereinbefore specified for gate valves and shall be furnished with a 2-inch square operating nut. The Contractor shall be responsible for verifying the outside diameter of the pipe to be tapped.
- B. Oversized valves shall be provided as required to permit the use of full-size cutters. Before backfilling, all exposed portions of bolts used to hold the two halves of the sleeve together shall be heavily coated with two coats of bituminous paint comparable to Inertol No. 66, Special Heavy. Sleeves shall be of cast iron furnished with rubber gaskets. Gaskets shall cover the entire area of flange surfaces.
- C. Tapping sleeves and valves shall be as manufactured by Clow Valve Co., Oskaloosa, IA; Mueller Co., Decatur, IL; American Valve and Hydrant, Birmingham, AL; MH Valve, Anniston, AL; Kennedy Valve, Elmira, NY; US Pipe, Chattanooga, TN; or approved equal.

2.06 BUTTERFLY VALVES:

- A. Buried butterfly valves shall be Class 150B, iron body, rubber seated, with mechanical joint ends. Butterfly valves shall conform to AWWA C504, except as otherwise specified herein. Butterfly valves shall have valve seats designed to provide bubble-tight shutoff at 150 psi upstream and downstream. Butterfly valve operators shall be wheeled and flanged with indicators. Use of wafer valves is unacceptable.

- B. Butterfly valve designs utilizing continuous lining on the internal body surfaces and extending over the flanges, will NOT be acceptable. Valve disks shall seat at an angle of 90 degrees to the axis of the pipe.
- C. Valve seats shall be of molded natural rubber, BUNA-NM or EPDM. Rubber seats may be attached to the body or the disk. If the seat is attached to the disk, the seat ring on the body shall be of stainless steel. Bolts shall extend through the seat.
- D. Seats mounted on the disk shall be securely clamped to the disk. All clamps, retaining rings, and their fasteners shall be Series 300 stainless steel.
- E. The valve disk shall be of either ductile iron conforming to ASTM A536 or Type 304 stainless steel.
- F. The valve shaft shall be Type 300 stainless steel or carbon steel with stainless steel joints. The valve disk and shaft connection shall be by means of mechanically secured taper pins extending through the disk and shaft. Taper pins, lockwashers and nuts shall be 18-8 stainless steel. The shaft seals shall be designed for the use of standard chevron type packing or standard O-ring seals.
- G. The manual operation mechanism shall be firm fixed to the valve body. The operator shall be permanently lubricated, and totally enclosed with a cast iron case, and the nut for buried valves shall turn in the direction specified above to open. The operator for buried valves shall be suitable for submersion. The operator shall have adjustable threaded collars at each end of the stroke.
- H. Butterfly valves shall be as manufactured by MH Valve Company, Anniston, AL; Keystone Valves USA, Houston, TX; Henry Pratt Company, Aurora, IL; or approved equal and shall conform to the above specifications.

2.07 DAMPENED SWING CHECK VALVES:

- A. Provide swing check valves with weighted arm plus an externally mounted air cushion cylinder APCO Series 6000 as manufactured by Valve and Primer Corporation, Inc.; Golden-Anderson Figure 250-D as manufactured by GA Industries, Cranberry Township, PA, or approved equal.
- B. The dampened swing check valves shall be flanged with cast iron body, bronze seat ring and continuous stainless-steel shaft connected to an external lever and weight and bronze air cushion cylinder.
- C. Valves shall be full ported and prevent reverse flow when the inlet pressure becomes less than the downstream pressure and shall be tight seated.
- D. The disc shall be cast iron, utilizing a double clevis hinge connected to a ductile iron disc arm. The disc arm assembly shall be suspended from the stainless-steel shaft.

- E. The air cushion cylinder shall be constructed of corrosion resistant material and the piston shall be totally enclosed within the cylinder (not open at one end). The cushion cylinder assembly shall be externally attached to the right side of the valve body looking downstream and be adjustable to cushion the closure of the valve. Cushioning shall be by air trapped in the cushion cylinder, which shall be fitted with a one-way adjustable control check valve to cushion disc contact to the seat at the shut-off point.

2.10 VALVE BOXES AND EXTENSIONS:

- A. Valve boxes shall be manufactured in North America. The minimum outside diameter of the boxes shall be 5½-inches and the lengths shall be as necessary to suit the ground elevation and the depth of each valve operator, regardless of the depth of cover.
- B. When there is more than 6 feet of cover, valve operators shall have non-rising extension stems which raise the operating nut to a depth of approximately 4 feet below grade. The extension stem shall have a centering support ring at the upper end. The lower socket shall be tapped with a set screw into the valve nut to prevent the extension stem from lifting off the valve nut.
- C. Each valve shall be provided with a box which has a close fitting 7-1/4-inch diameter cover and is substantially dirt-tight. The top of the cover shall be flush with the top of the box rim. The word "WATER" shall be cast in the top of the cover.
- D. Valve boxes shall be of cast iron and of the adjustable sliding, heavy pattern type. They shall be so designed and constructed as to prevent direct transmission of traffic loads to the pipe or valve. The upper or sliding section of the box shall be provided with a flange on the top of the section (not on the bottom) having sufficient bearing area to prevent undue settlement. The lower section of the box shall be designed to enclose the operating nut and stuffing box of the valve and to rest on the backfill. The boxes shall be adjustable through at least 6 inches vertically without reduction of lap between sections to less than 8-inches.

PART 3 - EXECUTION

3.01 AFFIDAVIT OF COMPLIANCE

- A. The manufacturer shall furnish as part of the shop drawing submittal the Engineer with an affidavit stating that valve(s), hydrants conform to the applicable requirements of the applicable AWWA Standard and the Engineer's specifications, and that all tests specified therein have been performed and all test requirements have been met and the test date.
- B. A copy of the Affidavit of Compliance shall be delivered to the construction site attached to each valve and/or hydrant furnished. The Affidavit shall be attached to the valve or hydrant inside a waterproof pouch.
- C. Any valve or hydrant received without the required affidavit shall be removed from the project and replaced at no expense to the Owner.
- D. All materials shall be certified "NEW". No reconditioned or repaired materials are permitted. Any reconditioned or repaired materials furnished or installed shall be removed and replaced with new materials at no expense to the Owner.

3.02 INSTALLATION:

- A. All valves shall be carefully installed and supported in their respective positions free from distortion and strain. Care shall be taken to prevent damage or injury to the valves and appurtenances during handling and installation.
- B. All material shall be carefully inspected for defects in workmanship and all debris and foreign material cleaned out of valve openings and seats. All mechanisms shall be operated to check for proper functioning, and all nuts and bolts checked for tightness.
- C. Valves and other equipment that do not operate easily or are otherwise defective shall be repaired or replaced at the Contractor's expense.
- D. Hydrants shall be set plumb. Earth fill shall be carefully tamped around the hydrants to a distance of 4 feet on all sides of the hydrant, or to the undisturbed trench face, if less than 4 feet. Hydrants and connecting pipe shall have at least the same depth of cover as the distributing main. Hydrants shall be set upon a layer of stone or a slab of concrete not less than 4-inches thick and 15-inches square. The side of the hydrant opposite the pipe connection shall be firmly wedged against the vertical face of the trench with a concrete thrust block, as indicated on the drawings.
- E. Broken stone shall be placed around the base of the hydrant at the location of the drain hole and backfill around the hydrant shall be thoroughly compacted to the grade line in a satisfactory manner. Hydrants shall have the interiors cleaned of all foreign matter before installation and shall be inspected in both the open and closed positions.

- F. The body of the hydrant shall be of sufficient length to allow the hydrant to be set at the proper elevation, as shown on the drawings. Extensions shall be furnished and installed at the Contractor's expense, when required for greater depths.
- F. Valve boxes shall be set plumb, flush with the ground or paved surface, and centered directly over the operating nut of the valves. Earth fill shall be carefully tamped around the valve boxes to a distance of 4 feet on all sides of the boxes or to the undisturbed trench face, if less than 4 feet.
- G. Valves shall be operational and accessible at all times during construction and warranty period. The Contractor shall verify proper operation of all valves in the presence of the Engineer and/or Owner following completion of the project and prior to the acceptance of Substantial Completion.

END OF SECTION

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SECTION 02516

CONNECTIONS TO EXISTING WATER MAINS

PART 1 - GENERAL

1.01 WORK INCLUDED:

- A. This section covers connections to existing water mains, complete.
- B. The Contractor shall furnish all pipe, fittings, valves, tapping machines, if required, and appurtenances. The Contractor shall do all excavation and backfill as required.

1.02 RELATED WORK:

- A. Section 02080, DUCTILE IRON PIPE AND FITTINGS.
- B. Section 02514, HYDRANTS AND VALVES. (Tapping sleeves and valves specified)
- C. Section 03302, FIELD CONCRETE.

PART 2 - PRODUCTS: NOT APPLICABLE

PART 3 - EXECUTION

3.01 CONTRACTOR OPERATIONS:

- A. The Contractor shall make all connections to the existing mains as indicated on the drawings and as herein specified.
- B. The Contractor shall develop a program for the construction and putting into service of the new work subject to the approval of the Engineer. All work involving cutting into and connecting to the existing work shall be planned so as to interfere with operation of the existing facilities for the shortest possible time and when the demands on the system best permit such interference even to the extent of working outside of normal working hours to meet these requirements.
- C. The Contractor shall have all possible preparatory work done prior to making the connection and shall provide all labor, tools, material, and equipment required to do the work in one continuous operation.
- D. The Contractor shall have no claim for additional compensation, by reason of delay or inconvenience, for adapting his operations to the needs of the Owner's water supply. No damages shall be claimed by the Contractor for delays in dewatering pipelines nor shall any

damages be claimed because of water leaking through closed valves after dewatering is completed.

- E. Existing pipeline that is not to be abandoned but if damaged by the Contractor during the work shall be replaced by him at his own expense in a manner approved by the Engineer.

3.02 TAPPING CONNECTION TO EXISTING MAINS:

- A. Tapping connections to the existing mains, where indicated on the drawings, shall be made with service pressure in the main, using tapping sleeves and valves and a suitable tapping machine.
- B. Other connections to existing mains shall be made with the main out of service, unless otherwise required by the Engineer. Such connections will not require tapping sleeves and valves but connections as indicated on the drawings.

END OF SECTION

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SECTION 02745

PAVING

PART 1 - GENERAL

1.01 WORK INCLUDED:

The Contractor shall furnish all labor, materials and equipment and shall replace the pavements as indicated on the drawings and as herein specified.

1.02 RELATED WORK:

- A. Section 00890, PERMITS
- B. Section 02300, EARTHWORK

1.03 SYSTEM DESCRIPTION:

A. TYPE 1. PERMANENT TRENCH PAVEMENT

Areas shall be paved with temporary trench binder course pavement, 2-inches thick, as soon as practicable after installation of individual pipeline segments. Temporary pavement shall be maintained a minimum of 90 days prior to installation of permanent trench binder course pavement, 2 inches thick and permanent trench top course pavement, 1-1/2-inches thick. This may require that the temporary pavement be maintained until the following year, at which time the permanent pavement shall be installed. Permanent trench binder course and trench top course pavement shall be installed only with the approval of the Engineer.

1.04 REFERENCES

The following standards form a part of these specifications and indicate the minimum standards required:

American Society for Testing and Materials (ASTM)

ASTM D1557 Test for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 Pound Rammer and 18-Inch Drop

State of Connecticut Department of Transportation (CT DOT)

Form 817 Standard Specifications for Roads, Bridges and Incidental Construction

4.03 Cold-Reclaimed Asphalt Pavement

4.06 Bituminous Concrete (Recycle or Crushed Glass Option)

1.05 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF GENERAL SPECIFICATIONS, SUBMIT THE FOLLOWING:

Six sets of complete job mix formula shall be submitted to the Engineer at least two weeks before any of the work of this section is to begin.

PART 2 - PRODUCTS

2.01 GRAVEL SUBBASE:

- A. Gravel subbase shall consist of inert material that is hard durable stone and coarse sand, free from loam and clay, surface coatings and deleterious materials.
- B. Gradation requirements for gravel subbase shall be as specified in Article M.05.01 Processed Aggregate Base and Pavement Surface Treatment.

2.02 BITUMINOUS CONCRETE PAVEMENT:

- A. Bituminous concrete pavements shall consist of Classes 1, 2 and 4 Bituminous Concrete.
- B. Bituminous concrete mixtures shall be within the composition limits of base courses, binder courses, top courses and surface treatment, in accordance with Article M.04.02 Mix Design and Job Mix Formula, with constituents that conform to Table A, below.

TABLE A
PERCENT BY WEIGHT PASSING SIEVE DESIGNATION

Standard Sieves	Class 1	Class 2	Class 4
2 in	-	-	100
1 in	100	-	-
¾ in	90-100	-	60-80
½ in	70-100	100	-
3/8 in	60-82	90-100	42-66
¼ in	-	-	-
No.4	40-65	55-80	30-55
No.8	28-50	40-64	20-40
No.30	10-32	16-36	-
No.50	6-26	8-26	5-18
No.200	3-8	3-8	0-5
PG Binder Content, %	5-6.5	5-8	4-6

* Percentages shown for aggregate sizes are stated as proportional percentages of total aggregate for the mix.

- C. The joint sealant shall be a hot poured rubberized emulsified asphalt sealant, meeting the requirements of Article M.04.01 Joint Seal Material.
- D. The tack coat shall be an asphalt emulsion, RS-1, conforming to Article M.04.01 Bituminous Concrete Materials.

2.03 PAVEMENT MARKINGS:

- A. Pavement markings shall conform to the requirements of Section 12.09 Painted Pavement Markings.
- B. The mixture of the marking material shall be within the composition limits for reflectorized pavement markings as described in the DOT Specifications as follows:
 - 1. Fifteen-minute dry paint – M.07.20.
 - 2. Hot applied fast-drying paint – M.07.21.
- C. Application of the glass beads to be used as reflector material on the striping shall conform to Section 12.09 Painted Pavement Markings and Article M.07.30 Glass Beads.

PART 3 - EXECUTION

3.01 GENERAL:

Paving courses required for the project shall be as shown on the drawings and as specified herein. Pavement thicknesses specified are measured in compacted inches. If a pavement course thickness exceeds 2-1/2 compacted inches, the course shall be installed in multiple lifts with each lift not exceeding 2-1/2 compacted inches in thickness.

3.02 GRAVEL SUBBASE:

- A. The gravel subbase to be placed under pavement shall consist of gravel evenly spread and thoroughly compacted. Depths of the subbase shall be as shown on the drawings.
- B. The gravel shall be spread in layers not more than 4-inches thick, compacted measure. All layers shall be compacted to not less than 95 percent of the maximum dry density of the material as determined by ASTM D1557 Method C at optimum moisture content.

3.03 TEMPORARY BITUMINOUS PAVEMENT:

- A. Where specified and required by the Engineer and after placement of the gravel subbase, the Contractor shall place temporary bituminous pavement above the trench, between the edges of the existing pavement. It shall consist of Class 1 or Class 2 Bituminous Concrete Pavement, 2-inches thick, as shown on the drawings and described herein.

- B. The temporary pavement shall be repaired as necessary to maintain the surface of the pavement until replaced by permanent pavement. When so required by the Engineer, the Contractor shall remove the temporary pavement and install or regrade the subbase for installation of permanent pavement.

3.04 PERMANENT BITUMINOUS PAVEMENT:

- A. The bituminous paving mixture, equipment, methods of mixing and placing, and the precautions to be observed as to weather, condition of base, etc., shall be in accordance with Section 4.06 Bituminous Concrete.

B. BASE COURSE (CLASS 4) AND BINDER COURSE (CLASS 1) PAVEMENT:

1. Immediately prior to installing the base and/or binder course, the trimmed edges shall be made stable and unyielding, free of loose or broken pieces and all edges shall be thoroughly broomed clean. Contact surfaces of trench sides, curbing, manholes, catch basins, or other appurtenant structures in the pavement shall be painted thoroughly with a uniform coating of asphalt emulsion (tack coat), just before any mixture is placed against them.
2. The base and/or binder course shall be repaired as necessary to maintain the surface of the pavement until placement of the permanent overlay. If required, the Contractor shall place a leveling course before placing the permanent overlay.

C. TOP COURSE (CLASS 2) PAVEMENT (PERMANENT OVERLAY):

1. The top course shall be placed over the trench or full width as shown on the drawings or as specified.
2. Prior to placement of the top course, the entire surface over which the top course is to be placed, including against curbs, gutters and castings, shall be broom cleaned and tack coated.
3. Top course pavement placed over trenches may be feathered to meet existing paved surfaces, if approved by the Engineer.
4. Prior to placing full width top course, keyways shall be cut in all intersecting streets.

3.05 PAVEMENT PLACEMENT:

- A. Unless otherwise permitted by the Engineer for particular conditions, only machine methods of placing the pavement shall be used. The equipment for spreading and finishing shall be mechanical, self-powered pavers, capable of spreading and finishing the mixture true to line, grade, width and crown. The mixtures shall be placed and compacted only at such times as to permit proper inspection and checking by the Engineer.

- B. After the paving mixtures have been properly spread, initial and intermediate compaction shall be obtained by the use of steel wheel rollers having a weight of not less than 10 tons. Vibratory roller, if used, shall be of a self-propelled type specifically designed for the compaction of bituminous concrete. It shall be equipped with a spread control device and set to prevent the roller from traveling in excess of 2 1/2 mph (220 fpm) while operating in vibratory mode, and 5 mph (440 fpm) while operating in the static mode.
- C. Final rolling of the top course or surface treatment pavement shall be performed by a steel wheel roller weighing not less than 10 tons at a mix temperature and time sufficient to allow for final smoothing of the surface and thorough compaction.
- D. Immediately after placement of top course or surface treatment pavement, all joints between the existing and new top course or surface treatment pavements shall be sealed with joint sealant.
- E. Where there is no backing for the edges of the curb-to-curb pavement, the Contractor shall provide a gravel transition. The gravel transition shall be installed immediately after the pavement is placed, shall be feathered and extend a minimum of 18-inches, and shall be compacted using the same equipment as for pavement compaction. The gravel shall be uniformly graded material meeting the requirements of Article M.02.04 Gravel Shoulders.
- F. When required by the Engineer, the Contractor shall furnish and install additional paving to provide satisfactory transition for driveways and walkways impacted by a new curb-to-curb pavement installation. The transition installation will be considered incidental to the curb-to-curb pavement installation.

3.06 PAVEMENT REPAIR:

- A. If required in the contract or if permanent pavement becomes rough or uneven, permanent pavement patches and trenches shall be repaired and brought to grade utilizing "infrared" paving methods following completion of the construction.
- B. The Contractor performing the work shall use care to avoid overheating the pavement being repaired.
- C. Pavement repair shall extend a minimum of 6-inches beyond all edges of the pavement patch to assure adequate bonding at the pavement joints.

END OF SECTION

SECTION 02920

LOAMING AND SEEDING

PART 1 - GENERAL

1.01 WORK INCLUDED:

This section covers all labor, materials, and equipment necessary to do all loaming, seeding and related work as indicated on the drawings and as herein specified. All lawns disturbed by the Contractor's operations shall be repaired as herein specified.

1.02 QUALITY ASSURANCE:

- A. For a particular source of loam, the Engineer may require the Contractor to send approximately 10 pounds of loam to an approved testing laboratory and have the following tests conducted:

1. Organic concentration
2. pH
3. Nitrogen concentration
4. Phosphorous concentration
5. Potash concentration

- B. These tests shall be at the Contractor's expense. Test results, with soil conditioning and fertilizing recommendations, shall be forwarded to the Engineer.

1.03 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF GENERAL SPECIFICATIONS, SUBMIT THE FOLLOWING:

- A. Six sets of information detailing the seed mixes, fertilizers, mulch material, slope protection material (if required) and origin of loam shall be submitted to the Engineer for review.

- B. Three sets of test results shall be submitted to the Engineer for review.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. LOAM:

1. Loam shall be a natural, fertile, friable soil, typical of productive soils in the vicinity, obtained from naturally well-drained areas, neither excessively acid nor alkaline, and containing no substances harmful to grass growth. Loam shall not be delivered to the site in frozen or muddy condition and shall be reasonably free of stumps, roots,

heavy or stiff clay, stones larger than 1-inch in diameter, lumps, coarse sand, noxious weeds, sticks, brush or other litter.

2. The loam shall contain not less than 4 percent nor more than 20 percent organic matter as determined by the loss of weight by ignition of oven-dried samples. Test samples shall be oven-dried to a constant weight at a temperature of 230 degrees F.

B. LIME:

Lime shall be standard commercial ground limestone containing at least 50 percent total oxides (calcium oxide and magnesium oxide), and 50 percent of the material must pass through a No. 100 mesh sieve with 98 percent passing a No. 2 mesh sieve.

C. FERTILIZER:

Fertilizer shall be commercial fertilizer, 10-10-10 fertilizer mixture containing at least 40 percent of organic nitrogen. It shall be delivered to the site in the original sealed containers, each showing the manufacturer's guaranteed analysis. Fertilizer shall be stored so that when used it will be dry and free flowing. No fertilizer shall be used which has not been marketed in accordance with State and Federal Laws, relating to fertilizers.

D. MULCH:

1. Materials to be used in mulching shall conform to the following requirements:
2. Straw Mulch - Straw Mulch shall consist of stalks or stems of grain after threshing.
3. Wood Fibre Mulch - Wood Fibre Mulch shall consist of wood fibre produced from clean, whole uncooked wood, formed into resilient bundles having a high degree of internal friction and shall be dry when delivered to the project.

E. SEED:

1. Seed shall be of an approved mixture, the previous year's crop, clean, high in germinating value, a perennial variety, and low in weed seed. Seed shall be obtained from a reliable seed company and shall be accompanied by certificates relative to mixture purity and germinating value.

2. Grass seed for lawn areas shall conform to the following requirements:

	Proportion by Weight	Germination Purity	Purity Minimum
Chewing's Fescue	30%	70%	97%
Kentucky 31 Fescue	30%	90%	98%
Kentucky Blue Grass	20%	80%	85%
Domestic Rye Grass	20%	90%	98%

Grass seed for cross-country areas, slopes and other areas not normally mowed shall conform to the following requirements:

	Proportion by Weight	Germination Minimum	Purity Minimum
Creeping Red Fescue	50%	85%	95%
Kentucky 31	30%	85%	95%
Domestic Rye	10%	90%	98%
Red Top	5%	85%	92%
Ladino Clover	5%	85%	96%

F. TEMPORARY COVER CROP:

1. Temporary cover crop shall conform to the following requirements:

	% Weight	Germination Minimum
Winter Rye	80 min.	85%
Red Fescue (creeping)	4 min.	80%
Perennial Rye Grass	3 min.	90%
Red Clover	3 min.	90%
Other Crop Grass	0.5 max.	
Noxious Weed Seed	0.5 max.	
Inert Matter	1.0 max.	

G. SLOPE EROSION PROTECTION:

1. Erosion control blanket shall be 100% degradable plastic mesh with 100% degradable straw or straw/coconut fill. Fill shall be held together by degradable fastening. Weight shall be 0.50 lb/sq. yd. Erosion control blankets shall be applied parallel to direction of water flow. The erosion control blankets shall be by North American Green, Evansville, IN or approved equal. For slopes 2:1 or greater, Model SC150 shall be used. For slopes less than 2:1, Model S150 shall be used.

2. Six-inch wire staples shall be placed according to manufacturers recommendations to anchor the mesh material. Staples shall be designed to decompose.

PART 3 - EXECUTION

3.01 SURFACE PREPARATION:

- A. After approval of rough grading, loam shall be placed on areas affected by the Contractor's operations. Loam shall be at least 6-inches compacted thickness.
- B. Lime shall be applied to bring the pH to 6.5 or, without a soil test, at the rate of 2-3 tons of lime per acre.
- C. Fertilizer shall be applied according to the soil test, or without a soil test, at the rate of 1000 pounds per acre.
- D. Loam shall be worked a minimum of 3-inches deep, thoroughly incorporating the lime and fertilizer into the soil. The loam shall then be raked until the surface is finely pulverized and smooth and compacted with rollers, weighing not over 100 pounds per linear foot of tread, to an even surface conforming to the prescribed lines and grades. Minimum depth shall be 6-inches after completion.

3.02 SEEDING:

- A. Seeding shall be done when weather conditions are approved as suitable, in the periods between April 1 and May 30 or August 15 to October 1, unless otherwise approved.
- B. If there is a delay in seeding, during which weeds grow or soil is washed out, the Contractor shall remove the weeds or replace the soil before sowing the seed, without additional compensation. Immediately before seeding is begun, the soil shall be lightly raked.
- C. Seed shall be sown at the approved rate, on a calm day by machine.
- D. One half the seed shall be sown in one direction and the other half at right angles. Seed shall be raked lightly into the soil to a depth of 1/4-inch and rolled with a roller weighing not more than 100 pounds per linear foot of tread.
- E. The surface shall be kept moist by a fine spray until the grass shows uniform germination over the entire area. Wherever poor germination occurs in areas larger than 3 sq. ft., the Contractor shall reseed, roll, and water as necessary to obtain proper germination.
- F. The Contractor shall water, weed, cut and otherwise maintain and protect seeded areas as necessary to produce a dense, healthy growth of perennial lawn grass.

- G. If there is insufficient time in the planting season to complete the fertilizing and seeding, permanent seeding may be left until the following planting season, at the option of the Contractor or as required by the Engineer. In that event, a temporary cover crop shall be sown. This cover crop shall be cut and watered as necessary until the beginning of the following planting season, at which time it shall be plowed or harrowed into the soil, the area shall be fertilized and the permanent seed crop shall be sown as specified.

3.03 PLACING MULCH:

- A. Straw Mulch shall be loosely spread to a uniform depth over all areas designated on the plans, at the rate of 4-1/2 tons per acre, or as otherwise required.
- B. Straw Mulch may be applied by mechanical apparatus, if in the judgment of the Engineer the apparatus spreads the mulch uniformly and forms a suitable mat to control slope erosion. The apparatus shall be capable of spreading at least 80 percent of the hay or straw in lengths of 6-inches or more, otherwise it shall be spread by hand without additional compensation.
- C. Wood Fibre Mulch shall be uniformly spread over certain selected seeded areas at the minimum rate of 1,400 pounds per acre unless otherwise required. It shall be placed by spraying from an approved spraying machine having pressure sufficient to cover the entire area in one operation.

3.04 SEEDING AND MULCHING BY SPRAY MACHINE:

- A. The application of lime, fertilizer, grass seed and mulch may be accomplished in one operation by the use of an approved spraying machine. The materials shall be mixed with water in the machine and kept in an agitated state in order that the materials may be uniformly suspended in the water. The spraying equipment shall be so designed that when the solution is sprayed over an area, the resulting deposits of lime, fertilizer, grass seed and mulch shall be equal to the specified quantities.
- B. A certified statement shall be furnished, prior to start of work, to the Engineer by the Contractor as to the number of pounds of limestone, fertilizer, grass seed and mulch per 100 gallons of water.
- C. This statement should also specify the number of square yards of seeding that can be covered with the solution specified above. If the results of the spray operation are unsatisfactory, the Contractor will be required to abandon this method and to apply the lime, fertilizer, grass seed and mulch by other methods.

3.05 INSPECTION AND ACCEPTANCE:

At the beginning of the planting season following that in which the permanent grass crop is sown, the seeded areas will be inspected. Any section not showing dense, vigorous growth at that time shall be promptly reseeded by the Contractor at his own expense. The seeded

areas shall be watered, weeded, cut and otherwise maintained by the Contractor until the end of that planting season, when they will be accepted if the sections show dense, vigorous growth.

END OF SECTION

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SECTION 03302
FIELD CONCRETE

PART 1 - GENERAL

1.01 WORK INCLUDED:

- A. This Section covers concrete and all related items necessary to place and finish the concrete work.
- B. Concrete thrust, and anchor blocks, to be provided at all water main bends, tees, plugs and wyes and at other locations required by the Engineer shall be installed in accordance with the details shown on the drawings and as specified in this section.
- C. Concrete encasement for piping with shallow cover and for encasement of telephone, and electrical duct bank when specified shall be installed in accordance with the details shown on the drawings and as specified in this section.

1.02 RELATED WORK:

- A. Section 02300, EARTHWORK
- B. Section 02080, DUCTILE IRON PIPE AND FITTINGS

1.03 REFERENCES:

- A. The following standards form a part of this specification:

American Concrete Institute (ACI)

- | | |
|---------------|---|
| ACI 304 | Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete. |
| ACI 305 | Recommended Practice for Hot Weather Concreting |
| ACI 306 | Recommended Practice for Cold Weather Concreting |
| ACI SP-66 ACI | Detailing Manual |
| ACI 318 | Building Code Requirements for Reinforced Concrete |

American Society for Testing and Materials (ASTM)

- | | |
|-----------|---|
| ASTM A615 | Deformed and Plain Billet-Steel Bars for Concrete Reinforcement |
| ASTM C33 | Concrete Aggregates |

ASTM C94	Ready-Mixed Concrete
ASTM C143	Test for Slump of Portland Cement Concrete
ASTM C150	Portland Cement
ASTM C260	Air Entraining Admixtures for Concrete
ASTM C494	Chemical Admixtures for Concrete

1.04 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF GENERAL SPECIFICATIONS, SUBMIT THE FOLLOWING:

Six copies of the statement of materials constituting the design of mixes for each size aggregate as required by ASTM C94 shall be submitted to the Engineer within one week following award of the Contract.

PART 2 - PRODUCTS

2.01 CONCRETE:

- A. All concrete reinforced or non-reinforced shall have a 28-day compressive strength of 3000 psi unless otherwise noted on the design drawings. A minimum of 5.5 sacks of cement per cubic yard and a maximum water cement ratio of 6.9 gallons per sack shall be used.
- B. Concrete shall conform to ASTM C94. The Contractor shall be responsible for the design of the concrete mixtures. Slump shall be a maximum of 4-inches and a minimum of 2-inches, determined in accordance with ASTM C143.
- C. Admixtures shall be as specified in subsection 2.05. No additional admixtures shall be used unless approved by the Engineer.
- D. No additional water, except for the amount indicated by the design mix shall be added to the concrete without the prior permission of the Engineer.

2.02 REINFORCING:

Reinforcing as shown on the plans or as required by the Engineer, shall conform to ACI 318 and ASTM A615 and shall be detailed in accordance with ACI SP-66. All Steel reinforcing bars shall be grade 60.

2.03 CEMENT:

The cement shall be an approved brand of American manufactured Portland Cement, Type II conforming to the applicable requirements of ASTM C150.

2.04 AGGREGATES

- A. Except as otherwise noted, aggregate shall conform to the requirements of ASTM C33.
- B. Maximum size aggregate shall be 3/4-inch.

2.05 ADMIXTURES:

- A. All concrete (unless otherwise directed) shall contain an air entraining agent. Air entrained concrete shall have air content by volume of 4 to 8 percent for 3/4-inch aggregate.
- B. Air entraining agent shall be in accordance with ASTM C260 and shall be Darex AEA, as manufactured by W.R. Grace & Company; Placewel (air entraining Type), as manufactured by Johns Manville; Sika AER as manufactured by Sika Chemical Company; or an approved equal product.
- C. Water reducing agent shall be WRDA, as manufactured by W.R. Grace & Company; Placewel (non-air entraining Type), as manufactured by Johns Manville; Sika Plastiment as manufactured by Sika Chemical Company; or an approved equal product.
- D. Water reducing agent-retarder shall be "Daratard," as manufactured by W.R. Grace & Company; Sika Plastiment as manufactured by Sika Chemical Company; or an approved equal product.

2.06 WATER:

- A. Water for concrete shall be potable, free of deleterious amounts of oil, acid, alkali, organic matter and other deleterious substances.

2.07 CONCRETE FORMS:

- A. Forms for exterior and interior surfaces which will be exposed to view after the work is completed, whether such surfaces are painted or unpainted, shall be new plywood stock, steel, tempered masonite, or other materials which will provide smooth concrete surfaces without subsequent surface plastering. Plastic or plastic-faced forms shall not be used, except with the prior approval of the Engineer.
- B. Form ties shall be cone type or equal, with waterstop, which leaves no metal closer than 2-inches to finished face of concrete.
- C. Form release agent shall be a non-staining, non-yellowing, non-toxic liquid free from kerosene and resins of the type recommended by the manufacturer of the forming system being used such as EZ strip by L&M Construction Chemicals, Omaha, NB and "Magic Kote" by Symons Corp., Des Plaines, IL or approved equal.
- D. Where steel adjacent to vertical faces of forms cannot be otherwise secured, mortar doughnuts shall be used to prevent steel from lying too close to the finish vertical faces of the concrete

PART 3 - EXECUTION

3.01 PREPARATION:

- A. Before placing concrete, forms and the space to be occupied by the concrete shall be thoroughly cleaned and reinforcing steel and embedded metal shall be free from dirt, oil, mill scale, loose rust, paint or the material which would tend to reduce the bond.
- B. Earth, concrete, masonry, or other water permeable material against which concrete is to be placed shall be thoroughly saturated with water immediately before concrete is placed.
- C. No concrete shall be placed until the consolidation of the ground and the arrangement and details of forms and reinforcing have been inspected and approved by the Engineer.

3.02 THRUST AND ANCHOR BLOCKS:

- A. Minimum bearing areas for thrust blocks and dimensions of anchor blocks shall be as shown on the drawings.
- B. Concrete for thrust and anchor blocks shall be placed against undisturbed earth, and wooden side forms shall be used to provide satisfactory lines and dimensions. Felt roofing paper shall be placed to protect joints. No concrete shall be placed so as to cover joints, bolts or nuts, or to interfere with the removal of the joints.

3.03 FILL CONCRETE:

- A. Fill concrete shall be placed in those locations as indicated on the design drawings. Fill concrete shall consist of materials as previously specified, with a minimum 28-day compressive strength of 3000 psi.
- B. Before fill concrete is placed, the following procedures shall be used to prepare surfaces; all dirt, scum and laitance shall be removed by chipping and washing. The clean, roughened base surface shall be saturated with water, but shall have no free water on the surface. A coat of 1:2 cement-sand grout, approximately 1/8-inch thick, shall be well scrubbed into the thoroughly dampened concrete base. The concrete fill shall be placed immediately, before grout has dried or set.
- C. Fill concrete shall be brought to lines and grades as shown on the design drawings.

3.04 CONCRETE PLACING DURING COLD WEATHER:

- A. Concrete shall not be placed on frozen ground, and no frozen material or material containing ice shall be used. Materials for concrete shall be heated when temperature is below 40°F, or is expected to fall to below 40°F, within 73 hours, and the concrete after placing shall be protected by covering, heat, or both.

- B. All details of Contractor's handling and protecting of concrete during freezing weather shall be subject to the approval of the Engineer. All procedures shall be in accordance with provisions of ACI 306.

3.05 CONCRETE PLACING DURING HOT WEATHER:

- A. Concrete just placed shall be protected from the direct rays of the sun and the forms and reinforcement just prior to placing, shall be sprinkled with cold water. The Contractor shall make every effort to minimize delays, which will result in excessive mixing of the concrete after arrival on the job.
- B. During periods of excessively hot weather (90°F or above), ingredients in the concrete shall be cooled insofar as possible and cold mixing water shall be used to maintain the temperature of the concrete at permissible levels all in accordance with the provisions of ACI 305. Any concrete with a temperature above 90°F, when ready for placement, will not be acceptable, and will be rejected.

3.06 FIELD QUALITY CONTROL:

- A. Concrete inspection and testing shall be performed by the Engineer or by an inspection laboratory, designated by the Engineer, engaged and paid for by the Owner. Testing equipment shall be supplied by the laboratory, and the preparation of samples and all testing shall be performed by the laboratory personnel. Full assistance and cooperation, concrete for samples, and such auxiliary personnel and equipment as needed shall be provided by the Contractor.
- B. At least 4 standard compression test cylinders shall be made and tested and 1 slump test from each day's placement of concrete. A minimum of four compression test cylinders shall be made and tested for each 100 cubic yards of each type and design strength of concrete placed. One cylinder shall be tested at 7 days, and two at 28 days. The fourth cylinder from each set shall be kept until the 28-day test report on the second and third cylinders in the same set has been received. If the average compressive strength of the two 28-day cylinders do not achieve the required level, the Engineer may elect to test the fourth cylinder immediately or test it after 56 days. If job experience indicates additional cylinder tests or other tests are required for proper control or determination of concrete quality, such tests shall be made.
- C. The Engineer shall have the right to reject concrete represented by low strength tests. Rejected concrete shall be promptly removed and replaced with concrete conforming to the specification. The decision of the Engineer as to whether substandard concrete is to be accepted or rejected shall be final.

END OF SECTION

SECTION 11304

SUBMERSIBLE WELL PUMPS

PART 1 - GENERAL

1.01 WORK INCLUDED:

- A. This Section covers the furnishing and installation of the submersible well pump, check valves and appurtenances complete for Replacement Well 3A in Colchester CT. Appurtenances shall include motor, check valve, column pipe and power cable as required for complete operation of the pump.
- B. All components, except as otherwise noted, shall be provided by one supplier and shall be installed by a licensed CT Well Driller.
- C. This Section directs special attention to certain features but does not purport to cover all details of the design, manufacture, or installation of the pumping unit. The final responsibility for supplying and installing pumping equipment that functions as specified herein belongs to the Contractor and his suppliers.
- D. A variable frequency drive, provided under Division 13 of this Contract, shall be used with Replacement Well 3A. Contractor shall coordinate variable frequency drive manufacturer selection with submersible pump manufacturer and shall be solely responsible for ensuring that the individual variable frequency drive furnished is completely compatible with all requirements and intended functions of the driven equipment.

1.02 RELATED WORK:

- A. Equipment Checkout and Testing is covered by Section 01750.
- B. Electrical variable frequency drive equipment for the submersible pump and motor as specified under Division 13.
- C. Power to all equipment specified in this section shall be coordinated with Division 16 ELECTRICAL.

1.03 SERVICE CONDITIONS:

- A. The pumping unit for Replacement Well 3A shall be a submersible well pump. The pump will be installed in the new Replacement Well 3A Pump House and pump water to the existing Water Treatment Facility.

1.04 PUMP SCHEDULE:

- A. The performance of the submersible pump furnished and installed under this section shall comply with the operating conditions included in the table below.
- B. The submersible pump is listed at different service conditions. The conditions outline the curve that the design point has been based upon. Proposed pump must meet all conditions for consideration.
- C. No deviation below the listed parameters will be permitted.

	<u>Flow Rate</u> <u>(gpm)</u>	<u>TDH</u>	<u>Min. Pump</u> <u>Efficiency</u>	<u>HP</u>	<u>Nominal</u> <u>Speed</u> <u>(rpm)</u>
Minimum Flow Design Point	100	550	75%	50	3450
Normal Flow Design Point	300	420	80%	50	3450
Maximum Flow Design Point	400	310	75%	50	3450

1.05 QUALITY ASSURANCE:

A. GENERAL:

1. This specification directs special attention to certain features but does not purport to cover all details of the design, manufacture or installation of the pumping unit. The final responsibility for supplying and installing pumping equipment which functions as specified herein rests with the Contractor.
2. Workmanship and the method and materials of construction shall conform to the best practice and highest standards applicable for the design use as specified.
3. Pumping units furnished shall be complete in all particulars and ready for final assembly, installation and operation.
4. Any mechanical, civil, or electrical changes required by the use of an approved equal product shall be the responsibility of the Contractor.
5. All equipment shall conform to Hydraulic Institute Standards and shall be manufacturer's standard products presently in commercial production.

6. All the equipment specified under this Section shall be furnished by a single supplier and shall be products of manufacturers regularly engaged in the production of said equipment. The supplier shall have the sole responsibility for proper functioning of the pumps and equipment supplied.
7. Equipment shall conform to requirements for materials, installation and equipment approvals of state, local, Underwriter's Laboratories, Inc., or other applicable codes, whether or not called for on the drawings or in the specifications.

B. MANUFACTURERS REQUIREMENTS:

1. Pump manufacturers shall certify proof of successful operating experience during the last 10 years of twenty installations of equipment comparable to that specified herein.
2. The manufacturer shall provide the supervisory service of a factory trained engineer, who is specifically trained on type of equipment supplied, for a period of not less than one (1) 4 hour day to assist in installation of the pumping equipment, and related appurtenances, to provide initial startup of the pump to instruct the Owner's operating personnel in the operation and maintenance of the equipment provided.
3. Non-Witnessed Factory Test: The pump bowl and motor assemblies shall be given operational tests in accordance with the standards of the Hydraulic Institute. Recordings of the tests shall substantiate the correct performance of the equipment at the design head, capacity, speed and horsepower as herein specified.

1.06 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF GENERAL SPECIFICATIONS, SUBMIT THE FOLLOWING:

- A. Prior to pump acceptance: the Contractor shall submit to the Engineer for review, six (6) copies of each of the following: Complete shop drawings; Complete wiring diagrams; Catalog curves showing pump performance at full speed and a speed curve showing all required operating points; Catalog information showing the general performance characteristics for the submersible motor; Catalog cut sheets for the column pipe, check valve, submersible power cable, and cable splice kits
- B. Prior to pump shipment from the manufacturer, the Contractor shall submit to the Engineer for review, six copies of each of the following: Complete corrected shop drawings (if changes proposed); Certified pump curve; Complete operating and maintenance instructions; and Parts lists. The certified pump curve shall show the actual performance of the pumps under factory testing.
- C. Complete test results on the motor from the routine test as defined in the NEMA standard for a motor of its class and rating to determine that it is free from electrical and mechanical defects and to provide assurance that it meets the design specifications.

- D. Upon completion of installation, the results of the field and acceptance tests as specified under this section of the specification shall be submitted to the Engineer.
- E. Furnish written certification from the manufacturer's representative of the proper installation of each component.
- F. PUMP TEST (Non-Witnessed):
 - 1. The pump shall be factory tested, in the shop of the manufacturer for head, capacity, efficiency, and brake horsepower at 50%, 65%, 85%, and 100% of the rated speed.
 - 2. Six (6) certified copies of the results in the form of pump characteristic curves shall be furnished to the Engineer for review prior to shipment.
- G. OPERATIONS AND MAINTENANCE MANUALS (four sets):
 - 1. Complete operations and maintenance information for this specific equipment.
 - 2. These manuals shall be reviewed by the Engineer for completeness; those that are deemed inadequate shall be returned for correction.
 - 3. Complete parts list including the manufacturer's reference and ordering numbers.
 - 4. A complete list of the manufacturer's name, address and phone number, the local representative's name, address and phone number, the model number and serial number of all equipment supplied.
 - 5. Recommended spare parts list

1.07 WARRANTY:

- A. The pump manufacturer and the motor manufacturer shall each individually and separately warranty that the equipment they supplied under this Section fully meets the criteria specified herein and shall further warranty that the equipment is free from all defects in materials and workmanship.
- B. The manufacturer's warranties from defects shall contain a provision that the manufacturer shall repair or replace any defects, to the satisfaction of and at no additional cost to the Owner, for a period of twenty-four (24) months for the pump and motor from the documented date of installation.

PART 2 - PRODUCTS

2.01 SUBMERSIBLE WELL PUMPS:

- A. PUMP MANUFACTURER:

1. Submersible well pump shall be as manufactured by Goulds, Franklin Electric or approved equal.
2. The pump supplier shall assume complete responsibility for the pump and motor.

B. MOTOR ASSEMBLY

1. One (1) 50 Hp, 3450 rpm, 460 volt, 5 phase, 60 Hz, submersible well pump and motor shall be provided.
2. The submersible motor shall be designed for continuous duty underwater operation.
3. The motor shall be designed with normal starting torque and low starting current for across line starting.
4. A shroud shall be provided to ensure water flow across the motor for cooling.
5. The motor shall be designed for operation with variable frequency drives.
6. The motor shall be water filled and shall incorporate a mechanical seal to restrict foreign matter from entering the motor.
7. The thrust bearing shall be of ample capacity to carry the weight of all rotating parts plus the hydraulic thrust and shall be an integral part of the driver.

C. BOWL ASSEMBLY:

1. Pump bowls shall be of 304 stainless steel and shall be fitted with stainless steel bowl wear rings.
2. Wear rings shall have the minimum practical clearance to the mating cylindrical surface of the impeller to provide adequate sealing independent of vertical positioning of the impellers.
3. Bowls and cases shall have stainless steel type bushings to support and guide and shaft. Bushing material shall be 304 stainless steel.
4. A sand collar of rubber or stainless steel, 304, shall be provided to protect the suction adapter bearing from abrasives in the liquid pumped.
5. The intermediate stages shall be selected to provide the maximum efficiency with least number of stages.
6. Impeller shall be of the enclosed type, cast of stainless steel, AISI 304, accurately

cast, machined, balanced, and filed for optimum performance and minimum vibration.

7. The impeller design shall be non-overloading for the capacity of the motor selected over the full operating range of the pump.
8. The impeller shall be securely fastened to the bowl shaft with taper collects of ASTM A582, Grade 416 stainless steel.
9. Bowl shaft shall be sufficient diameter to transmit the pump horsepower with a liberal safety factor and rigidly support the impellers between the bowl or case bearings.
10. The bowl shaft material shall be high chrome stainless steel of ASTM A276, Grade 416.
11. A cable guard to protect the power cable as it passes the bowl assembly is required and shall be fastened to the bowl assembly with corrosion resistant materials.

D. SUCTION ADAPTER:

1. Shall be a one-piece casting of stainless steel designed to serve as the suction inlet, the lower bearing housing and the motor adapter piece.
2. The coupling housing portion shall be designed to prevent the entrance of abrasive material into the top end of the motor.
3. The pump suction shall include a 304 stainless steel strainer. The inlet area shall be equal to at least 3 times the impeller inlet area.
4. The coupling connecting the motor to the pump bowl assembly shall be of size and strength to withstand maximum torque generated by the motor plus added safety factor.
5. The coupling shall be of 416 stainless steel and keyed or splined to the pump shaft.

E. DROP PIPE:

1. Drop pipe is to be 5-inch diameter high grade threaded and coupled low carbon steel designed for minimum friction loss.
2. Total pipe length shall be adequate to provide a pump inlet setting 2-feet above the top of well screen.
3. Actual drop pipe length shall be coordinated with the completed well depth as constructed and must be field verified by the Contractor prior to ordering the materials.

4. Drop pipe to be provided in interchangeable sections having no length greater than 10 feet.
5. All threaded joints to be drilled and tapped to accept ¼ inch self-locking stainless-steel set screws.
6. Contractor shall furnish and install the set screws at time of installation.
7. The drop pipe shall also be equipped with corrosion resistant power cable clamps located every 10 feet.

F. STILLING TUBES

1. One (1) 1.5-inch poly stilling tubes shall be installed with the pumping equipment to serve as conduits for level sensors / level measuring devices.
2. The stilling tubes shall be secured to the column pipe with corrosion resistant materials and shall terminate at the top of the pump bowl assembly.
3. The terminal ends of the tubes shall be pinched to prevent sensors or measuring devices from existing the end of the tube and shall be slotted to allow for the free flow of water in and out of the tubes with changes in water levels within the well.

2.02 A/C INDUCTION DRIVE MOTORS FOR VARIABLE SPEED APPLICATIONS:

1. A submersible a/c motor suitable for use with variable speed motor drive applications shall be provided for the William Marshall Replacement Well pump.
2. The motor shall, in general, meet the requirements specified in Subsection 2.01 above.
3. The motor shall be a model as manufactured by Hitachi, Franklin Electric, or approved equal.
4. The submersible motor shall have a minimum 85.2% nominal efficiency at full load.

2.03 SUBMERSIBLE POWER CABLE

1. Submersible power cable shall be sized according to Article 430 of the National Electrical Code.
2. Three separate conductors and a ground wire shall be included.
3. Each conductor shall be individually jacketed, and the conductors and ground wire shall be included in a single flat jacketed assembly.

4. The conductor insulation shall be water and oil resistant, suitable for continuous immersion.
5. The length of the cable to be furnished shall be the sum of (a) total pump setting, including bowl unit (b) plus one foot for each 50 feet of setting (or fraction thereof) to compensate for possible twist or sag during installation.
6. The cable will be suitably supported from the column using corrosion resistant materials.
7. All cable splices shall be watertight at the pressure encountered in the application.
8. A maximum of one (1) cable splice is permitted between the motor and the pitless adapter junction box.

PART 3 - EXECUTION

3.01 INSTALLATION:

1. All pumps shall be assembled and installed in strict accordance with the manufacturer's recommendations and as approved by the Engineer.
2. Pumps stored on site shall have covered and taped ends for protection.
3. Pump equipment damaged or bent during shipping or storage shall be replaced.
4. All pump motors stored on site shall be stored in according to motor manufacturer's recommendations until pumps are operational and accepted by the Engineer.
5. Pump checkout and testing shall be as described in Section 01750, Equipment Checkout and Testing, and as described below.

3.02 FIELD AND ACCEPTANCE TESTS:

1. After the pump has been installed and connected, checked out as required by Section 01750 and after inspection, operation, and adjustment have been completed by the manufacturer's representative, the pumping equipment shall be field tested in the presence of the Engineer, for overall wire to water efficiency and for general performance and fitness for the service specified. Results of these tests shall be submitted to the Engineer.
2. The Contractor will be responsible for providing a means of accurately measuring the quantity of water discharged by the pump during the startup and field-testing procedures.
3. Pump discharge pressures shall be measured by specially calibrated pressure gauges, and electrical input measured by the use of suitable instruments.

4. Duration of the testing shall be a minimum of 4-hours or as determined by the Engineer.
5. If the pumping unit fails to deliver the design capacity under the design pumping heads, or if the wire to water efficiency under the design head fails to reach the efficiency stated in the specification, the Contractor shall, at his own expense, on the written request of the Engineer, replace the motor, impeller, or any other parts, or provide any other required modifications to improve the unit until the specified capacity and efficiency are fulfilled.
6. VFD Testing shall be in accordance with Division 1, 11, 13, 15 and 16 as required.

3.03 MANUFACTURER'S SERVICES:

A. SERVICES TO BE PROVIDED:

1. For the submersible pumps, the service representative shall be responsible for complete component inspection on site after delivery and shall assist in the correct assembly of the components for a minimum period of one (1) four-hour day.
 - a. For inspection and check out of the erected equipment.
 - b. For startup services and supervision.
2. The minimum period of time herein specified does not relieve the manufacturer from providing sufficient time to satisfactorily complete the required service functions.
3. The manufacturer's representative shall certify in writing that the submersible pump has been properly installed.
4. The Owner reserves the right to video tape the instruction of the operating personnel for future use in training.

3.04 SPARE PARTS: None

END OF SECTION

SECTION 13200

PREFABRICATED PRECAST CONCRETE UTILITY BUILDINGS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK:

- A. Design, furnish, and install the prefabricated steel-reinforced precast concrete building(s) as indicated on the Contract Drawings. The building shall be delivered FOB to the jobsite and installed by the General Contractor. The Building Manufacturer shall provide all lifting cables and hardware needed to off-load and set the building.
- B. Precast building appurtenances and accessories including, but not limited to:
 - 1. Doors and associated hardware
 - 2. Process piping, Electrical, HVAC and equipment openings as shown on the drawings

1.2 SUBMITTALS:

- A. Six copies of one (1) comprehensive shop drawing submittal booklet (bound in 3- ring binder(s)) shall be submitted to the Engineer for review and shall be in accordance with the requirements of the project, showing dimensions, sizes, thickness, materials, finishes and methods of assembly as shown on the drawings. Submit Manufacturer's technical data for all building hardware and equipment. All work shall be fabricated and erected in accordance with the Manufacturer's drawings. Shop drawings shall consist of manufacturer's scale drawings, cuts or catalogs including descriptive literature and complete characteristics and specifications, and code requirements. Shop drawings shall be in accordance with the specifications, and shall be submitted as one single comprehensive package, including all components.

1.3 QUALITY ASSURANCE:

- A. The Precast Concrete Building Manufacturer shall have a minimum of five (5) years' experience in building fabrication. In addition, the Manufacturer shall have made no less than ten (10) buildings similar to the one on this project. Evidence must be submitted to verify that these requirements are met prior to being deemed an acceptable manufacturer.

- B. The structure shall be manufactured in a PCI certified plant. In addition, the Building Manufacturer must maintain "Certification in Good Standing" for product groups B & C, under the PCI plant certification program.
- C. The Engineer shall have the right to inspect or test any materials during fabrication in the factory. At the option of the Engineer, certified tests of materials may be accepted in lieu of field tests.
- D. The building structure shall be warranted against deterioration for a period of twenty-five (25) years. Building components shall be provided with a two (2) year warranty, from the date of substantial completion of the project.
- E. The building shall be manufactured by Oldcastle/Rotondo Precast, Avon, CT; United Concrete Products, Wallingford, CT; Shea Concrete Products, Amesbury, MA; or approved equal.

1.4 REFERENCES:

- A. The following standards form a part of these specifications:

AMERICAN CONCRETE INSTITUTE (ACI)

ACI-318 Building Code Requirements for Structural Concrete

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C150 Portland Cement

ASTM C33 Concrete Aggregates

ASTM C260 Air-Entraining Admixtures for Concrete

ASTM A185 Steel Welded Wire Fabric for Concrete Reinforcement

ASTM C494 Chemical Admixtures for Concrete

ASTM A615 Deformed and Plain Billet Steel Bars for Concrete Reinforcement

BUILDING OFFICIALS & CODE ADMINISTRATORS (BOCA)

The Boca National Building Code

1.5 DESIGN CRITERIA:

- A. Structural design calculations for the building shall be prepared and sealed by a registered professional Engineer, in the state of Connecticut, and shall be submitted for approval prior to fabrication.
- B. The building shall be designed to meet the following loading requirements:
 - 1. Roof Live Load - 60 psf
 - 2. Floor Live Load - 150 psf
 - 3. Wall Wind Load (130 mph)-45 psf
- C. The building shall have minimum interior dimensions as shown on the drawings and shall be constructed of steel-reinforced precast concrete.
- D. The precast concrete building shall be such that the roof and walls are cast monolithically at manufacture. The floor shall be permanently attached to the walls by eight (8) welded connections and a continuous shear keyway, which is filled with non-shrink grout
- E. The building shall have a minimum roof thickness of five (5) inches, minimum floor thickness of eight (8) inches (with lightening voids to reduce the building weight), and minimum wall thickness of three (3) inches.
- F. The building shall be entirely factory assembled and shipped as a 1-piece unit.
- G. The building exterior finish shall be formed brick finish, submitted to and approved by the engineer.
- H. The exterior surface of the building body shall receive one (1) coat of Thoroseal concrete sealer and one (1) coat of Thorocoat acrylic coating, color to match brick color of Well No. 3 building. The exterior building trim shall be treated in the same manner, except color shall be as selected by OWNER.
- I. The interior walls and ceiling of the building shall receive one (1) coat of Thoroseal concrete sealer and one (1) coat of Thorocoat acrylic coating, Alpine White color (#400) prior to installation of any mountings.

- J. The building shall be United Concrete Precast, Oldcastle/Rotondo Precast or approved equal.

PART 2 - PRODUCTS

2.1 DESIGN:

- A. The building as shown on the drawings shall be a prefabricated steel-reinforced precast-concrete structure.
- B. A Registered Professional Structural Engineer holding a currently valid license in the State of Connecticut shall prepare the building design.
- C. Structural design calculations, with the Connecticut Professional Engineer's dated live stamp and signature, shall be submitted for review.

2.2 CONCRETE:

- A. Concrete used in the manufacture of the various structural components of the precast concrete building shall be factory batched and shall meet the following requirements:
 - 1. Portland cement shall be Type I, II or III conforming to ASTM C-150.
 - 2. Fine aggregate shall consist of natural sand conforming to ASTM specification C-33.
 - 3. Coarse aggregate shall consist of 1/2" maximum well graded crushed stone conforming to ASTM specification C-33.
 - 4. Air entrainment admixture shall conform to ASTM C260. The air-entrained content shall be not less than 4 percent nor greater than 7 percent.
 - 5. A superplasticizer shall be used and shall conform to ASTM C494 type F or G. Concrete shall be placed at a slump of between 5 and 8 inches.
 - 6. The concrete used for the structural components shall attain a minimum 28-day compressive strength of 5,000 psi.

2.03 STEEL REINFORCING:

- A. Welded wire fabric shall conform to ASTM A185. Reinforcing steel shall be new billet steel meeting the requirements of ASTM A615.
- B. All reinforcement shall be free from loose rust, oil, and contaminates which

reduce bond. Any foreign material shall be removed by suitable means prior to installation.

- C. Provide supports for reinforcement including chairs, bolster bars, and other devices for spacing and securing reinforcing in accordance with CRSI requirements. Legs of all supports in contact with exposed-to-view surfaces shall be plastic coated in accordance with CRSI, class I.

2.4 DOOR & FRAME:

- A. The access door and frame shall be the following:

1. The building shall be outfitted with a 3' x 7', 18 Gauge CECO insulated honeycomb core steel door (Part # IC3070MLL83C).
2. The door shall be fitted with a 16 Gauge CECO steel door frame (Part # C334S3070LL63EO(sp)).
3. A ¾" National Guard stepped aluminum threshold (Part # 426E) shall be installed to insure against water infiltration.
4. Door shall be painted gray

- B. Door Hardware

1. The door shall be equipped with three (3) 4 ½" S.S. Parker door hinges with vandal resistant non-removable hinge pins (Part # B22794HN).
2. The door shall be equipped with one Parker 500 series door closer (Part # 1534BCAL).
3. One (1) Best heavy-duty cylindrical lock set (Part # 83K7D4A-S3-626-RH) and latch protector (Part # LP-211-SL) shall be installed per door. Lock and keypad to match Treatment Building lock and key system.
4. A 1 ½" x 2 ½" Aluminum drip strip, National Guard (Part # 16AD), shall be installed above the door
5. The doors and frames shall comply with the Steel Door Institute "Recommended Specifications for Standard Steel Doors and Frames" (SDI-100), and as herein specified.

2.5 TOLERANCES:

- A. Maximum variation from nominal dimensions: 1 inch.
- B. Maximum out of square: 1/8 inch per ten feet, non-cumulative.
- C. Maximum Misalignment of Anchors, Inserts, and Openings: 1/8 inch.
- D. Maximum Bowing of Sections: L/360

2.6 ACCESSORIES:

- A. Connecting and Supporting Devices: ANSI/ASTM A36 carbon Steel plates, angles, and inserts; hot-dip galvanized in accordance with ANSI/ASTM A153.
- B. Bolts, Nuts, and Washers: ANSI/ASTM A320, Type 316 Stainless Steel.
- C. Bearing Strips: Multipolymer plastic material as manufactured by Korolath of New England, Inc., Hudson, MA, or equivalent.
- D. Joint Sealants: Seal wall and floor joints with non-shrink grout, backer rod and sealant. Sealant to be polysulfide caulking, Sika-Flex, or equivalent, in color matching exterior finish. Seal roof joints, if any, with 12-inch wide EPDM membrane 0.060-inch thick cemented to roof surface in accordance with membrane manufacturer's recommendations.
- E. Provide supports for reinforcement including chairs, bolster bars, and other devices for spacing and securing reinforcing in accordance with CRSI requirements. Legs of all supports in contact with exposed-to-view surfaces shall be plastic coated in accordance with CRSI, class I.

PART 3 - EXECUTION

3.01 DELIVERY, STORAGE & HANDLING:

- A. The building shall be stored on dunnage placed at the proper locations to prevent cracking, distortion, or any other physical damage.
- B. The building shall be shipped F.O.B. jobsite by the Manufacturer and shall be provided with lifting fixtures for lifting and setting the building without incurring damage to the walls or roof. The Building Manufacturer shall provide all cables and lifting hardware for use in off-loading and setting the building.

END OF SECTION

**PCP-3A WELL CONTROL PANEL I/O
COLCHESTER CT**

TAG #	DESCRIPTION	DI	DO	AI	AO
	Pump Start/Stop	1	1		
	VFD speed feedback			1	
	VFD Speed control				1
	VFD alarms	2			
	Well Level			1	
	Discharge Pressure			1	
	Well station flow			1	
	Low well level alarm		1		
	low-low well level pump stop		1		
	Hatch intrusion alarm	1			
	Building High temp	1			
	Well Station Intrusion Alarm	1			
	Power loss	1			
	Personnel emergency button	1			
	Fire/smoke alarm	1			
	Surge Suppressor Fault	1			
	PLC Fault	1			
Total		8	1	5	2

SECTION 13410

PROCESS CONTROL STRATEGIES

PART 1 - GENERAL

1.01 DESCRIPTION:

A. General Requirements and Definitions

1. The intent is to use the existing Treatment Building Remote Terminal Unit (RTU) and furnish new pump control panel (PCP-3A) for the Replacement Well 3A. Furnish and install new field instruments as described in Division 13.
2. Provide all labor, materials, equipment, operations, methods and procedures as indicated in the Contract Documents, together with all items necessary for or incidental to the completion of the work.
3. All systems indicated in the Contract Documents shall mean all necessary supervision, labor, equipment and materials required to provide complete, properly functioning systems.
4. Refer to Electrical and Mechanical Drawings to coordinate material and equipment locations.

B. Work Included

1. The Water Department's Integrator shall be retained by the Contractor to perform programming within the existing RTU and SCADA System. The Water Department's SCADA Integrator is Integrated Control Systems Inc., no equal, to ensure consistency with the Water Department's existing design, standards and programming scheme. The contact person is Dominic Carelli, telephone (518) 461-7445 (cell).
2. Furnish, install, configure, and program instrumentation and control systems as described and specified herein and as shown on the Contract Drawings.
3. Utilize the new PLC in PCP-3A to generate alarms and signals and send to the existing RTU in the Treatment building. Refer to PCP-3A Well Control Panel I/O table, attached.
4. Modify programming in the existing RTU in the treatment building to allow for all communication with new Well 3A and new instruments.
5. Coordinate with the manufacturers of supplied equipment for specific instrumentation and control requirements. Installation and wiring of instrumentation shall be in accordance with manufacturer's recommendations.
6. Any deviation in instrumentation or electrical materials or methods caused by requirements of the supplied equipment will be provided at no additional cost to the OWNER.

7. Furnish and install all transducers, converters, terminals, switches, transformers, interposing relays (for both new and existing equipment), AC surge protection, fiber optic media converter (as necessary), 4-20 ma isolators, signal transmitters, signal splitters/boosters, uninterruptible power supplies, power supply connections and other miscellaneous instrumentation required to make a complete system required for new Well 3A instruments and control panels. A fiber optic media converter shall be provided at the Treatment Building RTU panel.
8. Furnish analog signal conditioning isolators between field instruments and control panels to protect analog signals from noise, surges and ground loops required for new Well 3A instruments.
9. Furnish and install all vendor or manufacturer cables and appurtenances between primary instruments and the transmitters, receiving instruments or destination terminals. All methods, materials and supplies will meet the requirements of Division 11, Division 13 and Division 16.
10. The General Contractor shall furnish and install all sleeves, bolts, inserts, equipment mounting hardware and other items to be attached to or imbedded in concrete and masonry work.
11. Provide start-up, testing and training for the entire instrumentation and control system including all new instruments, new pump control panel and existing RTU in treatment building.
12. Upon completion of the project, the Instrumentation System Supplier shall provide four (4) separate 4-hour working days on-site (not including travel time) to be used upon demand of the Owner within the first eighteen (18) months of operation. This time shall be used for service calls (not related to warranty or deficiencies in the Contract work), modifications to PLC programming and integration of new system into the existing SCADA system.

C. Related Work Specified Elsewhere

1. Section 13420 – Field Instruments and Equipment
2. Section 13431 – Variable Frequency Drives
3. Electrical – Division 16.

D. Demonstration and final Engineer-witnessed testing

1. The Owner will assume no liability or responsibility for any portions of the installation under this Contract until they are demonstrated and accepted in writing. Final demonstrations shall be made only after the Engineer is satisfied that the work has been completed in accordance with the intent of the Contract Documents.
2. After the Instrumentation and Control System is completed, the Contractor shall request that the Engineer witness a demonstration of the total system operation. If any system or piece of equipment within a system fails to function properly, rectify such defects or inadequacies and make a final demonstration.

3. All demonstrations shall be scheduled at the convenience of the Engineer and the Owner and shall be scheduled with at least five (5) days written notice.

1.02 QUALITY ASSURANCE:

- A. All materials provided under this Contract shall be equal in quality, appearance and performance to that specified herein and shall be subject to the approval of the Engineer. Verify the availability of all materials proposed to be used in the execution of the work prior to submitting same for the Engineer's approval. The discontinuance or production of any material or product after approval has been granted shall not relieve the Contractor from furnishing an Engineer approved alternate of comparable quality and design without additional cost.
- B. Materials and equipment furnished under this Contract shall be standard products of manufacturers regularly engaged in manufacture of such products and shall be manufacturer's latest standard design that complies with Specification requirements. Products shall essentially duplicate material and equipment that have been in satisfactory local use at least three years.
- C. The Contractor shall have supplied comparable systems to those specified herein and shall maintain engineering and service departments capable of designing and maintaining these systems. Provide, for a period of three (3) years from the date of final acceptance of the work, all necessary supervision, labor, materials, and equipment, in order to correct any defects in any system due to faulty materials, equipment, installation methods, or workmanship and consequent damage resulting from such defects. This work shall be scheduled during normal working hours and at the convenience of the Owner.
- D. The Instrumentation Supplier may provide certain items by others for inclusion within his Control Panels. This shall include, but not be limited to, instrumentation/controls specified to be provided with the equipment of other systems.
- E. Programming standards
 1. Update existing wiring diagrams, I/O schedules and PLC database mapping, the Water Department's Integrator shall document all changes to software programming files.

1.03 SUBMITTALS TO THE ENGINEER:

- A. Shop Drawings and Samples
 1. Submit Shop Drawings in accordance with Section 01330 and as indicated herein.
 2. Shop Drawings shall be thoroughly checked by the Contractor for compliance with the Contract Documents. Verify that all equipment and

materials proposed to be furnished will fit into available space and maintain specified clearances, and that all equipment is compatible with the system operation. Provide complete equipment catalog cuts, schematic wiring diagrams, point to point wiring diagrams for all systems inputting to the PLC system.

3. Shop Drawings Shall Consist of:
 - a. Project name and location
 - b. Contractor's name and contact information
 - c. Instrumentation System Supplier name and contact information
 - d. Index Sheet - Listing the equipment being submitted using equipment designations, tag identification, and/or symbols, indicated on the Contract Documents together with the proposed manufacturer, style/type and catalog number.
 - e. Manufacturer's scale or dimensioned drawings along with standard catalog number.
 - f. Wiring diagrams shall be provided showing the interfacing between field hardware, PLCs, including network switches.
 4. Submissions shall be in the form of individual binders, of the quantity indicated in the General Conditions. Each equipment type shall be separated by index tabs with typewritten titles.
 5. Provide samples of instruments, devices, graphics, etc., within ten (10) days upon receipt of request from the Engineer.
- B. Maintain properly documented and witnessed test and checkout reports, described in Section 1.01 E and 3.02, and submit these to the Engineer. Test reports should indicate each control panel component tested and checked, with initials or signature, and listing of any problems encountered. Provide the following submittals described in Section 3.02:
1. Start-up checklist and procedure
 2. Factory test reports and panel certifications
 3. Contractor testing and checkout reports
 4. Final start-up schedule and request for Engineer witnessed testing
- C. Upon completion of the work and before request for final payment, deliver to the Engineer six (6) bound sets of full and complete directions pertaining to the operation and maintenance of all equipment and systems installed under this Contract. These directions shall be typewritten on 8-1/2" x 11" sheets neatly bound with index tabs, and shall be accompanied by plans, diagrams, etc., of the work installed, parts lists, etc., necessary for the guidance of the Owner in operating, altering or repairing the installation. Operational descriptions should include custom functional descriptions of the controller programming, list of hard-coded timers and set points, list of user-settable timers, control set points, alarm set points, and description of enable/disable functions. The descriptions should describe how to operate in automatic and manual, where applicable.
- D. Provide the Owner with a list of local service departments of duly authorized distributors of materials and equipment of the type installed, which will stock the manufacturer's standard parts, etc.

- E. At the completion of the installation, provide reproducible Record Drawings electronically on computer disk, accessible in AutoCAD. Also provide six (6) printed sets of each full-size Drawing indicating the final configuration of all systems as they were installed. Symbols, equipment designations, etc., shall be consistent with the Contract Documents. Provide exact locations of all work which has been concealed in concrete, masonry or underground. Final payment of at least 5% of the value of the work described herein will not be released until as-built drawings and documented programming has been received.

1.04 DELIVERY, STORAGE AND HANDLING:

- A. Coordinate material and equipment delivery with the project schedule. Notify the Engineer immediately, in writing, if material or equipment delivery will adversely affect the project schedule, include documentation from equipment suppliers indicating the revised delivery dates and the reason for the delay.
- B. Coordinate delivery of equipment directly to other vendors where instrumentation supplied under this section has to be installed in panels supplied under other specification sections.
- C. Exercise care during loading, transporting, unloading and handling of materials to prevent damage.
- D. Check for defective or damaged materials, and for incomplete equipment shipments within seven (7) days after equipment delivery to the project site.
- E. Store materials and equipment on the construction site in enclosures or under protective covering in order to assure that materials and equipment are kept undamaged, clean and dry.
- F. Replace or repair, to the satisfaction of the Engineer, all materials and equipment that are defective or that have been damaged during installation, at no additional cost to the Owner.

1.05 FUNCTIONAL DESCRIPTION AND EQUIPMENT:

A. General

- 1. The new Well 3A shall pump water into the 8-inch raw water main and flow to the existing Treatment Facility. Well 3A shall include a submersible pump, VFD, level indicating system in Well 3A, flow meter, pressure transmitter as shown on the drawings.

B. Well No. 3A Control Loop Description

- 1. Below is a description of how Well 3A shall operate:
 - a. The integrator shall program an interlock that prevents Well No. 3 and Well 3A pumps operating at the same time.

- b. The operator at the Operator Interface Terminal (OIT) screen designates mode of operation (1) SCADA control / operation or (2) Local Manual Control.
- c. The Well 3A pump shall start and stop based on signals from the SCADA system and operate to maintain a user-adjustable flow setpoint. Integrator shall program an interlock of the Well 3A pump with low well level. PCP-3A PLC shall monitor the discharge flow rate for the well pump to maintain the selected flow within the preset limits.
- d. All pump control and system alarm functions shall be delayed by means of user adjustable 0-90 sec. software time delay relays. Well No. 3 has a 10 second start delay, 60 second delay for stopping on high well field pressure and 90 second delay for low well lockout alarm – replicate time delays for Well No. 3A.
- e. The water flow rate of Well 3A shall transmit to the PCP-3A and be totaled, displayed and recorded in the PLC. The PLC shall tabulate and store the minimum, average, maximum, and the total daily flows from the well. The flow rate shall be displayed as gallons per minute (gpm) and million gallons per day (MGD).
- f. For manual flow control from PCP-3A, the output for the pacing signal is manually set at the OIT.
- g. The operator shall be able to manually start/stop the well pump from the VFD.
- h. Level probes and indicators/transmitters shall monitor the level of the water in the well. If Well 3A is being over pumped and the water level in the well drops to an adjustable low normal operating level, the VFD shall reduce flow to maintain this well level. The PCP-3A PLC shall output a low well level alarm and a low-low well level alarm. The low-low well level alarm shall shut down the Well 3A pump.
- i. Well 3A pump shall shut down based on a user adjustable well field pressure setpoint.
- j. The PCP-3A shall tabulate and store the minimum, average, and maximum water level for Well 3A.
- k. The PCP-3A PLC shall log the hours of operation of the Well 3A pump.
- l. If a power failure occurs all proposed equipment shall go into standby and will require a manual reset through a manual push button on PCP-3A before restarting operations.
- m. All well alarms and shutdown functions will have maintenance override that can be set at the OIT.

C. Process Control System Description

The Water Department's Integrator shall provide the following modifications to Treatment Building RTU and SCADA system:

- 1. Programming in the RTU and SCADA system in the plant shall be made for the new Well 3A pump station. Programming shall consist of pump start/stop signals, flow control setpoint, automatic versus manual operation through SCADA, call-out and logging of alarms, run indications, visual and trending of all new analogue devices, etc. required for the new PCP-3A.

2. Analog signals for process instrumentation shall be trended and monitored for out-of-range or signal failure. When the signal input is below 4 mA or above 20 mA, a signal failure alarm shall be annunciated.
3. Alarms described in the functional descriptions shall be configured as either non-critical or critical alarms and the Operator shall have the capability of specifying whether the alarm is dialed out or not.

PART 2 - PRODUCTS - Not Applicable

PART 3 - EXECUTION

3.01 GENERAL:

- A. All instrumentation and control shall be installed in accordance with state and local building and electrical codes, general instrumentation practices, and manufacturer's requirements. All equipment shall be fully tested and calibrated. All instrumentation shall operate in accordance with the design intent. Provide documented record drawings. The Engineer shall review all instrumentation and controls at the time of startup, and all corrections made by contractor as required.
- B. The ranges and field connections shall be verified by the Engineer and instrumentation system integrator during the submittal process.
- C. The contractor shall plan and execute the installation so that the facility will be able to meet its discharge permit at all times. Submit a plan prior to construction.
- D. The control panels shall be completely factory assembled and tested. Do not ship the panel to the site until the Owner has approved the completed panel. The contractor shall provide all equipment from other divisions as required to make a complete system.

3.02 START-UP AND TESTING:

- A. In accordance with Specification Division 1.
- B. Start-up of individual control systems may be required prior to start-up of the overall system and control system network. The Instrumentation Supplier shall integrate all individual sub-control systems into a site-wide complete system to achieve final start-up. A start-up checklist and procedure for the PLC network, and Instrumentation shall be prepared and submitted to the Engineer for approval prior to final start-up.
- C. The Contractor shall coordinate the work of the system manufacturer's service personnel as necessary. This shall include the installation, interconnection, testing, and calibration of the instruments, and the scheduling of the manufacturer's service personnel.

- D. The Instrumentation System Supplier shall perform factory testing and checkout of each panel prior to delivery. Submit factory test reports and panel certifications.
- E. Each panel shall be tested and checked out in the field to confirm each input and output connected to instrumentation and other devices. Submit testing and checkout reports to the Engineer with final start-up schedule and request for Engineer witnessed testing.

END OF SECTION

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SECTION 13420

FIELD INSTRUMENTS AND EQUIPMENT

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK:

Supply field instruments and equipment as shown on the Drawings and indicated herein.

1.02 RELATED WORK:

- A. Section 01330 SUBMITTALS
- B. Section 13410 PROCESS CONTROL STRATEGIES
- C. Section 11000 EQUIPMENT
- D. Division 1 – General Requirements

1.03 SUBMITTALS TO THE ENGINEER:

In accordance with Sections 01330 and 13410.

1.04 TESTING AND START-UP:

In accordance with Section 13410.

PART 2 - PRODUCTS

2.01 GENERAL:

- A. All the equipment shall be the manufacturer's latest proven design. Specifications and drawings call attention to certain features, but do not purport to cover all details entering into the design of the instrumentation system. The completed system and the equipment furnished by the contractor shall be compatible with the functions required.
- B. Components shall be finished to the manufacturer's standard for the service intended unless otherwise indicated in the specifications or on the drawings.
- C. All electrical components of the system shall operate on 120-volt, single-phase, 60-Hertz current, or 24vdc except as otherwise noted in the specifications.
- D. All controls for electrically operated or motor-driven equipment shall be completed, including all necessary auxiliary relays, so as to require only wiring and connections to the equipment control circuit. All contacts for control of motor-operated or electrically

operated equipment shall be rated not less than 10 amperes on 120 volts unless otherwise specified herein.

- E. All motor-operated or electrically operated equipment shall have separate 120-volt power and control circuits, and optionally 208v 3 phase, 120v 1 phase, and 480v 3 phase, as required.
- F. Control wiring for externally operated motors shall be No. 12 AWG, minimum and in accordance with Division 16.
- G. All necessary fuses or switches required by the instrumentation manufacturer for his equipment shall be provided with the equipment. All instruments requiring an external power supply shall have a labeled ON-OFF switch.
- H. Provide all required piping, connections, hangers, supports, etc. required for the Instrumentation and equipment, unless specified to be provided by Others.
- I. The Drawings and Specifications indicate the energy sources that will be provided. Any other devices necessary to obtain proper operation of the instrument system from these energy sources shall be furnished with the instrumentation.
- J. Instrumentation equipment supplier shall provide and install all instrument cable as needed between instrumentation system equipment components, unless otherwise indicated.
- K. Nameplates shall be attached to all field-installed units.
- L. All field-mounted instrumentation utilizing 4-20 mA signals shall be furnished with an appropriately sized local surge arrester at each end of the line. The surge arrester shall be adequate for the intended function and shall be by a nationally recognized manufacturer with a minimum of 3-years' experience in the manufacturer of such devices. Submit selected model and backup information for review and acceptance by the Engineer. Surge arrester shall be manufactured by Transtector, Phoenix Contact, or equal.
- M. Instrumentation shall be installed per instrumentation construction standards and details, manufacturers recommended practices in accordance with the mechanical, instrumentation and electrical drawings and specifications. Instrumentation shall be suitable for the application and the environment. Equipment shall be pre-calibrated. Provide all field calibration as required to verify correct operation. Review calibration ranges during shop drawing submittal with Engineer. All instrumentation shall be factory calibrated, bench checked, and field calibrated in accordance with ISA Standards and Practices. Equipment shall be suitable for use with the process fluid, when applicable.

2.02 FLOW MEASURING DEVICES (FE/FIT):

A. Magnetic Flow Meter and Indicating Transmitter

1. Provide magnetic tube type flow meter and transmitter as indicated on the Drawings and herein specified. The flow meters will be hardwired to the indicator, and the isolated PLC.
2. Completely obstruction-less design with stainless steel or Hastelloy C4 electrodes and electrode access ports.
3. Internal power source
4. Constructed of non-magnetic steel (316ss/Hastelloy) with class 150 ANSI flange connections. Provide unit with PTFE or hard rubber liner suitable for use with potable water.
5. Enclosure shall be NEMA 4X rated, paint finish and corrosion resistant
6. Stainless Steel grounding rings shall be provided and installed at each end of the flow tube. Grounding rings shall be bonded to the flow tube enclosure and to a suitable earth ground with stainless steel bond straps.
7. Accuracy of plus or minus 1% of actual flow.
8. Supply a spool piece with the same flange to flange dimensions as the magnetic flow meter to replace the meter during maintenance.
9. The flow transmitter shall be remote located. Unit shall be capable of bi-directional flow and shall display flow rate in both directions and flow total.
10. The signal converter or indicating transmitter [LED local indicator] furnished with an indicator shall be calibrated to read in gpm, range 0-500 gpm.
11. The transmitter output shall be converted to a 4-20 mA flow rate signal. The 4-20mA signal shall be sent to the PLC in the equipment control panel.
12. Supply a ductile iron pipe spool piece with the same flange-to-flange dimension as the flow meter to replace the meter during maintenance.
13. Water Flow Display/Totalizer
 - a. The display/totalizer signal shall go to the RTU. The RTU shall be actuated by 4-20 mA/DC signal. The flow shall be displayed as “Gallons Per Minute”.

- b. The totalizer signal, complete with flow integrator, shall be actuated by the 4-20 mA input signal proportional to square root of pressure differential and through a math counter and timer provide total flow data. The RTU shall indicate flow as "hundreds of gallons" or " x 100 GAL".
- c. The display/totalizer shall be provided with a dry contact which closes with flow.

14. Magnetic flow meter and indicator shall be Siemens Strans Magnetic Flow Meter and Transmitter.

2.03 WELL LEVEL SENSORS AND INDICATOR TRANSMITTER (LE)

1. New well level sensor shall be installed for Well 3A. The well level sensors shall be installed to a depth of approximately 60-feet below existing grade for Well 3A. The well level sensor shall send a 4–20mA signal proportional to the level to the RTU.
2. For the purpose of standardization, the continuous level transmitter and sensing element for each well shall be KPSI, Part Number 700S14A4A030 as manufactured by Measurement Specialties / Pressure Systems, Inc or approved equal.
3. The Contractor shall provide well level sensing equipment according to the following criteria. The specifications of the level transmitter specified above will supersede any conflicting criteria listed below:
 - a. The water level in each well shall be transmitted via a 4 – 20mA standard signal to the PCP-3A.
 - b. Each sensing cable shall be vented and constructed of polyurethane.
 - c. Each sensing element shall have an outer body diameter that is less than 0.70 inches.
 - d. Each sensing element shall have a titanium body and shall be provided with a sinkweight recommended by the manufacturer for the application.
 - e. Each sensing element shall include a piezoresistive micromachined silicon bridge-level strain gauge with a standard accuracy of $\pm 0.1\%$.
 - f. Each sensing element shall be provided with a wall-mounted NEMA 4 sensor termination enclosure with a field-replaceable desiccant module and signal conditioner which operates on 2-wire, 4-20mA, providing excitation voltage and signal processing for the bridge level sensing element electronics via an amplifier board. Each amplifier board shall be powered with a 14 to 33 Vdc supply, powered from the dc power supply.
 - g. Each sensor termination enclosure shall have surge and lightning protection.
 - h. Each sensor termination enclosure shall be provided with a clearly visible moisture status indicator.

4. The Contractor shall be responsible for connecting the probes and transmitters, as well as providing the necessary conduit and wiring to bring the signal into the instrumentation cabinet and dc power to the transmitter.

2.04 MEASURING DEVICES:

A. Pressure Indicating Transmitters (PIT)

1. Provide indicating transmitter according to the following criteria:
 - a. Output signal shall be 4-20 mA dc.
 - b. Transmitter 4-20 mA output shall be fully adjustable over a 15:1 range.
 - c. Accuracy shall be 0.1 percent of span.
 - d. Instrument body shall be 316 stainless steel.
 - e. Zero adjustment shall be possible without removing the cover.
 - f. Transmitter mechanism shall be protected by a gasketed, weatherproof enclosure providing environmental protection of NEMA 4X.
 - g. Sensor shall be of cobalt-nickel chrome alloy.
 - h. Transmitter shall be pipe stand mounted from wall or process piping.
2. Provide transmitter with a local indicator with a segmental dial and plug in connection mounted on the transmitter cover.
 - a. The indicator accuracy shall be + 2 percent of maximum scale.
 - b. Indication shall be a uniform scale with range as specified.
 - c. Cover shall be compatible with the transmitter providing a NEMA 4X enclosure.
3. Provide two-valve manifold for instrument isolation, drainage, and calibration.
4. Provide one hand-held terminal/communicator device to enable the operator, locally at each transmitter, to perform calibration, zeroing, configuration selection for signal output mode (e.g., linear), and selection of engineering units for display and other transmitter configuration functions. In lieu of the hand-held device, if available as an option from the manufacturer, each transmitter may be furnished with an integral

display with pushbuttons to enable transmitter electronics programming, configuration, and testing functions.

5. Pressure indicating transmitters shall be Foxboro IDP-20, Model 1151 GP by Rosemount, or approved equal.

2.05 PERSONNEL EMERGENCY PUSHBUTTON

1. A personnel emergency alarm, push button (maintain contact type), push to alarm-pull to silence, minimum 1-1/2-inch diameter red mushroom head, shall be centrally located within one foot of the meter vault floor.

2. Upon pushing the button an alarm signal shall be sent to the RTU.

2.06 INSTRUMENT WIRING REQUIREMENTS:

All wiring shall be furnished and installed by Electrical Contractor.

PART 3 - EXECUTION

3.01 GENERAL:

- A. All instrumentation shall be installed in accordance with state and local building and electrical codes, general instrumentation practices, and manufacturer's requirements. All equipment shall be fully tested and calibrated. All instrumentation shall operate in accordance with the design intent. Provide documented record drawings. The Engineer shall review all instrumentation and controls at the time of startup, and all corrections made by the Contractor as required.
- B. The ranges and field connections shall be verified by the Engineer and instrumentation system integrator during the submittal process.
- C. The Contractor shall plan and execute the installation so that the facility will be able to meet its water system permit at all times. Submit a plan prior to construction.

3.02 START-UP AND TESTING:

- A. In accordance with Specification Division 1 and Section 11000.
- B. A start-up checklist and procedure for the Instrumentation shall be prepared and submitted to the Engineer for approval prior to final start-up.
- C. Operator training shall be provided for a minimum of two, 4-hour days (not including travel time) for the overall instrumentation and control system.
- D. The system integrator shall provide complete documentation for all systems prior to Owner/Engineer witness testing.

3.03 WARRANTY:

- A. All Instrumentation shall be warranted for one year from final acceptance of the system. The warranty shall include the immediate (within 24 hours) response to emergency calls affecting treatment plant operations including problems and questions regarding equipment, software, and programming.
- B. Warranty shall be in accordance with Division 1 and Section 11000.

END OF SECTION

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SECTION 13430

CONTROL PANELS

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK

Fabricate panels as described herein and integrate into the Owner's instrumentation and control system as described in Section 13410. Modify existing panels as described in Section 13410. All new panel components shall be furnished and installed in accordance with these specifications and applicable standards and codes.

1.02 SUBMITTALS TO THE ENGINEER

In accordance with Section 01330.

1.03 TESTING AND START-UP

In accordance with Section 13410.

PART 2 – PRODUCTS

2.01 GENERAL:

- A. Control Panel materials and fabrication methods must conform to /underwriter Laboratories specification section UL 508A, and applicable referenced specifications noted therein.
- B. Control panels shall be furnished and installed in accordance with methods described in Division 16, and as indicated on the Drawings and in the Specifications. All transducers, converters, terminals, fuses, transformers, relays, signal transmitters, power supply connections and other miscellaneous equipment required to make a complete system shall be furnished and installed in the control panels. All wiring into and out of the control panel shall be terminated on terminal blocks.
- C. Panel components including power supplies, switches, relays, instrumentation, etc. supplied by the various equipment manufacturers, but indicated to be installed within panels furnished by the Instrumentation Supplier, shall be furnished to the Instrumentation Supplier for incorporation into his panels. Instrumentation Supplier shall install these items within his panel and shall produce a complete, functional, pre-wired system for installation requiring only external power and instrumentation connections. The General Contractor shall coordinate this requirement and shall ensure that equipment manufacturers provide all necessary installation instructions and requirements to the Instrumentation Supplier.

- D. Provide all required connections, mounting accessories, supports, etc. required for the installation of the Control Panels, unless specified to be provided by Others.
- E. Each alarm-actuating circuit shall contain a simple means for disconnecting the alarm function during normal maintenance or standby of the equipment which actuates the alarm.
- F. All panel indicators, panel meters, and recorders shall be by a common manufacturer and shall be of the same manufacturer and type as specified herein.
- G. All panels, and panel mounted instruments and control devices shall have identifying nameplates in accordance with Division 16. Equal quality nameplates shall be attached to all field-installed units.

2.02 CONTROL PANELS:

A. GENERAL - Components

1. Control Panel enclosures shall consist of fully welded body with door extending the full width of the panel to provide full access to the panel-mounted components. The door shall be of formed sheet metal and shall be equipped with quarter-turn latches and 180° hinges. Each door of each enclosure shall be equipped with keyed quarter-turn lever handle.
2. The supplier shall size all control panels with at least 50% excess interior space available for future expansion, ease of maintenance and orderliness.
3. For Painted Steel Enclosures, following fabrication, the panel and its component parts shall be degreased, bonderized, sprayed with two base coats, a rust inhibitor and a regular alkyd primer, and finished with an air-dry enamel of a color selected by the Engineer.
4. All instruments and accessories shall be mounted, wired or piped to terminal strips or bulkhead fittings which shall be properly identified to provide ease of field connection.
5. The exterior and interior components of all control panels shall be “finger-safe” and free from the danger of electrical shock when in normal operating position. If a component required within the panel by these specifications cannot be made “finger-safe”, obtain approval of its use from the Engineer and provide a clear warning label near the device.
6. All pump controls, interlocks, contacts, relays, power supplies and other miscellaneous equipment required to make a complete system in accordance with the intent of this section of the specifications shall be furnished and installed in the control panel. The components shall be industrial rated, heavy duty.
7. Power for panels shall be from the distribution panel as shown on the Electrical Drawings.
8. All indicator lights and push button switches shall be through-door flush mounted and sealed in accordance with respective equipment and control panel manufacturers recommendations.

9. Uninterruptible Power Supply (UPS) shall be provided for each PLC panel and for other panels or hardware when shown on the Drawings. See Section 13450 for specifications. The UPS shall be installed within the panel and may sit on the bottom of the panel enclosure however, the UPS shall not be located within 6-inches of any active components. The UPS shall not need to be moved to access other panel components.
10. Din-Rail shall be heavy duty steel intended for industrial control panel use.
11. Wire ducts shall be self-extinguishing rigid PVC heavy duty industrial grade.
12. Miscellaneous Push Button Switches:
 - a. Reset Switch shall clear all alarm indicators. If alarm condition persists, alarm indicator shall re-illuminate.
 - b. Reset button shall be heavy duty, oil tight, red LED operator, similar to hand switches.
13. Indicating Lights shall be LED technology with push-to-test feature. Indicating light housing shall be heavy duty, oil-tight type with removable contact blocks.
14. Duplex receptacles shall be ground fault circuit interrupt type with industrial grade cast aluminum housing box and cover.
15. Programmable Logic Controllers: PLCs shall be as specified in Section 13440.

B. Human Machine Interface/Operator Interface Terminal (HMI/OIT):

1. HMI/OIT to the PLC shall be furnished and installed on panels as noted in the control panel descriptions and shown on the Drawings. The Instrumentation supplier shall furnish and program the HMI/OIT. The screens to be provided for each HMI/OIT will vary depending upon local process function. The HMI/OIT shall display screens for the pump station and chemical feed process operations and all process instruments. The Instrumentation Supplier shall develop screens to display functions described in Section 13410. Submit draft screens to the Engineer during Shop Drawing review.
2. The HMI/OIT shall have the following specifics:
 - a. The HMI/OIT shall be a 256-color display touch screen.
 - b. Viewing area shall be at least 10-inches width by 8-inches height, or as indicated in the panel descriptions.
 - c. Display brightness of 300 cd/m²
 - d. Display contrast of 60:1
 - e. Minimum display resolution of 640 x 480 pixels
 - f. Minimum 2 megabytes of user memory
 - g. Ethernet and fiber port required to meet SCADA and panel performance specifications.
 - h. Compatible with controller supplied to display all PLC I/O values, control equipment, display alarm information, acknowledge alarms locally and silence horns on site.
 - i. NEMA 4X rating
 - j. Allen Bradley Panelview, Xycom Proface, or equal.
3. Provide licensed copy of the panel graphic configuration software and final OIT screen programming to the Owner.

C. Control Panels to be provided or modified by Instrumentation Supplier:

Well 3A Pump Control Panel	PCP-3A
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D. PCP-3A, Well 3A Building - Provide the following components:

1. NEMA 4 enclosure
2. HMI/OIT
3. Ethernet switch/hub
4. PLC – fiber optic and ethernet
5. Power Supplies
6. Surge Protection (power supply and analog field signal)
7. UPS sized for all critical panel components
8. GFCI duplex receptacle
9. General Alarm Amber Indicating Light
10. Alarm reset push-button
11. All other components required to obtain the functionality described in Section 13410 and to meet all codes and regulations.

E. Panel Indicator:

1. Panel Indicator, 3.5 digits, 1/8 DIN, 4-20mADC inputs, sealed faceplate, 240vac power, panel mounted, 0.20% accuracy full scale, two high/low alarms field configurable with isolated dry contacts, and, tagging, range and calibration per table. Panel indicators shall be KEP, Precision Digital, or equal.

F. Low Panel Temperature Switch (TSL):

1. Temperature switch shall have the following specifications: 316ss enclosure corrosion resistant body, field adjustable single setpoint, adjustable deadband, NEMA 4X, two dry isolated Form C contacts 10 amp rating.
2. Temperature switch shall be manufactured by Ashcroft or equal.

PART 3 - EXECUTION

3.01 GENERAL:

- A. All controls shall be installed in accordance with state and local building and electrical codes, general instrumentation practices, and manufacturer's requirements. All equipment shall be fully tested and calibrated. Provide documented record drawings. The Engineer shall review all instrumentation and controls at the time of startup, and all corrections made by Contractor as required.
- B. The ranges and field connections shall be verified by the Engineer and instrumentation system integrator during the submittal process.
- C. The Contractor shall plan and execute the installation of the new control panel and disconnection of the old control panel so that the Owner will be able to provide safe

potable drinking water and fire protection at all times. Submit a plan prior to construction.

- D. The control panels shall be completely factory assembled and tested. Do not ship the panel to the site until the Owner has approved the completed panel. The contractor shall provide all equipment from other divisions as required to make a complete system.

3.02 WARRANTY:

- A. The entire Control Panel and its components, including software and programming shall be warranted for one year from final acceptance of the system. The warranty shall include the immediate (within 24 hours) response to emergency calls affecting treatment plant operations including problems and questions regarding equipment, software, and programming.

END OF SECTION

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SECTION 13431

VARIABLE FREQUENCY DRIVE

PART 1 - GENERAL

1.01 WORK INCLUDED:

- A. Provide variable frequency drive, accessories and all wiring and conduit required for a complete system.
- B. The equipment shall be compatible and suitable for use in the intended service.

1.02 RELATED WORK:

- A. Division 1 - General Requirements
- B. Section 01329 – SUBMITTALS FOR OPERATION AND MAINTENANCE MANUALS
- C. Section 01330 – SUBMITTALS
- D. Division 11 – Process Equipment
- E. Division 13 – Instrumentation and Controls
- F. Division 15 – Mechanical Equipment
- G. Division 16 – Electrical

1.03 QUALITY ASSURANCE:

- A. The preferred manufacturer of the variable frequency drive for the project is Yaskawa.
- B. All equipment shall be tested at the factory. Unless specified elsewhere, standard factory inspection and operational tests will be acceptable.

1.04 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF GENERAL SPECIFICATIONS, SUBMIT THE FOLLOWING:

- A. Submit Shop Drawings for all variable frequency drives specified herein in accordance with Specification Section 01330, in addition to the following information:

1. Manufacturer and equipment type.
 2. Standard catalog information sheet.
 3. Detailed Shop Drawings indicating plan, elevation, end, and isometric views of drive and enclosure. Drawings shall include:
 - a. Details of panel mounted VFD controls
 - b. Clearances required to provide heat dissipation, and
 - c. A list of components to be supplied.
- B. Single-line diagram.
- C. Complete bill of materials.
- D. Additional information necessary to verify that the equipment to be supplied has features specified.
- E. The above shall be submitted in a single complete brochure that shall be in the form of a soft cover binder with index tabs.
- F. The vendor shall provide a coordination study, calculations and recommendations for circuit breaker trip settings for the complete system lineup.
- G. Provide O&M manuals in accordance with Specification Section 01760.

PART 2 - PRODUCTS

2.01 MATERIALS:

- A. Variable Frequency Drive (VFD)
1. Contractor shall coordinate variable frequency drive selection with the well pump manufacturer.
 2. The drive shall be capable of varying the speed of a standard NEMA Design B induction motor from a standstill to the standard speed of the motor. The unit shall transform input power into a variable voltage, adjustable frequency three-phase output of suitable capacity and waveform.
 3. Input voltage shall be as indicated on the Drawings and/or as specified in the equipment specification sections. Frequency shall be 60 Hz.

4. Output shall be three (3) phase voltage as indicated on the Drawings and/or as specified in the equipment specification sections.
5. The drive shall be a PWM (Pulse Width Modulated) transistorized inverter. Drives shall be a 6 pulse systems, as specified herein, and in compliance with IEEE-519.
6. The drive manufacturer shall have not less than five years of experience in the manufacture of drives in the United States.
7. The drives shall be rated for variable torque and/or constant torque applications (460V - 1 HP to 150 HP), depending on the individual driven load requirements. For constant torque applications, the output transistors shall be low-gain, fully rated. Derated high-gain transistors are not acceptable. Drives shall be rated constant torque with a service factor of 1.15 under continuous duty.
8. Power Line Considerations
 - a. The drive shall be designed to operate in accordance with all performance requirements of the contract documents from a power source which contains a maximum of 5% total harmonic distortion, 20% notch depth, and 22,800 volt-microseconds notch area as defined by IEEE-519-1992.
 - b. Each VFD or multiple sets of VFDs shall be designed and installed such that:
 - i) The total harmonic distortion reflected back to the power source is a maximum of 5%,
 - ii) The notch depth reflected back to the power source is a maximum of 20%, and
 - iii) The notch area reflected back to the power source is a maximum of 22,800 volt-microseconds.
 - iv) The total harmonic distortion, notch depth and notch area shall be as defined by IEEE-519-1992.
 - c. Line reactors and harmonic filters shall be provided by VFD supplier as required to comply with IEEE standards and shall be rated for and compatible with the VFD supplied. They shall function as a complete system.
 - i) Harmonic traps shall be tuned to shunt the 5th harmonic (300 HZ). The trap shall be U.L. listed and be provided with a pilot relay and

- motor rated contactor to be switched on and off through the VFD auxiliary run contact.
- ii) The line reactors and harmonic traps shall be mounted inside the respective VFD enclosures. Traps shall be fuse-protected as a minimum and shall protect internal wiring and components on each phase and shall be current limiting.
 - iii) Traps and reactors shall be Harmonic Guard manufactured by Trans Coil, Inc of Milwaukee, WI or equal. Data on these items shall be included with VFD shop drawing submittal.
 - iv) The harmonic traps and filters shall be downstream of the manufacturers incoming disconnect switch. Drive output cables shall be run in separate conduits not in cable trays.
- d. The VFD supplier shall perform a computer simulated power system study to verify compliance with the parameters as stated herein. The results of this study shall be submitted to the Engineer. At a minimum the submitted results of this study shall include:
- i) A brief summary of the equations and calculation procedures used in the study.
 - ii) A results summary sheet which briefly describes the power system configuration analyzed and which states the calculated values of total harmonic distortion, notch depth and notch area, both with and without reactors and filters.
 - iii) Computer generated graphs that illustrate the voltage and current waveforms of the power system with the VFDs operating. These waveform graphs shall directly illustrate the results of the power system computer model study.
 - iv) Detailed list of the amplitude of harmonic currents and voltages to the 50th harmonic.
- e. The Contractor shall provide the VFD supplier with all power system data, which should be made available by the local electric utility upon request, required to perform the above-described study. These data may include but are not limited to:
- i) A complete one-line diagram of the subject electrical distribution system. The diagram must show the lengths of all bus and cable runs, impedance values of all types of bus and cable used, and number of conductors per phase.

ii) Complete electrical data on all equipment shown on the one line diagram is required. At a minimum this data shall consist of:

- Transformers - kVA, primary voltage, secondary voltage, short circuit capacity or impedance.
- Motors - stator resistance, no load RMS current, no load kVA, no load kW, locked rotor RMS current, locked rotor kVA, locked rotor kW, horsepower, base speed, number of poles, efficiency at relevant speeds, power factor at relevant speeds, full load RMS current.
- Generators - short circuit capacity or sub-transient reactance's (X_d), power factor, kW, X/R ratio.

iii) If the distribution system can function in more than one configuration, the configuration(s) to be analyzed shall be clearly defined. Any other information that may affect the behavior of the distribution system shall also be provided.

9. Ambient Conditions

- a. Environment - Indoors, NEMA 1 enclosure.
- b. Ambient Temperature - 10 degrees C to 40 degrees C
- c. Altitude - Less than 3,300 feet
- d. Relative humidity - 90% maximum
- e. Vibration - less than .5G

10. VFD Heat Dissipation Requirements:

- a. VFD supplier shall coordinate requirements for heat dissipation with enclosure provided.
- b. The heat dissipation system utilized shall not reduce the specified NEMA rating of the enclosure.
- c. Where heat sinks or other methods to control heat are utilized, the contractor shall coordinate all clearance requirements.

11. Control System

- a. Input power:
 - i) Main circuit: 460V/60Hz.
 - ii) Control circuit, no external power for input shall be required.
- b. Tolerance: Voltage + 10%. Frequency + 2 Hz.
- c. Control method: Sinusoidal PWM control
- d. Output Voltage: 3PH 460 Volt.
- e. Output Frequency: 0.01 Hz to 60 Hz
- f. Frequency resolution: 0.01 Hz Operating panel input; 0.03 Hz Analog input; 0.01 Hz Computer interface input
- g. Frequency accuracy: + 0.5% of max frequency at 25 deg. C + 10 deg. C
- h. Volts/Hz characteristics:
 - i) Either constant V/f or variable V/f (user selectable)
 - ii) Base frequency adjustable from 25 Hz to 60 Hz
 - iii) Voltage boost adjustable from 0% to 30%
 - iv) Starting frequency adjustable from 0 Hz to 10 Hz
- i. Overload current shall be 150% for 1 minute (constant torque applications).
- j. Frequency command signal:
 - i) 3k Potentiometer
 - ii) 0-10 VDC; 0-5 VDC; 4-20 mA
- k. Frequency jump - 3-point settings: Setting jump frequency (0 to Max frequency), and width (0 to max frequency).
- l. Upper/lower limit frequencies:
 - i) Upper limit 0 to Max frequency.

- ii) Lower limit 0 to upper limit.
 - m. Pulse Width Modulated (PWM) carrier frequency: Adjustable from 400Hz to 2000Hz.
12. The drive shall provide a minimum displacement power factor of 0.95 throughout the speed range.
 13. The efficiency of the drive at full speed shall be a minimum of 98 percent.
 14. The drive shall be provided with an MCP type circuit breaker to serve as a disconnect and coordinated with the drive protective features for the motor to form a complete combination type starter/controller. If necessary, the drive shall also be provided with current limiting fuses on the input side of the drive, sized and rated as required by the drive manufacturer, so that the drive is rated for the available fault current.
 15. The drive shall contain relays, push buttons, timers, and all other appurtenances necessary for the specific application as specified in the equipment and instrumentation specification sections, and as shown on the Drawings. See Division 16 for component specifications.
 16. Enclosure type shall be as required for the specific application as shown on the Drawings and/or as specified in the equipment specification sections. VFD enclosures shall conform to the requirements of Division 16.
 17. Operational Functions:
 - a. Acceleration/deceleration times: 0.1 to 600 seconds, 2 separate acceleration and deceleration times.
 - b. Forward or reverse run can be chosen.
 - c. Jogging
 - i) Running - 0 to 20 Hz
 - ii) Braking - Deceleration, DC injection, or coasting
 - d. Multispeed run: up to 7 preset speeds can be chosen.
 - e. VFD shall be capable of accepting a 4-20 mA input signal control setpoint and adjusting speed accordingly.
 - f. Automatic Restart: Recovers a normal run of a coast-stopping motor.

- g. Soft Stall: Sustains a run in overload mode. (90% - 150% adjustable)
- h. Overload: Adjustable from 60 - 100%
- i. Complete adjustment of parameters gives thousands of volt/frequency patterns.
- j. VFD shall accept an auxiliary control relay dry contact from control system to "RUN" and VFD shall provide a dry contact "Running" and a dry contact "Stopped", as well as a 4-20 mA DC pacing signal.
- k. VFD shall have 4-20 mA DC kW load analog output.
- l. Elapsed time meters.

18. Protective Features:

- a. Functions individually identified by the following fault codes:
 - i) Overcurrent during acceleration (OC1)
 - ii) Overcurrent during deceleration (OC2)
 - iii) Overcurrent during run (OC3)
 - iv) Overcurrent detected at start-up (OCA)
 - v) Short circuit at load (OCL)
 - vi) Overcurrent in regenerative discharge resistor (OCr)
 - vii) Overvoltage during deceleration (OP2)
 - viii) Overvoltage (OP)
 - ix) Overload (OL)
 - x) Overload of regenerative discharge resistor (OLr)
 - xi) Overhead (OH)
 - xii) Ground Fault (EF)
 - xiii) Emergency Stop (E)
 - xiv) Frequency Setting Signal Abnormality (Err.1)
 - xv) EE Prom abnormality (EEP, EEP2, EEP3)
 - xvi) Computer link abnormality (Err.t)
- b. Drive shall have an external fault trip input terminal.
- c. Drive shall reset when a designated contact is closed on the terminal strip.

19. Monitor Functions

- a. The drive shall have display scaler of monitoring frequency. (Range 0.10 to 200)
- b. The drive shall be able to monitor different parameters.
- c. The drive shall have an LED on the front panel showing that the main DC circuit capacitor is charged.

20. Controller

- a. All parameters should be adjustable from the keypad.
- b. One key shall toggle between panel control and terminal control.
- c. The drive shall have a reset to factory settings function.
- d. The keypad shall be NEMA 12 rated.
- e. The keypad shall be installed in the enclosure door and provide keypad access without opening the enclosure door. For dead front panels, the keypad shall be located on the interior face panel.
- f. The keypad shall allow for parameters to be changed while drive is running.
- g. Most commonly used parameters should be labeled on the keypad.

21. All models shall be UL listed.

22. The drive shall be provided with a thermal overload relay with reset button.

23. The drive shall be provided with auxiliary run contacts for both inverter and bypass contactor, to indicate running status in either mode.

24. Drive shall be capable of computer link through a supplied standard RS232C board.

25. Drive shall be capable of proportional/integral control.

26. Drive shall be capable of PG/TG (Pulse Generator/Torque Generator) speed feedback control through an optional control board.

27. Variable frequency drive vendor must be a local distributor, located within 100 miles of the installation, which has factory-trained personnel and warranty authorization; capable of testing unit(s) with motor loads.

28. Variable Frequency Drives shall have elapsed time 4 digit meter at VFD.

PART 3 - EXECUTION

3.01 INSTALLATION:

- A. All interconnecting wiring between panels, unless specifically detailed otherwise, shall be by the electrical trade regardless of source of the panel itself.
- B. Install enclosures in locations as shown on the Drawings. Large enclosures shall be secured to floor or equipment pad. Small enclosures may be supported on walls using metal framing channels or similar hardware to provide a minimum ½-inch air space between enclosure and wall.
 - 1. All framing channels and mounting hardware for NEMA 3R and NEMA 4 enclosures shall be galvanized steel.
 - 2. All framing channels and mounting hardware for NEMA 4X enclosures shall be stainless steel.
- C. Mounting heights shall be as shown on the Contract Drawings or the tops placed a maximum of 72-inches above finished floor or platform when the elevation is not shown.

3.02 TESTS:

- A. Testing shall be in accordance with Division 1, 11, 13, 15 and 16 as required.

END OF SECTION

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SECTION 13440

PROGRAMMABLE CONTROLLERS

PART 1- GENERAL

1.01 DESCRIPTION:

A. Work Included:

1. Furnish, install, program and test the controllers, also called programmable logic controllers (PLCs) or programmable automation controllers (PACs), as shown on the Drawings, noted in the Control Panel Specification Section 13430 and described herein. The controllers shall be programmed to meet the functional descriptions and general requirements detailed in Section 13410. The controllers shall be networked and integrated with the SCADA system control station and other SCADA system hardware.
2. Controllers shall be provided with a processor capable of performing the intended control functions, data gathering, storing, logical functions, polling, reading and writing and other operations intended to achieve the system monitoring and control as described in Section 13410. Sufficient I/O modules shall be furnished to collect all signals listed in the I/O lists in Attachment 1 as well as additional signals required to meet the functional descriptions and intentions of the Drawings and Specifications.
3. The controllers shall be equipped with all communications ports and cabling required to meet the functional descriptions and connect to equipment as shown on the Drawings and as specified herein. Where applicable, communication ports shall be required for the operator interface terminal (OIT), programming connection, network connections, autodialer, I/O modules and other hardware connections indicated herein.
4. Provide at least 20% spare I/O or one full spare module of each type of I/O for each control panel controller, which ever provides a greater number of spare I/O, unless otherwise specified.
5. Provide the Owner with the original licensed software for each piece of hardware provided including the programming and communication software for the controllers, PLCs, and/or PACs.

B. Related Work Specified Elsewhere.

1. General requirements are specified in Division 1.
2. Process Control Strategies - Section 13410.

3. Control Panels – Section 13430.
4. Electrical requirements are specified in Division 16.

1.02 QUALITY ASSURANCE:

- A. All programmable controllers provided shall be by the same manufacturer and shall be compatible with the SCADA software, operator interfaces, and other control equipment in the specified system.
- B. The programmable controllers and all of the corresponding components within the family of controller products shall be offered by a company who regularly manufactures and services this type of equipment. The manufacturer shall have a fully operational quality assurance and quality control program.
- C. All products shall be designed, manufactured, and tested in accordance with recognized IEC and JIS industrial standards as follows:
 1. Vibration..... The method of testing is to be based upon the IEC 68-2-6 and JIS C 0911 standard specifications for vibration.
 2. Electrical Safety..... The method of testing is to be based upon the UL508 or CSA C22.2/14 standard specification.
 3. EMI Emissions..... The method of testing is to be based upon the FCC part 15, ICES-003 Class A, En55022
 4. EMC Immunity..... The method of testing is to be based upon the EN61326-1 EMC immunity standards.
- D. The manufacturer or its authorized representative shall provide complete technical support for all of their products upon request.

1.03 SUBMITTALS:

- A. Submit shop drawings in accordance with Section 01330 and Section 13410. Include cut sheets and bill of materials to indicate processor type, power supply, chassis, I/O modules, communications modules and other components for the complete PLC system, and specified herein. For the PLC control panel uninterruptable power supply (UPS), submit calculated load and UPS sizing sheet for each PLC panel with the shop drawings.
- B. Control logic and programming shall be fully documented including file descriptions, individual logic descriptions and address tag names. Electronic files shall be provided with final programs for each controller, clearly identified by controller tag name. Operation instructions, programming manuals, software manuals, and installation instructions shall be provided with the Operation and Maintenance Manual described in Section 13410.

1.04 DELIVERY, STORAGE AND HANDLING:

- A. In accordance with Section 13410.

PART 2 - PRODUCTS

2.01 GENERAL:

- A. The controllers shall consist of rugged components designed specifically for industrial environments. The controllers shall consist of a power supply and one or more racks containing a central processing unit (CPU) module, I/O modules, and communication interface modules. The controller shall consist of a base unit with integral power supply and be capable of modular I/O expansion. All components shall be housed in structurally secure enclosures, rack mountable.
- B. The controllers shall have multiple communications ports or communication interface modules including a dedicated programming port, connection to OIT (where applicable), serial port, Ethernet port, and other interfaces as needed. The Contractor shall be responsible for ensuring that all required ports are provided to complete the system.
- C. The I/O system shall be modular. Each module shall be fully enclosed within a durable plastic shroud. When mounted on the system base or chassis, each I/O module shall not occupy more than one available slot.
- D. All components within the controller family shall be manufactured with a high degree of durability. All switches and other operator-controlled devices shall be of the size and durability for their intended use as is normally offered for industrial applications. All signal cables furnished by the manufacturer shall be constructed so as to withstand, without damage, all normal use and handling.
- E. In order to minimize spare parts stocking requirements, the controller family shall have a high degree of interchangeability. The system shall incorporate a modular design using plug-in assemblies with pin and socket connectors. Wherever possible, all assemblies and sub-assemblies performing similar functions shall be interchangeable. The system design shall accommodate the replacement of assemblies without having to disconnect field wiring. Wherever possible, removable connectors shall be used to connect field wiring to the individual circuit board assemblies. All major assemblies and sub-assemblies, circuit boards, and devices shall be identified using permanent labels or markings each of which indicates the manufacturer's catalog number and a product manufacturing date code.
- F. All components shall meet the following:

STORAGE CONDITIONS:

TEMPERATURE: -40 to 85 degrees Celsius

OPERATING CONDITIONS:

TEMPERATURE: -30 to 70 degrees Celsius

SHOCK: 30 g panel mounted

HUMIDITY: 5 to 95% relative humidity, non-condensing

2.02 PROGRAMMABLE LOGIC CONTROLLERS (PLCs):

A. Controllers shall be capable of performing the functions described in Section 13410, with the following minimum specifications:

1. PLC-Control Panels (PCP-3A):
 - a. Min. Memory: 8 KB of program memory
 - b. Scan Time: 1 ms/K or faster
 - c. Minimum Local I/O total onboard and with modules:
 - d. Min. Number of addressable registers for internal and physical I/O and other required values: as required to meet programming, data collection and alarming as described in Section 13430, plus 20% spare.
 - e. Integral 10/100 MBps Ethernet/IP port
 - f. Fiber optic media converter
 - g. Battery Backup
 - h. Sufficient ports to connect to the HMI/OIT, a laptop for programming, the I/O modules, and other connections as stated or implied herein and shown on the Drawings.
2. Capable of performing all floating point decimal calculations necessary for complete operation of the system. The SCADA systems PC shall not be required to perform any mathematical operations or routines, unless stated otherwise.
3. Power: 10-30 VDC power supply or 110-120 VAC power supply. Each PLC and all PLC control panel components shall be connected to an uninterruptible power supply (UPS).
4. Provide sufficient I/O modules to make a complete and operable system, plus spare as indicated in Paragraph 1.01 (A) 4. Functional requirements in Section 13410 for specific I/O requirements.
5. Required agency approvals:

UL Listed (UL 508)

CSA Certified (CSA 142)

IEC 68-2-6

- B. Programming and diagnostic software shall be IBM-compatible (Windows based) and support the five programming languages identified by the IEC 1131-3 standard. Provide all programming required to configure each PLC or controller to provide complete control and monitoring functions as described in Section 13410. All final control programs and OIT programs shall be backed-up and provided to the Owner electronically. The Master/Key disks for the programming software shall be provided to the Owner at final acceptance of the system.
- C. An additional day of programmer time, including any travel expenses, shall be provided during the first year of operation to modify programming of the controllers or OITs to customize the system. This time shall not be used to correct or troubleshoot start-up issues. The Integrator shall provide troubleshooting and start-up services at no additional cost to the Owner.
- D. Provide programming cables and appurtenances to allow the Owner to connect a laptop PC to all controllers and interfaces for programming.
- E. Provide manufacturer's standard slot filler for unused modular chassis slots and/or terminator end caps, as applicable.
- F. Spare Parts: Provide a minimum of the following spare parts:
 - 1. one (1) spare power supply for each type of programmable controller provided,
 - 2. one (1) spare processor (CPU) for each type of programmable controller provided, and
 - 3. One (1) of each type of I/O module provided.
- G. The PLCs shall be compatible with the specified SCADA network and existing PLCs. The PLCs shall be manufactured by Allen Bradley Micrologix 1400 or approved equal.

2.03 OPERATOR INTERFACE TERMINAL (OIT):

- A. OITs shall be provided as outlined and specified in Section 13430 and shall be compatible with the controllers and/or capable of communication, connection and configuration via Ethernet.

2.04 UNINTERRUPTABLE POWER SUPPLIES (UPS):

- A. UPS Power Supply Backup System: Provide an uninterruptible 120-volt backup power supply for each control panel to maintain continuous operation of controllers or PLCs, operator terminals, panel components, communication devices, monitoring instrumentation and control circuits during a power outage.
- B. The UPS shall be provided with surge arresting capabilities to prevent sudden surges to the attached electrical control systems.

- C. Each UPS will be either rack mounted or located in the bottom section of the control panels.
- D. Each UPS shall have at least 3 battery-supported NEMA 5-15R outlets and 6-foot AC cord with NEMA 5-15R input connection.
- E. Provide appropriate electrical disconnect or provision to easily remove and bypass the UPS.
- F. The UPS shall be type rated for industrial use and capable of supplying standby power to PLC, panel indicating lights and displays, all connected control panel equipment and circuits for a minimum of fifteen (15) minutes. The UPS shall provide standby output power at full-load for at least 5 minutes and half-load for at least 20 minutes.
- G. The UPS shall be manufactured by Tripp-Lite, APC or equal.

2.05 NETWORK AND COMMUNICATIONS ACCESSORIES:

- A. Where required, PLCs and other network connected components shall be equipped with a converter or interface module to allow fiber optic Ethernet communications between PLCs and the network. Provide an Ethernet copper to fiber optic converter that supports 10/100 BaseT to 100BaseFX fiber Ethernet conversion. The fiber optic communications module shall be rack-mount or panel-mount. Provide power to the unit via panel power 10-30 VDC. The converter shall be manufactured by Garrettcom, Sixnet, Moxa, approved equal.
- B. The fiber optic network shall incorporate all connectors, patch panels, cable splices, converters, and other components necessary to create a fully functional and reliable system. Products shall be rugged and suitable for industrial use.

PART 3 - EXECUTION

In accordance with Section 13410.

END OF SECTION

SECTION 15111

VALVES AND APPURTENANCES FOR POTABLE WATER WORK

PART 1 - GENERAL

1.01 WORK INCLUDED:

- A. This Section covers the furnishing and installation of all process valves and appurtenances as indicated on the drawings and as specified herein. All valves shall open counterclockwise unless otherwise indicated.

1.02 RELATED WORK:

- A. Section 01330, SUBMITTALS
- B. Section 09900, PAINTING
- C. Division 13, INSTRUMENTATION
- D. Section 15140, PROCESS PIPE AND FITTINGS
- E. Division 16, ELECTRICAL

1.03 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF GENERAL SPECIFICATIONS, SUBMIT THE FOLLOWING:

- A. SHOP DRAWINGS (SIX COPIES):
 - 1. Include manufacturers scale drawings and descriptive literature showing characteristics, materials, and dimensions.
 - 2. Include proper tag or identification number on each drawing.
- B. Provide four copies of operation and maintenance manuals for each item supplied. The manual shall be subject to review by the Engineer.
- C. Proof of successful operating experience during the last five years with a minimum of five installations comparable to that specified shall be submitted to the Engineer.

1.04 REFERENCES:

- A. The following standards form a part of this specification and indicate the minimum standards required:

American National Standards Institute (ANSI)

ANSI B16.1 Cast Iron Pipe Flanges and Flanged Fittings

American Society for Testing and Materials (ASTM)

ASTM A48 Gray Iron Castings

ASTM A126 Gray Iron Castings for Valves, Flanges, and Pipe Fittings

ASTM A216 Carbon Steel Castings Suitable for Fusion Welding for High-Temperature Service

ASTM A351 Austenitic Steel Castings for High-Temperature Service

ASTM A536 Ductile Iron Castings

ASTM A564 Hot-Rolled and Cold-Finished Age-Hardening Stainless and Heat-Resisting Steel Bars, Wire and Shapes

ASTM B16 Free-Cutting Brass Rod, Bar, and Shapes for Use in Screw Machines

ASTM B61 Stem and Valve Bronze Castings

ASTM B62 Composition Bronze or Ounce Metal Castings

ASTM D429 Rubber Property - Adhesion to Rigid Substrates

American Water Works Association (AWWA)

AWWA C500 Gate Valves, 3 through 48-inch NPS, for Water and Sewage Systems

AWWA C504 Rubber Seated Butterfly Valves

AWWA C509 Resilient-Seated Gate Valves, 3-inch through 12-inch NPS, for Water and Sewage Systems

AWWA C550 Protective Interior Coatings for Valves and Hydrants.

Federal Specifications (F.S.)

F.S. WW-V-51F Valves, Angle Check, and Globe, Bronze 125 and 150 pounds

F.S. WW-V-54D Int. and No. 1 Valves Gate, Bronze 125 and 150 pounds

PART 2 - PRODUCTS

2.01 RESILIENT SEAT GATE VALVES:

- A. Resilient seat, wedge-type gate valves shall be manufactured to meet all applicable requirements of AWWA C509. Valves 12 inches and smaller shall be bubble-tight at 200 psi water working pressure, tested in both directions.
- B. Valve bodies shall be of cast iron and shall have non-rising threaded bronze stems acting through a bronze stem nut. Operation shall be by handwheel and shall open as specified above. All valves within structures shall have flanged ends.
- C. The wedge shall be of cast iron with resilient seating surfaces permanently bonded to the wedge in strict accordance with ASTM D429 or attached to the face of the wedge with stainless steel screws. Each valve shall have a smooth, unobstructed water way free from any sediment pockets.
- D. Valves shall have low friction, torque-reduction thrust bearings. All O-rings and gaskets located above the stem collar shall be removable without taking the valve out of service.
- E. The interior and exterior surfaces of the valves shall have a non-toxic fusion bonded epoxy coating, which is NSF 61 approved and safe for potable water in accordance with AWWA C550.
- F. Valves for horizontal applications shall have Delrin wedge covers and be specifically designed for horizontal installation.
- G. For purposes of consistency, resilient seat gate valves shall be as manufactured by Mueller Co., Decatur, IL, or approved equal.
- H. Post indicating valve assemblies shall have a post and indicator as an integral part of the resilient seated gate valve assembly. The unit shall be provided with a detachable crank which OPENS the valve in a clockwise direction. Shafts shall be Type 304 stainless steel. Post indicators and valves shall be UL listed, FM approved. Post indicators and valves shall be as manufactured by Mueller, Clow, Kennedy or approved equal.

2.02 AIR CUSHIONED SWING CHECK VALVES:

- A. The valves shall have heavy duty bodies, constructed of high-strength cast iron conforming to ASTM A126 Class B, with integral flanges, faced and drilled per ANSI B16.1 Class 125 and be suitable for horizontal or vertical installation.
- B. The valve bodies shall be the full waterway type, designed to provide a net flow area not less than the nominal inlet pipe size when swung open no more than 25 degrees. The valves shall have replaceable stainless-steel body seats.
- C. Valve disks shall be cast iron, faced with a renewable resilient seat ring of rubber or other suitable material, held in place by a follower ring and stainless-steel screws.
- D. The disk arm shall be ductile iron or steel, suspended from and keyed to an austenitic stainless-steel shaft, which is completely above the waterway and supported at each end by heavy bronze bushings. The shaft key shall be secured with a setscrew. The shaft shall rotate freely without the need for external lubrication. The shaft shall be sealed where it passes through the body by means of a stuffing box and adjustable packing. Simple O-ring shaft seals are not acceptable.
- E. The valves shall be supplied with an outside lever and adjustable counterweight to initiate valve closure. Final closure shall be dampened by means of a single, side-mounted bronze air-cushion assembly directly mounted to the valve body on machined pads. The amount of cushioning shall be easily adjustable without the need for pre-charged air chambers. Commercial air cylinders, which pivot and/or are attached with fabricated brackets, are not acceptable.
- F. The valves shall swing open smoothly at pump start and close quickly and quietly upon pump shutdown, to prevent flow reversal. When closed, the valves shall seal drop tight.
- G. The valves shall be GA Industries, Inc. Figure 250-DS or approved equal.

2.03 AIR RELEASE VALVES:

- A. Valves shall be pressure air valves. The valves shall release the surge of air from an empty line when filling and release the accumulation of air when the system is under pressure.
- B. Valves shall have a cast iron body, cover and baffle meeting ASTM A48 Class 30, and a stainless-steel float.
- C. Pressure air valves shall have stainless steel seats with Buna-N rubber plungers.
- D. The floats shall be constructed so as to withstand a pressure of 1000 psi.
- E. Deep well air valves shall operate by sealing the HI-CAR rubber orifice with an unguided ball float. The valves shall have a throttling device on the discharge side to control the volume of air exiting the pump.

- F. Pressure air valves shall operate through a compound lever system with valve sealing faces of an adjustable HI-CAR rubber valve and stainless steel. Needle valves used to seal the orifice are not acceptable.
- G. Inlet and discharge connections shall be normal-pipe-thread (NPT) screwed, sizes as shown on the plans.
- H. The air release valve on the replacement well raw water line shall shut off tight at a pressure of 100 psi and have a maximum shut-off pressure of 180 psi.
- I. All air release valves shall have an in-line gate valve the same size as the air release valve. Connections to piping shall be by NPT connections the same size as the air release valve unless otherwise noted.
- J. Deep well air valves shall be as manufactured by APCO Valve and Primer Corp., Schaumburg, IL; Valmatic Valve and Manufacturing Corp, Lyons, IL; Crispin Air Valves (Multiplex Manufacturing Company), Berwick, PA; or approved equal.

2.04 PRESSURE GAUGES:

- A. A phosphor bronze Bourdon tube type of measuring element shall have a 4-1/2-inch dial size with approximately 80 divisions and an accuracy of 1/2 one percent of full scale. Dial shall be calibrated in feet and shall include a re-zeroing pointer and pointer-puller tool.
- B. Pressure gauge shall have a 1/2-inch bottom connection and shall be fitted with a snubber of either the restrictive type using a tiny needle valve orifice or the type, which uses a small plug of metallic porous sponge.
- C. Liquid fill shall be glycerin.
- D. Pressure gauge shall include a diaphragm with 316 stainless steel seal and housing. The lower half of the diaphragm seat shall be fitted with a bleed screw.
- E. Gauge range shall be 0 to 50,100 or 150 psi as required by the Engineer for all gauges.
- F. The gauge valve shall be a ball valve. The ball valve shall have a bronze body, stainless steel ball and Teflon seats with a spring-closing handle.
- G. A stainless-steel nipple shall be installed below the gauge valve with a double stainless-steel strap.

2.05 BALL VALVES:

- A. Provide brass ball valves as manufactured by Cambridge Brass, Cambridge, ON; Red Head Manufacturing, Lincoln, RI; or approved equal.

- B. All ball valves shall be full-ported with 90 degree stop.

2.06 PAINTING:

- A. Interior surfaces of valves and miscellaneous piping appurtenances shall be given a shop finish of an epoxy in accordance with AWWA C550, Protective Coatings for Valves and Hydrants.
- B. Parts customarily finished at the shop shall be given coats of paint filler and enamel or other approved treatment customary with the manufacturer.
- C. Ferrous surfaces obviously not to be painted shall be given a shop coat of grease or other suitable rust-resistant coating.
- D. Field painting is specified under Section 09900 PAINTING.

PART 3 - EXECUTION

3.01 INSTALLATION:

- A. Valves shall be carefully erected and supported in their respective positions free from distortion and strain. Care shall be taken to prevent damage or injury to the valves and appurtenances during handling and installation. Valve boxes shall be set plumb and centered over the valve-operating nut.

3.02 FIELD QUALITY CONTROL:

- A. Valves shall be operated for five complete cycles to check for proper functioning prior to testing for water tightness.
- B. All material shall be carefully inspected for defects in workmanship and materials, all debris and foreign material shall be cleaned out of valve openings and seats, and all operating mechanisms operated to check their proper functioning. Equipment, which does not operate easily or is otherwise defective shall be repaired or replaced at the Contractor's expense.

3.03 SPARE PARTS:

- A. One complete change of seat and packing per valve shall be supplied for valves with field replaceable seats and packing.

END OF SECTION

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SECTION 15140

PROCESS PIPE AND FITTINGS

PART 1 - GENERAL

1.01 WORK INCLUDED:

This section covers furnishing, laying, jointing, and testing of process pipe within the pump station, including fittings, special castings and appurtenant work, as indicated on the drawings and as specified.

1.02 RELATED WORK:

- A. Section 02080, DUCTILE IRON PIPE AND FITTINGS
- B. Section 09900, PAINTING
- C. Section 15111, VALVES AND APPURTENANCES FOR POTABLE WATER

1.03 QUALITY ASSURANCE:

- A. All pipe and fittings shall be inspected and tested at the foundry as required by the standard specifications to which the material is manufactured.
- B. The Owner reserves the right to have any or all pipe, fittings, and special castings inspected and/or tested by an independent service at either the manufacturer's plant or elsewhere. Such inspection and/or tests shall be at the Owner's expense.

1.04 REFERENCES:

The following standards form a part of this specification and indicate the minimum standards required:

American National Standards Institute (ANSI)

- | | |
|-------------|--|
| ANSI A21.4 | Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water |
| ANSI A21.10 | Ductile-Iron and Gray-Iron Fittings, 3-inches through 48-inches, for Water and Other Liquids |
| ANSI A21.11 | Rubber Gasket Joints for Ductile-Iron Pressure Pipe and Fittings |
| ANSI A21.15 | Flanged Ductile-Iron Pipe with Threaded Flanges |

- ANSI A21.50 Thickness Design of Ductile-Iron Pipe
- ANSI A21.51 Ductile-Iron Pipe, Centrifugally Cast in Metal or Sand-Lined Molds for Water or Other Liquids
- ANSI A21.53 Ductile-Iron Compact Fittings, 3 inch Through 16 inch., for Water and Other Liquids.

American Water Works Association (AWWA)

- AWWA C606 Standard for Grooved and Shouldered Joints
- AWWA C651 Standard for Disinfecting Water Mains

American Society for Testing and Materials (ASTM)

- ASTM A53 Pipe, Steel, Black and Hot-Dipped, Zinc-Coated (Galvanized) Welded and Seamless
- ASTM A307 Low-Carbon Steel, Externally and Internally Threaded Standard Fasteners

1.05 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF GENERAL SPECIFICATIONS, SUBMIT THE FOLLOWING:

- A. Six sets of shop drawings shall be furnished for review.
- B. Shop drawings shall consist of manufacturer's scale drawings, cuts, or catalogs including descriptive literature and complete characteristics and specifications and code requirements. Shop drawings shall be submitted for the ductile iron pipe, type of joint, fittings, couplings, filling rings, and lining and coating in accordance with specifications.
- C. Sworn certificates shall be furnished to the Engineer verifying the results of tests called for in subsection 1.03, Quality Assurance.
- D. Pipe support design calculations stamped and approved by a Professional Engineer registered in the state where the project is located.

PART 2 - PRODUCTS

2.01 DUCTILE IRON PIPE:

- A. All ductile iron pipe shall be designed in accordance with ANSI A21.50 and shall be manufactured in accordance with ANSI A21.51.

- B. Pipe for use with sleeve type couplings shall be as specified above except that the ends shall be plain (without bells or beads). The ends shall be cast or machined at right angles to the axis.
- C. Pipe for use with grooved type couplings shall have ends grooved in accordance with AWWA C606.
- D. Pipe thickness class, unless otherwise indicated:
 - 1. Minimum thickness class shall be Class 53 for use with threaded flanges.
 - 2. For grooved couplings, minimum thickness class shall be Class 53 for pipe smaller than 18-inches and Class 56 for pipe 18-inches and larger.
- E. Machined surfaces shall be cleaned and coated with a suitable rust-preventative coating at the shop immediately after being machined.
- F. The inside of pipe and fittings shall be given a cement lining and bituminous seal coat in accordance with ANSI A21.4. The thickness of lining shall be double that specified in the above referenced specification.
- G. The outside of pipe and fittings within structures shall not be coated with the bituminous coating, but shall be thoroughly cleaned as recommended by the coating manufacturer and given one shop coat of 69-1211 H.B. Epoxoline II primer made by Tnemec Company, Inc.; Multiprime made by Pittsburgh Plate Glass Co., Pittsburgh, PA; Recoatable Epoxy Primer B67H5/R5 made by Sherwin-Williams Company; or an approved equal product.

2.02 JOINTS:

- A. Flanged joints shall conform to ANSI A21.15 except that special drilling or tapping shall be provided as necessary to ensure correct alignment and bolting.
- B. Flanged pipe shall use long-hub flanges which shall be screwed on tight at the foundry by machine before they are faced and drilled.

2.03 FITTINGS:

- A. Fittings shall conform to the requirements of ANSI A21.10 and shall be of a pressure classification at least equal to that of the pipe with which they are used.
- B. Flanged fittings shall be faced and drilled in accordance with ANSI A21.10 except that special drilling or tapping shall be provided as necessary to ensure correct alignment and bolting.
- C. Provide ductile-iron grooved-end fittings conforming to ANSI A21.10 for center-to-face dimensions.

1. End preparation for grooved ends conforming to AWWA C606 for flexible or rigid joints as required by type of joint.
 2. Minimum wall thickness of grooved fittings 12-inch and smaller conforming to ANSI A21.53.
 3. Minimum wall thickness of grooved fittings larger than 12-inch conforming to ANSI A21.10.
- D. Fittings shall be provided with standard bosses where so indicated.

2.04 SLEEVE TYPE COUPLINGS:

- A. To ensure correct fitting of pipe and couplings, all flexible couplings and accessories shall be furnished by the supplier of the pipe and shall be of a pressure rating at least equal to that of the pipeline in which they are to be installed.
- B. Flexible couplings shall be Style 38 by Dresser Mfg. Div., Bradford, PA; Style 441 Smith-Blair, Inc., San Francisco, CA; R.H. Baker & Co., Inc., Huntington Park, CA; Clow Corporation, Rochester, NY; or approved equal products.
- C. All couplings shall be furnished with the pipe stop removed.
- D. Couplings shall be provided with gaskets of a composition suitable for exposure to the liquid within the pipe.

2.05 GROOVED COUPLINGS:

- A. Couplings shall conform to AWWA C606.
- B. Minimum pipe wall thickness shall be as specified under "Pipe For Use With Couplings."
- C. Unless otherwise indicated, when grooved couplings are used, joint to be of rigid type with pipe grooves cut to bring pipe ends together. Beam strength of joint shall be equal to or greater than that of flanged joint. Flexible type joint to be used only as specified or indicated.
- D. Where grooved couplings are indicated to provide for expansion or flexibility, cut pipe grooves to provide necessary expansion or flexibility.

2.06 WALL PENETRATIONS:

- A. RESTRAINED:

1. Where restrained wall penetrations are called for on the drawings, wall pipe castings with integral water stops shall be used. Outside surfaces of castings to be encased in concrete shall not be painted or coated.
2. OMNI*SLEEVE as manufactured by OMNI*SLEEVE, Cream Ridge, NJ, or approved equal shall be an accepted alternate when installed with retainer (tie) rods.
3. Wall sleeves with mechanical seals only will not be allowed in lieu of castings.

2.07 FILLING RINGS:

The Contractor shall provide suitable filling rings where the layout of the flanged piping is such as to necessitate their use. In materials, workmanship, facing and drilling, such rings shall conform to the 125-lb. ANSI Standard. Filling rings shall be of suitable length with nonparallel faces and corresponding drilling if necessary, to ensure correct assembly of the adjoining piping or equipment.

2.08 GASKETS, BOLTS, AND NUTS:

- A. For flanged joints, gaskets shall be a minimum of 1/8-inch thick full-face gaskets.
- B. Gaskets shall be of a composition suitable for exposure to the liquid within the pipe.
- C. Flanged joints shall be either made with bolts, bolt studs with a nut on each end, or studs with nuts where the flange is tapped. The number and size of bolts shall conform to the same ANSI Standard as the flanges. Bolts and nuts shall, except as otherwise specified or noted on the drawings, be heavy hex Grade B conforming to ASTM A307. Bolt studs and studs shall be of the same quality as machine bolts.

2.09 JOINT RESTRAINT:

- A. Where indicated or necessary to prevent joints or flexible couplings from pulling apart under pressure, suitable socket pipe clamps, tierods, and bridles shall be provided. Bridles and tierods shall be at least 3/4-inch diameter except where they replace flange bolts of smaller size, in which case they shall be fitted with a nut on each side of the pair of flanges. The socket clamps and tierods or bridles shall be coated with an approved primer paint after assembly, or, if necessary, prior to assembly.

PART 3 - EXECUTION

3.01 HANDLING AND CUTTING PIPE:

- A. Any pipe or fitting which has a damaged lining, scratched or marred machine surface, and/or abrasion of the pipe coating or lining shall be rejected and removed from the job site.

- B. Any fitting showing a crack and any fitting or pipe which has received a severe blow that may have caused an incipient fracture, even though no such fracture can be seen, shall be marked as rejected and removed at once from the work.
- C. In any pipe showing a distinct crack and in which it is believed there is no incipient fracture beyond the limits of the visible crack, the cracked portions, if so approved, may be cut off by and at the expense of the Contractor before the pipe is laid so that the pipe used may be perfectly sound. The cut shall be made in the sound barrel at a point at least 12-inches from the visible limits of the crack.
- D. Except as otherwise approved, all cutting shall be done with a machine suitable for cutting ductile iron pipe. Hydraulic squeeze cutters are not acceptable. Travel type cutters or rotary type abrasive saws may be used. All cut ends shall be examined for possible cracks caused by cutting.
- E. The Contractor's attention is directed to the fact that damage to the lining of pipe or fittings will render them unfit for use; he shall use the utmost care in handling and installing lined and coated pipe and fittings to prevent damage. Protective guards shall not be removed until the pipe is to be installed.
- F. Lined and coated pipe and fittings shall be assembled and installed with approved packing or gaskets of the type recommended by the pipe manufacturer for the particular lining used.
- G. Castings to be encased in masonry or concrete shall be accurately set with the bolt holes, if any, carefully aligned. OMNI*SLEEVE shall be installed per manufacturer's instructions.
- H. Immediately prior to being set, castings shall be thoroughly cleaned of all rust, scale and other foreign matter.

3.02 INSTALLING PIPE AND FITTINGS:

- A. No defective pipe or fittings shall be laid or placed in the piping, and any piece discovered to be defective after having been laid or placed shall be removed and replaced by a sound and satisfactory piece.
- B. Pipes and fittings shall be subjected to a careful inspection and a hammer test just before being installed.
- C. Before the pieces are assembled, rust-preventive coatings shall be removed from machined surfaces. Pipe ends, sockets, sleeves, housings, and gaskets shall be thoroughly cleaned and all burrs and other defects shall be carefully smoothed.
- D. Each pipe and fitting shall be cleared of all debris, dirt, etc., before being laid and shall be kept clean until accepted in the completed work.

- E. Flanged joints shall be made up tight, care being taken to prevent undue strain upon pump nozzles, valves, and other pieces of equipment.
- F. Pipe and fittings shall be laid accurately to the lines and grades indicated on the drawings or as required by the Engineer. Care shall be taken to ensure good alignment both horizontally and vertically.
- G. Castings to be encased in masonry shall be accurately set with the bolt holes, if any, carefully aligned.
- H. Immediately prior to being set, castings shall be thoroughly cleaned of all rust, scale and other foreign material.

3.03 ASSEMBLING SLEEVE TYPE COUPLINGS:

- A. Prior to the installation of flexible couplings, the pipe ends shall be cleaned thoroughly for a distance of 8-inches. Soapy water may be used as a gasket lubricant. A follower and gasket, in that order, shall be slipped over each pipe to a distance of about 6-inches from the end, and the middle ring shall be placed on the already laid pipe and until it is properly centered over the joint. The other pipe end shall be inserted into the middle ring and brought to proper position in relation to the pipe already laid. The gaskets and followers shall then be pressed evenly and firmly into the middle ring flares.
- B. After the bolts have been inserted and all nuts have been made up finger tight, diametrically opposite nuts shall be progressively and uniformly tightened all around the joint, preferably by use of a torque wrench of the appropriate size and torque for the bolts.
- C. The correct torque as indicated by a torque wrench shall not exceed 90 foot-pounds.

3.04 ASSEMBLING GROOVED COUPLINGS

- A. Clean grooves and other parts.
- B. Coat ends of pipe and outside of gasket with soft soap or silicone and slip gasket over one pipe end.
- C. Bring pipes to correct position and center gasket over pipe ends with lips against pipe.
- D. Place housing section, insert bolts and tighten nuts until housing sections are in metal-to-metal contact.
- E. If grooves must be cut in the field, the equipment used shall be as recommended by the coupling manufacturer. Finished grooves shall comply with AWWA C606.

3.05 PIPING SUPPORT:

- A. The Contractor shall furnish and install all supports necessary to hold the piping and appurtenances in a firm, substantial manner at the lines and grades indicated on the drawings or specified. Pipe supports shall be furnished with one shop coat of rust inhibitive primer.
- B. All pipe and appurtenances connected to equipment shall be supported in such a manner as to prevent any strain being imposed on the equipment. When manufacturers have indicated requirements that piping loads shall not be transmitted to their equipment, the Contractor shall submit a certification from the manufacturer stating that such requirements have been complied with.
- C. Piping within buildings shall be adequately supported from floors, walls, ceilings or beams. Supports from the floor shall be by approved saddle stands, or suitable concrete piers as indicated or approved. Pipe saddles shall be shaped to fit the pipe with which they will be used and shall be capable of screw adjustment. Brick and concrete piers shall conform accurately to the bottom one-third to one-half of the pipe. Piping along walls shall be supported by approved wall brackets with attached pipe rolls or saddles or by wall brackets with adjustable hanger rods. For piping supported from the ceiling, approved rod hangers of a type capable of screw adjustment after erection of the piping and with suitable adjustable concrete inserts or beam clamps shall be used.

3.06 TAPPED CONNECTIONS:

- A. Tapped connections in pipe and fittings shall be made so as to provide a watertight joint and adequate strength against pullout. The maximum size of taps in pipe or fittings without bosses shall not exceed that listed in the appropriate table of the Appendix to the ANSI A21.51, based on 3 full threads for ductile iron.
- B. Where the size of the connection exceeds that given above, a boss shall be provided on the pipe barrel and the tap shall be made in the flat part of the intersection of the run and branch of a tee or cross, or the connection shall be made by means of a tapped tee, branch fitting and tapped plug or reducing flange, or tapping tee and tapping valve, all as indicated or approved.

All drilling and tapping of ductile iron pipe shall be done normal to the longitudinal axis of the pipe; fittings shall be drilled and tapped similarly, as appropriate. Drilling and tapping shall be done only by skilled mechanics. Tools used shall be adapted to the work and in good condition so as to produce good, clean-cut threads of the correct size, pitch, and taper.

3.07 PRESSURE AND LEAKAGE TESTS:

- A. Prior to the pressure and leakage tests, the piping shall be thoroughly cleaned of all dirt, dust, oil, grease and other foreign material. This work shall be done with care to avoid damage to linings and coating.

- B. Except as otherwise required by the Engineer, all pipelines shall be given combined pressure and leakage tests in sections of approved length. The Contractor shall furnish and install suitable temporary testing plugs or caps; all necessary pressure pumps, pipe connections, meters, gates, and other necessary equipment; and all labor required. The Owner or Engineer may monitor the tests using their own gages.
- C. Subject to approval and provided that the tests are made within a reasonable time considering the progress of the project as a whole, and the need to put the section into service, the Contractor may make the tests when he desires.
- D. The section of pipe to be tested shall be filled with water of approved quality, and all air shall be expelled from the pipe. If hydrants and blowoffs are not available at high points for releasing air, the Contractor shall make the necessary taps at such points, including required excavation and backfilling, and shall plug said holes after completion of the test.
- E. The section under test shall be maintained full of water for 24 hours prior to the combined pressure and leakage test being applied.
- F. The pressure and leakage test shall consist of first raising the water pressure (based on the elevation of the lowest point of the section under test, corrected to the gage location) to a pressure in pounds per square inch numerically equal to the pressure rating of the pipe. If the Contractor cannot achieve the specified pressure and maintain it for a period of one hour, the section shall be considered as having failed to pass the pressure test.
- G. Following or during the pressure test, the Contractor shall conduct a leakage test by metering the flow of water into the pipe while maintaining pressure equal to the pressure rating of the pipe. If the average leakage during a two-hour period exceeds a rate of 11.6 gallons per inch of diameter per 24 hours per mile of pipeline, the section shall be considered as having failed the leakage test.
- H. If the section fails to pass the pressure and leakage test, the Contractor shall do everything necessary to locate, uncover, and repair or replace the defective pipe, fitting, or joint, all at his own expense and without extension of time for completion of the work. Additional tests and repairs shall be made until the section passes the specified test.
- I. If, in the judgment of the Engineer, it is impracticable to exactly follow the foregoing procedure, modifications in the procedure may be made as required and approved. The Contractor will still be responsible for providing a line, which satisfies the above leakage and pressure requirements.

END OF SECTION

SECTION 16010

ELECTRICAL WORK - GENERAL PROVISIONS

PART 1 - GENERAL

1.01 WORK INCLUDED:

- A. The work covered by this section of the specifications consists of furnishing all labor, equipment, appliances, materials and incidentals in connection with the installation of the complete electrical systems as herein specified and as shown on the drawings.
- B. It is not the intent that the drawings shall show every junction box, conduit, wire, fitting, device, accessory, etc., but the Contractor shall be required to furnish without additional expense all transportation, labor and materials necessary to complete the electrical systems in accordance with the best practice of the trade.
- C. Unless otherwise specified, materials of the same classifications, used for the same purpose shall be the product of the same manufacturer.
- D. The work shall include furnishing and installing the following items:
 - 1. Transformers
 - 2. Grounding System
 - 3. Panelboards
 - 4. Lighting Systems
 - 5. Motor Disconnect Devices
 - 6. Emergency Lighting System
 - 7. Heating, Cooling and ventilation Equipment power wiring
 - 8. Raceways
 - 9. Feeder and Branch Circuit Conductors
 - 10. Wiring Devices and Finish Plates
 - 11. Outlet Boxes
 - 12. Pull and Junction Boxes
 - 13. Hangers and Supports

14. Solderless Lugs and Connectors
15. Conduit and wire for equipment and controls furnished under other divisions of the specifications, when shown on the electrical plans, with the exception of the instrumentation low voltage signal wiring.

E. Electric Service and Metering

The power company serving this project is Eversource Electric.

1. Existing service is to remain with modifications as indicated.

F. Interpretation of Drawings

1. The Drawings are diagrammatic only and are not intended to show exact locations of outlets and conduit runs.
2. All three-phase circuits shall be run in separate conduits unless otherwise shown on the Drawings.
3. The Contractor shall verify with the Engineer the exact locations and mounting heights of lighting fixtures, switches and receptacles prior to installation.
4. Any work installed contrary to Contract Documents, or without approval by the Engineer, shall be changed or replaced as required by the Engineer and no extra compensation will be allowed the Contractor for making these changes.
5. The locations of equipment, fixtures, outlets, and similar devices shown on the Drawings are approximate only. Exact locations shall be as approved by the Engineer during construction. The Contractor shall obtain in the field all information relevant to the placing of electrical work and in case of any interference with other work, shall proceed as required by the Engineer and shall furnish all labor and materials necessary to complete the work in an approved manner.
6. Surface mounted panel boxes, junction boxes, conduit, etc., shall be supported by spacers to provide a clearance between wall and equipment.
7. The number of conductors shown on the Drawings are not necessarily the correct number required. As many conductors as are required in each case shall be installed.
8. The ratings of motors and other electrically operated devices together with the size shown for their branch circuit conductors and conduits are approximate only and are indicative of the probable power requirements insofar as can be determined in advance of the purchase of equipment.

The ratings shown for motor branch circuit protective devices are the maximum ratings permitted. Lower ratings may be used where approved as being proper for the dynamic characteristics of the motor and its connected load.

9. Unless otherwise specified, all conduits, wires, and cables and the support systems for the conduits and cables that are required to make the electrical connections to equipment shall be furnished and installed. All connections to equipment shall be made as shown, specified, and required and in accordance with the approved shop and setting drawings.
10. The Contractor shall verify, in the field, all measurements necessary for his work and shall assume responsibility for their accuracy.

1.02 LOCAL CONDITIONS:

- A. The Contractor shall provide and place all sleeves for conduits penetrating floors, walls, partitions, etc. The Contractor shall locate all necessary slots for his work and these shall be formed before concrete is poured.
- B. All cutting, and patching shall be done in a thoroughly workmanlike manner.
- C. The Contractor shall investigate each space in the building through which equipment must pass to reach its final location. If necessary, the manufacturer shall be required to ship his material in sections sized to permit passing through such restricted areas in the building.
- D. Before submitting proposals, the Contractor is expected to inspect the site and survey the conditions to be encountered in the performance of the work. Failure to familiarize himself with the conditions shall not relieve the Contractor's responsibility for full completion of the work in accordance with the provisions of the Contract.

1.03 PERMITS AND INSPECTION:

- A. Permits, fees and notices shall be in accordance with the General Conditions.
- B. All work shall meet or exceed the latest requirements of all national, state, county, municipal and other authorities exercising jurisdiction over electrical construction at this project.
- C. All required permit and inspection certificates shall be obtained, paid for, and given to the Owner at the completion of the work.

1.04 CODES AND STANDARDS:

- A. Unless indicated or specified otherwise, materials and workmanship shall conform with the latest editions of the following codes, standards and specifications.
1. Connecticut Electrical Code.
 2. National Bureau of Standards Handbook H-30 National Electrical Safety Code
 3. State and Local Codes, and all other authorities having jurisdiction
 4. Underwriter's Laboratories, Inc. (UL)
 5. American National Standards Institute, Inc.
 6. Institute of Electrical and Electronic Engineers (IEEE)
 7. National Electrical Manufacturers Association (NEMA)
 8. National Board of Fire Underwriters
 9. International Municipal Signal Association (IMSA)
 10. Insulated Power Cable Engineers Associated Specifications
 11. American Society for Testing Materials Specifications

1.05 REVIEW OF MATERIALS:

- A. Material and Equipment Schedules. As soon as practicable and within thirty days after the date of notice to proceed and before commencement of installation of any materials or equipment, the Contractor shall submit to the Engineer six (6) complete Brochures for approval of materials, fixtures, and equipment to be incorporated in the work. The list shall include manufacturer's name, catalog numbers, cuts, diagrams, drawings, and such other descriptive data as may be required. No consideration will be given to a partial submittal from time to time. Approval of materials will be based on manufacturer's published ratings. Any materials, fixtures and equipment listed that are not in accordance with the specification requirements will be rejected.
- B. Substitutions: Substitution of material or equipment shall be in accordance with the General Conditions.
- C. Shop Drawings. Shop drawings shall be submitted to the Engineer for review in accordance with the Division 1. Shop drawings shall be submitted for, but not limited to the following:
1. Panelboards

2. Lighting Fixtures
3. Transformers
4. Emergency Lighting
5. Wire and Cable
6. Heating, Cooling and Ventilation Equipment
7. Wiring Devices and Finish Plates
8. Contactors
9. Hangers and Supports
10. Disconnect Switches
11. Fuses
12. Circuit Breakers
13. Raceways

D. Submit the following information with all equipment shop drawings.

1. Manufacturer's certified scale drawings, cuts, or catalogs, including installation details and manufacturer's name.
2. Manufacturer's specifications, including certified performance characteristics and capacity ratings.
3. Electrical wiring diagrams and controls, where applicable.
4. Certificate of compliance with Code, where applicable.
5. Detail of all conduit stub-up with conduit size and dimensions from columns or walls.

E. Equipment shop drawings and wiring diagrams must be prepared specifically for this installation. Standard factory wiring diagrams with a revision marked in ink for this installation will be accepted.

F. All control and wiring diagrams shall be complete with the following description:

1. Sequence of operation
2. Sequence of interlocking

3. Operation of alarms
 4. Legend
 5. Wiring Numbers
- G. All equipment shop drawings shall be properly identified and indicate the Article number of the specifications or the Drawing number which applies to the submitted item.
- H. Shop drawings for the items listed above shall be submitted for approval in accordance with the preceding paragraphs. The Engineer, however, reserves the right to require submittal of shop drawings on any other material or equipment to be installed under this Section not specifically listed above.

1.06 MINOR DEVIATIONS:

- A. The work as shown on the drawings is diagrammatic and is intended to show the work included and the arrangement of the various systems.
- B. It is not intended that the accompanying plans and specifications cover every detail of the required installation. Furnish and install equipment, materials and labor as shown or specified, as are usually furnished, or as are needed to make a complete and satisfactory operating installation, whether mentioned or not, omitting only those items which are specifically excluded.
- C. Locations and mounting heights of equipment and/or devices as shown are approximately correct. The Engineer reserves the right to relocate any equipment or device prior to actual installation at no extra cost to the Owner.
- D. No deviation from layout shall be made without written approval from the Engineer.

1.07 TEMPORARY LIGHT AND POWER:

- A. The owner shall pay all energy charges as described in Division 1.

1.08 ELECTRICAL REFERENCE SYMBOLS:

- A. Symbols shown on the drawings shall approximate location of fixtures, outlet boxes, and conduit runs, and other equipment, unless otherwise detailed. The exact location shall be governed by structural conditions and obstructions. This is not to be construed to permit redesigning systems. All outlets shall be interconnected as shown on the drawings. Locate and install all boxes and equipment where they will be readily accessible.

1.09 PHASE IDENTIFICATION:

- A. The entire system of wiring shall be phased by color code as follows:
 - 1. Wires No. 6 AWG and smaller shall have a continuous colored outer covering.
 - 2. Wires larger than No. 6 AWG shall be identified at all points of termination by gummed tape, plastic tape, etc., applied to the wire.
 - 3. Bus bars in panelboards shall be properly identified by color as herein specified.
 - 4. Code colors for 120/208-volt systems shall be:
 - a. Phase A - Black
 - b. Phase B - Red
 - c. Phase C - Blue
 - 5. Code colors for 277/480-volt systems shall be:
 - a. Phase A - Brown
 - b. Phase B - Orange
 - c. Phase C - Yellow
 - 6. Neutral wires shall be white or grey.
 - 7. Equipment ground wires shall be green.
 - 8. The same colors shall be used for the same phases throughout the entire project.

1.10 PROTECTION AND CLEANING OF EQUIPMENT:

- A. All electrical equipment, upon receipt, shall be adequately stored and protected from damage.
- B. After installation, all electrical equipment shall be protected to prevent damage during the construction period. Openings in conduits and boxes shall be closed to prevent entrance of foreign materials.
- C. The interior of boxes and cabinets shall be left clean. Exposed surfaces shall be cleaned and plate surfaces polished.

1.11 OPERATION AND MAINTENANCE MANUALS:

- A. The Contractor shall furnish the Owner with four (4) copies of complete operating and maintenance manuals. Manuals shall include all equipment, maintenance instruction, parts list, warranties, schematic diagrams of control systems, and lubrication charts.
- B. Manuals shall contain only that information which specifically applies to this project, and all unrelated material shall be deleted. During the instruction period, herein specified, this manual shall be used and explained. Each copy of manual shall be clearly indexed and include a directory of all subcontractors and maintenance contractors, indicate the area of their responsibility, and list the name and telephone numbers of the responsible member of each organization. This material shall have a clear plastic protective shield over each sheet of data.
- C. Each manual shall be bound in an expandable plastic covered hard bound binder. Ring type binders will be acceptable. The manual's front cover and side cover shall be stamped "Operation and Maintenance Manual -- Electrical Systems" along with the project title.

1.12 OPERATING AND MAINTENANCE INSTRUCTIONS:

- A. A competent Engineer shall be provided by the Contractor to instruct operating personnel in the operation and maintenance of equipment and systems.

1.13 SPARE PARTS DATA:

- A. The Contractor shall furnish a complete list of recommended spare parts and supplies for the equipment furnished with current unit prices and source of supply.

1.14 TESTS:

- A. The Electrical Subcontractor shall perform all tests at the completion of the work and the results furnished to the Owner and Engineer in writing. Tests shall include, but not be limited to: all systems test free of shorts or grounds, proper neutral connections, ground system resistance, secondary voltages at main distribution panel, power panels and lighting panels, all lighting fixtures with lamps in place for 10 hours.
- B. Upon completion of all work, the Electrical Subcontractor shall furnish, in duplicate, certificates of inspections from all inspectors and authorities having jurisdiction, notarized letters from the manufacturers stating that authorized Factory Engineers or agents have inspected and tested the installation of their respective systems and found same to be in satisfactory operating condition.
- C. Furnish all labor, material, instruments, supplies and services and bear all costs for the accomplishment of the tests.

1.15 GUARANTEE:

- A. The Contractor shall guarantee equipment and performance of the installation and equipment in accordance with the GENERAL CONDITIONS.
- B. Lamps shall be furnished and installed in each lighting fixture as soon as fixtures are properly hung. Replace all lamps that fail within ninety (90) days after final acceptance at no additional cost. If the Contractor fails to replace lamps during the guarantee period, after a second request the Owner may replace lamps and back-charge Contractor.

PART 2 - PRODUCTS

2.01 MATERIALS:

- A. The materials used in all systems shall be new, unused and as hereinafter specified. All materials where not specified shall be of the very best of their respective kinds. Samples of materials or manufacturer's specification shall be submitted for approval as required by the Engineer.
- B. Materials and equipment used shall be U.L. listed wherever such approved materials and equipment is available.
- C. Electrical equipment shall at all times during construction be adequately protected against mechanical injury or damage by water. If any apparatus has been damaged, such damage shall be repaired by the Contractor at his cost and expense. If any apparatus has been subject to possible damage by water, it shall be thoroughly dried out and put through such special tests as required by the Engineer, at the cost and expense of the Contractor, or shall be replaced by the Contractor at his own expense.

PART 3 - EXECUTION

3.01 INSTALLATION:

- A. All work shall be executed in full accordance with the National Electrical Code and local rulings. Should any work be performed contrary to said rulings, ordinances and regulations, this Contractor shall bear full responsibility for such violations and assume all costs arising therefrom.
- B. Load Balance. Check the load balance on the phases of the various systems and reconnect where necessary as approved by the Engineer to provide equal division of the loads between the phases of the various systems.
- C. Before starting the work, confer with all other trades relative to the location of pipes, ducts, and apparatus or fixtures to be installed by them and select locations for the work which will avoid possible conflicts with the work of other trades involved. All differences or conflicting conditions concerning the work shall be

called to the attention of the Engineer for adjustment before starting work. For such work performed or materials installed in violation of the above clause the work shall be readjusted to the complete satisfaction of the Engineer at the sole expense of the Electrical Subcontractor.

D. Cleanup

1. This Contractor shall cooperate with other workmen and with the General Contractor in the daily removal of debris from the work site.
2. This Contractor shall leave "broom clean" all areas where he has interrupted or completed his work.
3. He shall cooperate with the General Contractor in good housekeeping procedures.
4. At the completion of his work, prior to the final inspection, this Contractor shall clean all devices, plates, fixtures, glassware, switches, cabinets, exposed conduits, fittings, etc. and shall have the premises in a thoroughly clean condition.

END OF SECTION

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SECTION 16050

BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

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

1.02 SUMMARY:

- A. This Section includes the following:
 - 1. Raceways.
 - 2. Building wire and connectors.
 - 3. Supporting devices for electrical components.
 - 4. Electrical identification.
 - 5. Electrical demolition.
 - 6. Cutting and patching for electrical construction.
 - 7. Touchup painting.

1.03 DEFINITIONS:

- A. EMT: Electrical metallic tubing.
- B. FMC: Flexible metal conduit.
- C. IMC: Intermediate metal conduit.
- D. LFMC: Liquidtight flexible metal conduit.
- E. RNC: Rigid nonmetallic conduit.
- F. RSC: Rigid Steel Conduit.

1.04 SUBMITTALS:

- A. Product Data: Electrical Equipment
- B. Shop Drawings: Electrical Equipment

- C. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

1.05 QUALITY ASSURANCE:

- A. 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.
- B. Comply with NFPA 70.

1.06 COORDINATION:

- A. Coordinate chases, slots, inserts, sleeves, and openings with general construction work and arrange in building structure during progress of construction to facilitate the electrical installations that follow.
 - 1. Set inserts and sleeves in poured-in-place concrete, masonry work, and other structural components as they are constructed.
- B. Sequence, coordinate, and integrate installing electrical materials and equipment for efficient flow of the Work. Coordinate installing large equipment requiring positioning before closing in the building.
- C. Where electrical identification devices are applied to field-finished surfaces, coordinate installation of identification devices with completion of finished surface.
- D. Where electrical identification markings and devices will be concealed by acoustical ceilings and similar finishes, coordinate installation of these items before ceiling installation.

PART 2 - PRODUCTS

2.01 RACEWAYS:

- A. EMT: ANSI C80.3, zinc-coated steel, with set-screw or compression fittings.
- B. FMC: Zinc-coated steel.
- C. IMC: ANSI C80.6, zinc-coated steel, with threaded fittings.
- D. LFMC: Zinc-coated steel with sunlight-resistant and mineral-oil-resistant plastic jacket.
- E. RNC: NEMA TC 2, Schedule 40 PVC, with NEMA TC3 fittings.

- F. Raceway Fittings: Specifically designed for the raceway type with which used.
- G. RSC: Zinc coated steel

2.02 CONDUCTORS:

- A. Conductors, No. 10 AWG and Smaller: Solid or stranded copper.
- B. Conductors, Larger than No. 10 AWG: Stranded copper.
- C. Insulation: Thermoplastic, rated at 75 deg C minimum.
- D. Wire Connectors and Splices: Units of size, ampacity rating, material, type, and class suitable for service indicated.

2.03 SUPPORTING DEVICES:

- A. Material: Cold-formed steel, with corrosion-resistant coating acceptable to authorities having jurisdiction.
- B. Metal Items for Use Outdoors or in Damp Locations: Hot-dip galvanized steel.
- C. Slotted-Steel Channel Supports: Flange edges turned toward web, and 9/16-inch diameter slotted holes at a maximum of 2-inches o.c., in webs.
- D. Slotted-Steel Channel Supports: Zinc coated slotted channel framing.
 - 1. Channel Thickness: Selected to suit structural loading.
 - 2. Fittings and Accessories: Products of the same manufacturer as channel supports.
- E. Nonmetallic Channel and Angle Systems: Structural-grade, factory-formed, glass-fiber-resin channels and angles with 9/16-inch diameter holes at a maximum of 8-inches o.c., in at least one surface.
 - 1. Fittings and Accessories: Products of the same manufacturer as channels and angles.
 - 2. Fittings and Accessory Materials: Same as channels and angles, except metal items may be stainless steel.
- F. Raceway and Cable Supports: Manufactured clevis hangers, riser clamps, straps, threaded C-clamps with retainers, ceiling trapeze hangers, wall brackets, and spring-steel clamps or click-type hangers.
- G. Pipe Sleeves: ASTM A 53, Type E, Grade A, Schedule 40, galvanized steel, plain ends.
- H. Expansion Anchors: Carbon-steel wedge or sleeve type.

- I. Toggle Bolts: All-steel springhead type.
- J. Powder-Driven Threaded Studs: Heat-treated steel.

2.04 ELECTRICAL IDENTIFICATION:

- A. Identification Devices: A single type of identification product for each application category. Use colors prescribed by ANSI A13.1, NFPA 70, and these Specifications.
- B. Raceway and Cable Labels: Comply with ANSI A13.1, Table 3, for minimum size of letters for legend and minimum length of color field for each raceway and cable size.
 - 1. Type: Pretensioned, wraparound plastic sleeves. Flexible, preprinted, color-coded, acrylic band sized to suit the diameter of the item it identifies.
 - 2. Type: Preprinted, flexible, self-adhesive, vinyl. Legend is over-laminated with a clear, weather- and chemical-resistant coating.
 - 3. Color: Black letters on orange background.
 - 4. Legend: Indicates voltage.
- C. Colored Adhesive Marking Tape for Raceways, Wires, and Cables: Self-adhesive vinyl tape, not less than 1-inch wide by 3 mils thick.
- D. Underground Warning Tape: Permanent, bright-colored, continuous-printed, vinyl tape with the following features:
 - 1. Not less than 6-inches wide by 4 mils thick.
 - 2. Compounded for permanent direct-burial service.
 - 3. Embedded continuous metallic strip or core.
 - 4. Printed legend that indicates type of underground line.
- E. Tape Markers for Wire: Vinyl or vinyl-cloth, self-adhesive, wraparound type with preprinted numbers and letters.
- F. Color-Coding Cable Ties: Type 6/6 nylon, self-locking type. Colors to suit coding scheme.
- G. Engraved-Plastic Labels, Signs, and Instruction Plates: Engraving stock, melamine plastic laminate punched or drilled for mechanical fasteners 1/16-inch minimum thickness for signs up to 20 sq. in. and 1/8-inch minimum thickness for larger sizes. Engraved legend in black letters on white background.
- H. Interior Warning and Caution Signs: Comply with 29 CFR, Chapter XVII, Part 1910.145. Preprinted, aluminum, baked-enamel-finish signs, punched or drilled for mechanical fasteners, with colors, legend, and size appropriate to the application.
- I. Exterior Warning and Caution Signs: Comply with 29 CFR, Chapter XVII, Part 1910.145. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate

signs with 0.0396-inch, galvanized-steel backing, with colors, legend, and size appropriate to the application. 1/4-inch grommets in corners for mounting.

- J. Fasteners for Nameplates and Signs: Self-tapping, stainless-steel screws or No. 10/32 stainless-steel machine screws with nuts and flat and lock washers.

2.05 EQUIPMENT FOR UTILITY COMPANY'S ELECTRICITY METERING:

- A. Electric service and metering equipment is existing to remain.

2.06 TOUCHUP PAINT:

- A. For Equipment: Equipment manufacturer's paint selected to match installed equipment finish.
- B. Galvanized Surfaces: Zinc-rich paint recommended by item manufacturer.

PART 3 - EXECUTION

3.01 ELECTRICAL EQUIPMENT INSTALLATION:

- A. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide the maximum possible headroom.
- B. Materials and Components: Install level, plumb, and parallel and perpendicular to other building systems and components, unless otherwise indicated.
- C. Equipment: Install to facilitate service, maintenance, and repair or replacement of components. Connect for ease of disconnecting, with minimum interference with other installations.
- D. Right of Way: Give to raceways and piping systems installed at a required slope.

3.02 RACEWAY APPLICATION:

- A. Use the following raceways for outdoor installations:
 1. Exposed: RSC.
 2. Concealed: RSC.
 3. Underground, Single Run: RNC.
 4. Underground Grouped: RNC.
 5. Connection to Vibrating Equipment: LFMC.
 6. Boxes and Enclosures: NEMA 250, Type 3R or Type 4.

- B. Use the following raceways for indoor installations:
 - 1. Exposed: RSC.
 - 2. Concealed: IMC.
 - 3. Connection to Vibrating Equipment: FMC; except in wet or damp locations, use LFMC.
 - 4. Damp or Wet Locations: RSC.
 - 5. Boxes and Enclosures: NEMA 250, Type 3R, unless otherwise indicated.

3.03 RACEWAY AND CABLE INSTALLATION:

- A. Install raceways and cables at least 6-inches away from parallel runs of heat generating equipment. Locate horizontal raceway runs above water and steam piping.
- B. Use temporary raceway caps to prevent foreign matter from entering.
- C. Make conduit bends and offsets so ID is not reduced. Keep legs of bends in the same plane and straight legs of offsets parallel, unless otherwise indicated.
- D. Use raceway and cable fittings compatible with raceways and cables and suitable for use and location.
- E. Install pull wires in empty raceways. Use No. 14 AWG zinc-coated steel or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12-inches of slack at each end of the pull wire.
- F. Install telephone and signal system raceways, 2-inch trade size and smaller, in maximum lengths of 150 feet and with a maximum of two 90-degree bends or equivalent. Separate lengths with pull or junction boxes where necessary to comply with these requirements, in addition to requirements above.
- G. Connect motors and equipment subject to vibration, noise transmission, or movement with a maximum of 72-inch flexible conduit. Install LFMC in wet or damp locations. Install separate ground conductor across flexible connections.

3.04 WIRING METHODS FOR POWER, LIGHTING, AND CONTROL CIRCUITS:

- A. Feeders: Type THHN/THWN insulated conductors in raceway.
- B. Underground Feeders and Branch Circuits: Type THWN or single-wire, Type UF insulated conductors in raceway.
- C. Branch Circuits: Type THHN/THWN insulated conductors in raceway.
- D. Branch Circuits: Type THW or THHN/THWN insulated conductors in raceway where exposed. Metal-clad cable where concealed in ceilings and gypsum board partitions.

- E. Branch Circuits: Type THW or THHN/THWN insulated conductors in raceway where exposed. Armored or nonmetallic sheathed cable where permitted by authorities having jurisdiction and where concealed in ceilings and gypsum board partitions.
- F. Remote-Control Signaling and Power-Limited Circuits: Type THHN/THWN insulated conductors in raceway for Classes 1, 2, and 3, unless otherwise indicated.

3.05 WIRING INSTALLATION:

- A. Install splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
- B. Install wiring at outlets with at least 12-inches of slack conductor at each outlet.
- C. Connect outlet and component connections to wiring systems and to ground. Tighten electrical connectors and terminals, according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A.

3.06 ELECTRICAL SUPPORTING DEVICE APPLICATION:

- A. Damp Locations and Outdoors: Hot-dip galvanized materials or nonmetallic, U-channel system components.
- B. Dry Locations: Steel materials.
- C. Support Clamps for PVC Raceways: Click-type clamp system.
- D. Selection of Supports: Comply with manufacturer's written instructions.
- E. Strength of Supports: Adequate to carry present and future loads, times a safety factor of at least four; minimum of 200-lb design load.

3.07 SUPPORT INSTALLATION:

- A. Install support devices to securely and permanently fasten and support electrical components.
- B. Install individual and multiple raceway hangers and riser clamps to support raceways. Provide U-bolts, clamps, attachments, and other hardware necessary for hanger assemblies and for securing hanger rods and conduits.
- C. Support parallel runs of horizontal raceways together on trapeze- or bracket-type hangers.

- D. Size supports for multiple raceway installations, so capacity can be increased by a 25 percent minimum in the future.
- E. Support individual horizontal raceways with separate, malleable-iron pipe hangers or clamps.
- F. Install 1/4-inch diameter or larger threaded steel hanger rods, unless otherwise indicated.
- G. Spring-steel fasteners specifically designed for supporting single conduits or tubing may be used instead of malleable-iron hangers for 1-1/2-inch and smaller raceways serving lighting and receptacle branch circuits above suspended ceilings and for fastening raceways to slotted channel and angle supports.
- H. Arrange supports in vertical runs so the weight of raceways and enclosed conductors is carried entirely by raceway supports, with no weight load on raceway terminals.
- I. Simultaneously install vertical conductor supports with conductors.
- J. Separately support cast boxes that are threaded to raceways and used for fixture support. Support sheet-metal boxes directly from the building structure or by bar hangers. If bar hangers are used, attach bar to raceways on opposite sides of the box and support the raceway with an approved fastener not more than 24-inches from the box.
- K. Install metal channel racks for mounting cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices unless components are mounted directly to structural elements of adequate strength.
- L. Install sleeves for cable and raceway penetrations of concrete slabs and walls unless core-drilled holes are used. Install sleeves for cable and raceway penetrations of masonry and fire-rated gypsum walls and of all other fire-rated floor and wall assemblies. Install sleeves during erection of concrete and masonry walls.
- M. Securely fasten electrical items and their supports to the building structure, unless otherwise indicated. Perform fastening according to the following unless other fastening methods are indicated:
 - 1. Wood: Fasten with wood screws or screw-type nails.
 - 2. Masonry: Toggle bolts on hollow masonry units and expansion bolts on solid masonry units.
 - 3. New Concrete: Concrete inserts with machine screws and bolts.
 - 4. Existing Concrete: Expansion bolts.
 - 5. Instead of expansion bolts, threaded studs driven by a powder charge and provided with lock washers may be used in existing concrete.
 - 6. Steel: Welded threaded studs or spring-tension clamps on steel.
 - a. Field Welding: Comply with AWS D1.1.

7. Welding to steel structure may be used only for threaded studs, not for conduits, pipe straps, or other items.
8. Light Steel: Sheet-metal screws.
9. Fasteners: Select so the load applied to each fastener does not exceed 25 percent of its proof-test load.

3.08 IDENTIFICATION MATERIALS AND DEVICES:

- A. Install at locations for most convenient viewing without interference with operation and maintenance of equipment.
- B. Coordinate names, abbreviations, colors, and other designations used for electrical identification with corresponding designations indicated in the Contract Documents or required by codes and standards. Use consistent designations throughout Project.
- C. Self-Adhesive Identification Products: Clean surfaces before applying.
- D. Identify raceways and cables with color banding as follows:
 1. Bands: Pretensioned, snap-around, colored plastic sleeves or colored adhesive marking tape. Make each color band 2-inches wide, completely encircling conduit, and place adjacent bands of two-color markings in contact, side by side.
 2. Band Locations: At changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.
 3. Colors: As follows:
 - a. Security System: Blue and yellow.
 - b. Telecommunication System: Green and yellow.
- E. Tag and label circuits designated to be extended in the future. Identify source and circuit numbers in each cabinet, pull and junction box, and outlet box. Color-coding may be used for voltage and phase identification.
- F. Install continuous underground plastic markers during trench backfilling, for exterior underground power, control, signal, and communication lines located directly above power and communication lines. Locate 6- to 8-inches below finished grade. If width of multiple lines installed in a common trench or concrete envelope does not exceed 16-inches, overall, use a single line marker.
- G. Color-code 208/120-V system secondary service, feeder, and branch-circuit conductors throughout the secondary electrical system as follows:
 1. Phase A: Black.
 2. Phase B: Red.
 3. Phase C: Blue.

- H. Color-code 480/277-V system secondary service, feeder, and branch-circuit conductors throughout the secondary electrical system as follows:
 - 1. Phase A: Brown.
 - 2. Phase B: Orange.
 - 3. Phase C: Yellow.
- I. Install warning, caution, and instruction signs where required to comply with 29 CFR, Chapter XVII, Part 1910.145, and where needed to ensure safe operation and maintenance of electrical systems and of items to which they connect. Install engraved plastic-laminated instruction signs with approved legend where instructions are needed for system or equipment operation. Install metal-backed butyrate signs for outdoor items.
- J. Install engraved-laminated emergency-operating signs with white letters on red background with minimum 3/8-inch high lettering for emergency instructions on power transfer, load shedding, and other emergency operations.

3.09 DEMOLITION:

- A. Protect existing electrical equipment and installations indicated to remain. If damaged or disturbed in the course of the Work, remove damaged portions and install new products of equal capacity, quality, and functionality.
- B. Accessible Work: Remove exposed electrical equipment and installations, indicated to be demolished, in their entirety.
- C. Abandoned Work: Cut and remove buried raceway and wiring, indicated to be abandoned in place, 2-inches below the surface of adjacent construction. Cap raceways and patch surface to match existing finish.
- D. Remove demolished material from Project site.
- E. Remove, store, clean, reinstall, reconnect, and make operational components indicated for relocation.

3.10 CUTTING AND PATCHING:

- A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces required to permit electrical installations. Perform cutting by skilled mechanics of trades involved.
- B. Repair and refinish disturbed finish materials and other surfaces to match adjacent undisturbed surfaces. Install new fireproofing where existing firestopping has been disturbed. Repair and refinish materials and other surfaces by skilled mechanics of trades involved.

3.11 FIELD QUALITY CONTROL:

- A. Inspect installed components for damage and faulty work, including the following:
 - 1. Raceways.
 - 2. Building wire and connectors.
 - 3. Supporting devices for electrical components.
 - 4. Electrical identification.
 - 5. Electrical demolition.
 - 6. Cutting and patching for electrical construction.
 - 7. Touchup painting.

3.12 REFINISHING AND TOUCHUP PAINTING:

- A. Refinish and touch up paint. Paint materials and application requirements per manufacturers recommendations.
 - 1. Clean damaged and disturbed areas and apply primer, intermediate, and finish coats to suit the degree of damage at each location.
 - 2. Follow paint manufacturer's written instructions for surface preparation and for timing and application of successive coats.
 - 3. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - 4. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

3.13 CLEANING AND PROTECTION:

- A. On completion of installation, including outlets, fittings, and devices, inspect exposed finish. Remove burrs, dirt, paint spots, and construction debris.
- B. Protect equipment and installations and maintain conditions to ensure that coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 16070

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY:

A. Section Includes:

1. Conduit supports.
2. Formed steel channel.
3. Spring steel clips.
4. Sleeves.
5. Mechanical sleeve seals.
6. Fire stopping relating to electrical work.
7. Fire stopping accessories.
8. Equipment bases and supports.

1.02 REFERENCES:

A. ASTM International:

1. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
2. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
3. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Fire Stops.
4. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems.

B. FM Global:

1. FM - Approval Guide, A Guide to Equipment, Materials & Services Approved by Factory Mutual Research for Property Conservation.

C. National Fire Protection Association:

1. NFPA 70 - National Electrical Code.

D. Connecticut Electric Code.

E. Underwriters Laboratories Inc.:

1. UL 263 - Fire Tests of Building Construction and Materials.
2. UL 723 - Tests for Surface Burning Characteristics of Building Materials.

3. UL 1479 - Fire Tests of Through-Penetration Fire stops.
4. UL 2079 - Tests for Fire Resistance of Building Joint Systems.
5. UL - Fire Resistance Directory.

1.03 DEFINITIONS:

- A. Fire stopping (Through-Penetration Protection System): Sealing or stuffing material or assembly placed in spaces between and penetrations through building materials to arrest movement of fire, smoke, heat, and hot gases through fire rated construction.

1.04 SYSTEM DESCRIPTION:

- A. Fire stopping Materials: ASTM E119, ASTM E814 to achieve fire ratings of adjacent construction in accordance with UL Design Numbers noted on the Architectural Drawings.
- B. Surface Burning: ASTM E84 with maximum flame spread / smoke developed rating of 25/450.
- C. Fire stop interruptions to fire rated assemblies, materials, and components.

1.05 PERFORMANCE REQUIREMENTS:

- A. Fire stopping: Conform to applicable code and UL requirements for fire resistance ratings and surface burning characteristics.
- B. Fire stopping: Provide certificate of compliance from authority having jurisdiction indicating approval of materials used.

1.06 SUBMITTALS:

- A. Section 01330 - Submittal Procedures: Requirements for submittals.
- B. Shop Drawings: Indicate system layout with location and detail of trapeze hangers.
- C. Product Data:
 1. Hangers and Supports: Submit manufacturers catalog data including load capacity.
 2. Fire stopping: Submit data on product characteristics, performance and limitation criteria.
- D. Fire stopping Schedule: Submit schedule of opening locations and sizes, penetrating items, and required listed design numbers to seal openings to maintain fire resistance rating of adjacent assembly.

- E. Design Data: Indicate load carrying capacity of trapeze hangers.
- F. Manufacturer's Installation Instructions:
 - 1. Hangers and Supports: Submit special procedures and assembly of components.
 - 2. Fire stopping: Submit preparation and installation instructions.
- G. Manufacturer's Certificate: Certify products meet or exceed specified requirements.
- H. Engineering Judgments: For conditions not covered by UL listed designs, submit judgments by licensed professional engineer suitable for presentation to authority having jurisdiction for acceptance as meeting code fire protection requirements.

1.07 QUALITY ASSURANCE:

- A. Through Penetration Fire stopping of Fire Rated Assemblies: ASTM E814 with 0.10-inch water gage (24.9 Pa) minimum positive pressure differential to achieve fire F-Ratings and temperature T-Ratings as indicated on Drawings, but not less than 1-hour.
 - 1. Wall Penetrations: Fire F-Ratings as indicated on Drawings, but not less than 1-hour.
 - 2. Floor and Roof Penetrations: Fire F-Ratings and temperature T-Ratings as indicated on Drawings, but not less than 1-hour.
 - a. Floor Penetrations within Wall Cavities: T-Rating is not required.
- B. Through Penetration Fire stopping of Non-Fire Rated Floor and Roof Assemblies: Materials to resist free passage of flame and products of combustion.
 - 1. Noncombustible Penetrating Items: Noncombustible materials for penetrating items connecting maximum of three stories.
 - 2. Penetrating Items: Materials approved by authorities having jurisdiction for penetrating items connecting maximum of two stories.
- C. Fire Resistant Joints in Fire Rated Floor, Roof, and Wall Assemblies: ASTM E1966 or UL 2079 to achieve fire resistant rating as required for assembly in which joint is installed.
- D. Fire Resistant Joints between Floor Slabs and Exterior Walls: ASTM E119 with 0.10-inch water gage (24.9 Pa) minimum positive pressure differential to achieve fire resistant rating as indicated on Drawings for floor assembly.
- E. Surface Burning Characteristics: 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.
- F. Perform Work in accordance with the latest adopted version of the State of Massachusetts Building and Fire Safety Codes.

G. Maintain one copy of each document on site.

1.08 QUALIFICATIONS:

- A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years' experience.
- B. Installer: Company specializing in performing work of this section with minimum three years' experience, approved by manufacturer.

1.09 PRE-INSTALLATION MEETINGS:

- A. Convene minimum one week prior to commencing work of this section.

1.10 DELIVERY, STORAGE, AND HANDLING:

- A. Accept materials on site in original factory packaging, labeled with manufacturer's identification.
- B. Protect from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original packaging.

1.11 ENVIRONMENTAL REQUIREMENTS:

- A. Do not apply fire stopping materials when temperature of substrate material and ambient air is below 60 degrees F (15 degrees C).
- B. Maintain this minimum temperature before, during, and for minimum 3 days after installation of fire stopping materials.
- C. Provide ventilation in areas to receive solvent cured materials.

PART 2 - PRODUCTS

2.01 CONDUIT SUPPORTS:

- D. Manufacturers:
 - 1. Allied Tube & Conduit Corp.
 - 2. Electro line Manufacturing Company.
 - 3. O-Z Gedney Co.
 - 4. Thomas and Betts
- E. Hanger Rods: Threaded high tensile strength galvanized carbon steel with free running threads.

- F. Beam Clamps: Malleable Iron, with tapered hole in base and back to accept either bolt or hanger rod. Set screw: hardened steel.
- G. Conduit clamps for trapeze hangers: Galvanized steel, notched to fit trapeze with single bolt to tighten.
- H. Conduit clamps - general purpose: One-hole malleable iron for surface mounted conduits.
- I. Cable Ties: High strength nylon temperature rated to 185 degrees F (85 degrees C). Self-locking.

2.02 FORMED STEEL CHANNEL:

- A. Manufacturers:
 - 1. Allied Tube & Conduit Corp.
 - 2. B-Line Systems.
 - 3. Midland Ross Corporation, Electrical Products Division.
 - 4. Unistrut Corp.
- B. Product Description: Galvanized 12 gage thick steel. With holes 1-1/2-inches on center.

2.03 SPRING STEEL CLIPS:

- A. Manufacturers:
 - 1. Allied Tube & Conduit Corp.
 - 2. B-Line Systems
 - 3. Midland Ross Corporation, Electrical Products Division.
 - 4. Unistrut Corp.
- B. Product Description: Mounting hole and screw closure.

2.04 SLEEVES:

- A. Sleeves for conduit, raceway, cable tray, busway, or cable through Non-fire Rated Floors: 18 gage thick galvanized steel.
- B. Sleeves for conduit, raceway, cable tray, busway, or cable through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe or 18 gage thick galvanized steel.

- C. Sleeves for conduit, raceway, cable tray, busway, or cable through Fire Rated and Fire Resistive Floors and Walls, and Fire Proofing: Prefabricated fire rated sleeves including seals, UL listed.
- D. Fire-stopping Insulation: Glass fiber type, non-combustible.

2.05 MECHANICAL SLEEVE SEALS:

- A. Manufacturers:
 - 1. Thunderline Link-Seal, Inc.
 - 2. NMP Corporation.
 - 3. PSI Link-Seal.
- B. Product Description: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between object and sleeve, connected with bolts and pressure plates causing rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

2.06 FIRESTOPPING:

- A. Manufacturers:
 - 1. Dow Corning Corp.
 - 2. Hilti Corp.
 - 3. 3M fire Protection Products.
- B. Product Description: Different types of products by multiple manufacturers are acceptable as required to meet specified system description and performance requirements; provide only one type for each similar application.
 - 1. Silicone Fire stopping Elastomeric Fire stopping: Single component silicone elastomeric compound and compatible silicone sealant.
 - 2. Foam Fire stopping Compounds: Single component foam compound.
 - 3. Formulated Fire stopping Compound of Incombustible Fibers: Formulated compound mixed with incombustible non-asbestos fibers.
 - 4. Fiber Stuffing and Sealant Fire stopping: Composite of mineral or ceramic fiber stuffing insulation with silicone elastomer for smoke stopping.
 - 5. Mechanical Fire stopping Device with Fillers: Mechanical device with incombustible fillers and silicone elastomer, covered with sheet stainless steel jacket, joined with collars, penetration sealed with flanged stops.
 - 6. Intumescent Fire stopping: Intumescent putty compound which expands on exposure to surface heat gain.
 - 7. Fire stop Pillows: Formed mineral fiber pillows.

C. Color: Dark gray.

2.07 FIRESTOPPING ACCESSORIES:

A. Primer: Type recommended by fire stopping manufacturer for specific substrate surfaces and suitable for required fire ratings.

B. Installation Accessories: Provide clips, collars, fasteners, temporary stops or dams, and other devices required to position and retain materials in place.

C. General:

1. Furnish UL listed products.
2. Select products with rating not less than rating of wall or floor being penetrated.

D. Non-Rated Surfaces:

1. Stamped steel, chrome plated, hinged, split ring escutcheons or floor plates or ceiling plates for covering openings in occupied areas where conduit is exposed.
2. For exterior wall openings below grade, furnish modular mechanical type seal consisting of interlocking synthetic rubber links shaped to continuously fill annular space between conduit and cored opening or water-stop type wall sleeve.

PART 3 - EXECUTION

3.01 EXAMINATION:

E. Verify openings are ready to receive sleeves.

F. Verify openings are ready to receive fire stopping.

3.02 PREPARATION:

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter affecting bond of fire stopping material.

B. Remove incompatible materials affecting bond.

C. Install damming materials to arrest liquid material leakage.

D. Obtain permission from Architect/Engineer before using powder-actuated anchors.

- E. Obtain permission from Architect/Engineer before drilling or cutting structural members.

3.03 INSTALLATION - HANGERS AND SUPPORTS:

A. Anchors and Fasteners:

1. Concrete Structural Elements: Provide expansion anchors and preset inserts.
2. Steel Structural Elements: Provide beam clamps and welded fasteners.
3. Concrete Surfaces: Provide self-drilling anchors and expansion anchors.
4. Hollow Masonry, Plaster, and Gypsum Board Partitions: Provide toggle bolts and hollow wall fasteners.
5. Solid Masonry Walls: Provide expansion anchors and preset inserts.
6. Sheet Metal: Provide sheet metal screws.
7. Wood Elements: Provide wood screws.

B. Inserts:

1. Install inserts for placement in concrete forms.
2. Install inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4-inches.
4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut flush with top of slab.

C. Install conduit and raceway support and spacing in accordance with NEC.

D. Do not fasten supports to pipes, ducts, mechanical equipment, or conduit.

E. Install multiple conduit runs on common hangers.

F. Supports:

1. Fabricate supports from structural steel or formed steel channel. Install hexagon head bolts to present neat appearance with adequate strength and rigidity. Install spring lock washers under nuts.
2. Install surface mounted cabinets and panelboards with minimum of four anchors.
3. In wet and damp locations install steel channel supports to stand cabinets and panelboards 1-inch off wall.
4. Support vertical conduit at every floor.

3.04 INSTALLATION – FIRESTOPPING:

- A. Install material at fire rated construction perimeters and openings containing penetrating sleeves, piping, ductwork, conduit and other items, requiring fire stopping.
- B. Apply primer where recommended by manufacturer for type of fire stopping material and substrate involved, and as required for compliance with required fire ratings.
- C. Apply fire stopping material in sufficient thickness to achieve required fire and smoke rating.
- D. Fire Rated Surface:
 - 1. Seal opening at floor, wall, ceiling, and roof as follows:
 - a. Install sleeve through opening and extending beyond minimum of 1-inch on both sides of building element.
 - b. Size sleeve allowing minimum of 1-inch void between sleeve and building element.
 - c. Pack void with backing material.
 - d. Seal ends of sleeve with UL listed fire resistive silicone compound to meet fire rating of structure penetrated.
 - 2. Where conduit penetrates fire rated surface, install fire stopping product in accordance with manufacturer's instructions.
- E. Non-Rated Surfaces:
 - 1. Seal opening through non-fire rated wall, floor and roof opening as follows:
 - a. Install sleeve through opening and extending beyond minimum of 1-inch on both sides of building element.
 - b. Size sleeve allowing minimum of 1-inch void between sleeve and building element.
 - c. Install type of fire stopping material recommended by manufacturer.
 - 2. Install escutcheons floor plates or ceiling plates where conduit, penetrates non-fire rated surfaces in occupied spaces. Occupied spaces include rooms with finished ceilings and where penetration occurs below finished ceiling.
 - 3. Exterior wall openings below grade: Assemble rubber links of mechanical seal to size of conduit and tighten in place, in accordance with manufacturer's instructions.

3.05 INSTALLATION - EQUIPMENT BASES AND SUPPORTS:

- A. Using templates furnished with equipment, install anchor bolts, and accessories for mounting and anchoring equipment.
- B. Construct supports of formed steel channel. Brace and fasten with flanges bolted to structure.

3.06 INSTALLATION – SLEEVES:

- A. Exterior watertight entries: Seal with adjustable interlocking rubber links.
- B. Conduit penetrations not required to be watertight: Sleeve and fill with silicon foam.
- C. Set sleeves in position in forms. Provide reinforcing around sleeves.
- D. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.
- E. Extend sleeves through floors 1-inch above finished floor level. Caulk sleeves.
- F. Where conduit or raceway penetrates floor, ceiling, or wall, close off space between conduit or raceway and adjacent work with fire stopping insulation and caulk airtight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.
- G. Install stainless steel escutcheons at finished surfaces.

3.07 FIELD QUALITY CONTROL:

- A. Inspect installed fire stopping for compliance with specifications and submitted schedule.

3.08 CLEANING:

- A. Clean adjacent surfaces of fire stopping materials.

3.09 PROTECTION OF FINISHED WORK:

- A. Protect adjacent surfaces from damage by material installation.

END OF SECTION

SECTION 16123

CONDUCTORS AND CABLES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

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

1.02 SUMMARY:

- A. This Section includes building wires and cables and associated connectors, splices, and terminations for wiring systems rated 600 V and less.
- B. Related Sections include the following:
 - 1. Division 16 Sections

1.03 SUBMITTALS:

- A. Product Data: For each type of product indicated.
- B. Qualification Data: For testing agency.
- C. Field Quality-Control Test Reports: From the Contractor.

1.04 QUALITY ASSURANCE:

- A. Testing Agency Qualifications: Testing agency as defined by OSHA in 29 CFR 1910.7 or a member company of the International Electrical Testing Association and that is acceptable to authorities having jurisdiction.
- 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 NFPA 70.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
 - 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 manufacturers specified.
 - 2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.02 CONDUCTORS AND CABLES:

- A. Available Manufacturers:
 - 1. Alcan Aluminum Corporation; Alcan Cable Div.
 - 2. American Insulated Wire Corp.; a Leviton Company.
 - 3. General Cable Corporation.
 - 4. Senator Wire & Cable Company.
 - 5. Southwire Company.
- B. Refer to Part 3 "Conductor and Insulation Applications" Article for insulation type, cable construction, and ratings.
- C. Conductor Material: Copper complying with NEMA WC 5 or 7; solid conductor for No. 10 AWG and smaller, stranded for No. 8 AWG and larger.
- D. Conductor Insulation Types: Type THHN-THWN complying with NEMA WC 5 or 7.
- E. Multi-conductor Cable: Metal-clad cable, Type MC with ground wire.

2.03 CONNECTORS AND SPLICES:

- A. Available Manufacturers:
 - 1. AFC Cable Systems, Inc.
 - 2. AMP Incorporated/Tyco International.
 - 3. Hubbell/Anderson.
 - 4. O-Z/Gedney; EGS Electrical Group LLC.
 - 5. 3M Company; Electrical Products Division.
- B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

PART 3 - EXECUTION

3.01 CONDUCTOR AND INSULATION APPLICATIONS:

- A. Exposed Feeders: Type THHN-THWN, single conductors in raceway.
- B. Exposed Branch Circuits, including in Crawlspace: Type THHN-THWN, single conductors in raceway.
- C. Underground Feeders and Branch Circuits: Type UF multi-conductor or Type THHN-THWN cable in conduit.
- D. Class 1 Control Circuits: Type THHN-THWN, in raceway.
- E. Class 2 Control Circuits: Type THHN-THWN, in raceway.

3.02 INSTALLATION:

- A. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- B. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips that will not damage cables or raceway.
- C. Install exposed cables parallel and perpendicular to surfaces of exposed structural members and follow surface contours where possible.
- D. Support cables according to Division 16 Section "Basic Electrical Materials and Methods."
- E. Seal around cables penetrating fire-rated elements as required.
- F. Identify and color-code conductors and cables according to Division 16 Section "Basic Electrical Materials and Methods."

3.03 CONNECTIONS:

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than un-spliced conductors.

1. Use oxide inhibitor in each splice and tap conductor when existing aluminum conductors are encountered requiring slicing.

C. Wiring at Outlets: Install conductor at each outlet, with at least 6-inches of slack.

3.04 FIELD QUALITY CONTROL:

A. Testing: Perform the following field quality-control testing:

1. After installing conductors and cables and before electrical circuitry has been energized, test for compliance with requirements.
2. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.3.1. Certify compliance with test parameters.

B. Test Reports: Prepare a written report to record the following:

1. Test procedures used.
2. Test results that comply with requirements.
3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

END OF SECTION

SECTION 16130
RACEWAYS AND BOXES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

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

1.02 SUMMARY:

- A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.
- B. Related Sections include the following:
 - 1. SECTION 16050 - "Basic Electrical Materials" for supports, anchors, and identification products.
 - 2. SECTION 16140 - "Wiring Devices" for devices installed in boxes and for floor-box service fittings.

1.03 DEFINITIONS:

- A. EMT: Electrical metallic tubing.
- B. ENT: Electrical nonmetallic tubing.
- C. FMC: Flexible metal conduit.
- D. IMC: Intermediate metal conduit.
- E. LFMC: Liquidtight flexible metal conduit.
- F. LFNC: Liquidtight flexible nonmetallic conduit.
- G. RNC: Rigid nonmetallic conduit.
- H. RSC: Rigid steel conduit.

1.04 SUBMITTALS:

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.
- B. Shop Drawings: Show fabrication and installation details of components for raceways, fittings, boxes, enclosures, and cabinets.
- C. Shop Drawings: Signed and sealed by a qualified professional engineer.
 - 1. Design Calculations: Calculate requirements for selecting seismic restraints.
 - 2. Detail assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
- D. Coordination Drawings: Reflected ceiling plans drawn to scale and coordinating penetrations and ceiling-mounted items. Show the following:
 - 1. Ceiling suspension assembly members.
 - 2. Method of attaching hangers to building structure.
 - 3. Size and location of initial access modules for acoustical tile.
 - 4. Ceiling-mounted items including lighting fixtures, diffusers, grilles, access panels, and special moldings.

1.05 QUALITY ASSURANCE:

- A. 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.
- B. Comply with NFPA 70.

1.06 COORDINATION:

- A. Coordinate layout and installation of raceways, boxes, enclosures, cabinets, and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment and partition assemblies.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

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 manufacturers specified.
1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.02 METAL CONDUIT AND TUBING:

A. Available Manufacturers:

1. AFC Cable Systems, Inc.
2. Alflex Inc.
3. Electri-Flex Co.
4. Grinnell Co./Tyco International; Allied Tube and Conduit Div.
5. LTV Steel Tubular Products Company.
6. Manhattan/CDT/Cole-Flex.
7. O-Z Gedney; Unit of General Signal.
8. Wheatland Tube Co.

B. Rigid Steel Conduit: ANSI C80.1.

C. Aluminum Rigid Conduit: ANSI C80.5.

D. IMC: ANSI C80.6.

E. Plastic-Coated Steel Conduit and Fittings: NEMA RN 1.

F. Plastic-Coated IMC and Fittings: NEMA RN 1.

G. EMT and Fittings: ANSI C80.3.

1. Fittings: Set-screw or compression type.

H. FMC: Zinc-coated steel.

I. LFMC: Flexible steel conduit with PVC jacket.

J. Fittings: NEMA FB 1; compatible with conduit and tubing materials.

2.03 NONMETALLIC CONDUIT AND TUBING:

A. Available Manufacturers:

1. American International.
2. Anamet Electrical, Inc.; Anaconda Metal Hose.
3. Certainteed Corp.; Pipe & Plastics Group.
4. Condux International.

5. Electri-Flex Co.
6. Lamson & Sessions; Carlon Electrical Products.
7. Manhattan/CDT/Cole-Flex.
8. RACO; Division of Hubbell, Inc.
9. Spiralduct, Inc./AFC Cable Systems, Inc.
10. Thomas & Betts Corporation.

B. ENT: NEMA TC 13.

C. RNC: NEMA TC 2, Schedule 40 and Schedule 80 PVC.

D. ENT and RNC Fittings: NEMA TC 3; match to conduit or tubing type and material.

E. LFNC: UL 1660.

2.04 BOXES, ENCLOSURES, AND CABINETS:

A. Available Manufacturers:

1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
2. Emerson/General Signal; Appleton Electric Company.
3. Hoffman.
4. Hubbell, Inc.; Killark Electric Manufacturing Co.
5. O-Z/Gedney; Unit of General Signal.
6. RACO; Division of Hubbell, Inc.
7. Robroy Industries, Inc.; Enclosure Division.
8. Spring City Electrical Manufacturing Co.
9. Thomas & Betts Corporation.
10. Walker Systems, Inc.; Wiremold Company (The).

B. Sheet Metal Outlet and Device Boxes: NEMA OS 1.

C. Cast-Metal Outlet and Device Boxes: NEMA FB 1, Type FD, with gasketed cover.

D. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

E. Cast-Metal Pull and Junction Boxes: NEMA FB 1, cast aluminum with gasketed cover.

F. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous hinge cover and flush latch.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
2. Nonmetallic Enclosures: Plastic finished inside with radio-frequency-resistant paint.

2.05 FACTORY FINISHES:

- A. Finish: For raceway, enclosures, or cabinet components, provide manufacturer's standard paint applied to factory-assembled surface raceways, enclosures, and cabinets before shipping.

PART 3 - EXECUTION

3.01 RACEWAY APPLICATION:

- A. Outdoors:
 - 1. Exposed: Rigid steel.
 - 2. Concealed: Rigid steel.
 - 3. Underground, Single Run: RNC.
 - 4. Underground Grouped: RNC.
 - 5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
 - 6. Boxes and Enclosures: NEMA 250, Type 3R or 4.
- B. Indoors:
 - 1. Exposed: Rigid steel conduit.
 - 2. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC; except use LFMC in damp or wet locations.
 - 3. Damp or Wet Locations: Rigid steel conduit.
 - 4. Boxes and Enclosures: NEMA 250, Type 1, except as follows:
 - a. Damp or Wet Locations: NEMA 250, Type 3R or 4 stainless steel.
- C. Minimum Raceway Size: 3/4-inch trade size.
- D. Raceway Fittings: Compatible with raceways and suitable for use and location.
 - 1. Rigid steel and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.
 - 2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings approved for use with that material. Patch all nicks and scrapes in PVC coating after installing conduits.
- E. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in nonmetallic sleeve.
- F. Do not install aluminum conduits embedded in or in contact with concrete.

3.02 INSTALLATION:

- A. Keep raceways at least 6-inches away from heat generating equipment.
- B. Complete raceway installation before starting conductor installation.
- C. Support raceways as specified in Division 16 Section "Basic Electrical Materials and Methods."
- D. Install temporary closures to prevent foreign matter from entering raceways.
- E. Protect stub-ups from damage where conduits rise through floor slabs. Arrange so curved portions of bends are not visible above the finished slab.
- F. Make bends and offsets so ID is not reduced. Keep legs of bends in the same plane and keep straight legs of offsets parallel, unless otherwise indicated.
- G. Install exposed raceways parallel or at right angles to nearby surfaces or structural members and follow surface contours as much as possible.
 - 1. Run parallel or banked raceways together on common supports.
 - 2. Make parallel bends in parallel or banked runs. Use factory elbows only where elbows can be installed parallel; otherwise, provide field bends for parallel raceways.
- H. Join raceways with fittings designed and approved for that purpose and make joints tight.
 - 1. Use insulating bushings to protect conductors.
- I. Tighten set screws of threadless fittings with suitable tools.
- J. Terminations:
 - 1. Where raceways are terminated with locknuts and bushings, align raceways to enter squarely and install locknuts with dished part against box. Use two locknuts, one inside and one outside box.
 - 2. Where raceways are terminated with threaded hubs, screw raceways or fittings tightly into hub so end bears against wire protection shoulder. Where chase nipples are used, align raceways so coupling is square to box; tighten chase nipple so no threads are exposed.
- K. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 1-inches of slack at each end of pull wire.
- L. Telephone and Signal System Raceways, 2-inch Trade Size and Smaller: In addition to above requirements, install raceways in maximum lengths of 150 feet and with a

maximum of two 90-degree bends or equivalent. Separate lengths with pull or junction boxes where necessary to comply with these requirements.

- M. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with UL-listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:
 - 1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
 - 2. Where otherwise required by NFPA 70.
- N. Stub-up Connections: Extend conduits through concrete floor for connection to freestanding equipment. Install with an adjustable top or coupling threaded inside for plugs set flush with finished floor. Extend conductors to equipment with rigid steel conduit; FMC may be used 6-inches above the floor. Install screwdriver-operated, threaded plugs flush with floor for future equipment connections.
- O. Flexible Connections: Use maximum of 72-inches of flexible conduit for recessed and semi-recessed lighting fixtures; for equipment subject to vibration, noise transmission, or movement; and for all motors. Use LFMC in damp or wet locations. Install separate ground conductor across flexible connections.
- P. Surface Raceways: Install a separate, green, ground conductor in raceways from junction box supplying raceways to receptacle or fixture ground terminals.
- Q. Install hinged-cover enclosures and cabinets plumb. Support at each corner.

3.03 PROTECTION:

- A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.
 - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - 2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

3.04 CLEANING:

- A. After completing installation of exposed, factory-finished raceways and boxes, inspect exposed finishes and repair damaged finishes.

END OF SECTION

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SECTION 16140

WIRING DEVICES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

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

1.02 SUMMARY:

- A. This Section includes the following:
 - 1. Single and duplex receptacles and ground-fault circuit interrupters.
 - 2. Single- and double-pole snap switches.
 - 3. Device wall plates.

1.03 DEFINITIONS:

- A. GFCI: Ground-fault circuit interrupter.
- B. PVC: Polyvinyl chloride.
- C. TVSS: Transient voltage surge suppressor.
- D. UTP: Unshielded twisted pair.

1.04 SUBMITTALS:

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: List of legends and description of materials and process used for pre-marking wall plates.
- C. Samples: One for each type of device and wall plate specified, in each color specified.
- D. Field quality-control test reports.

1.05 QUALITY ASSURANCE:

- A. Source Limitations: Obtain each type of wiring device through one source from a single manufacturer.

- 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 NFPA 70.

1.06 COORDINATION:

- A. Receptacles for Owner-Furnished Equipment: Match plug configurations.
 - 1. Cord and Plug Sets: Match equipment requirements.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

- A. 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:
 - 1. Wiring Devices:
 - a. Bryant Electric, Inc./Hubbell Subsidiary.
 - b. Eagle Electric Manufacturing Co., Inc.
 - c. Hubbell Incorporated; Wiring Device-Kellems.
 - d. Leviton Mfg. Company Inc.
 - e. Pass & Seymour/Legrand; Wiring Devices Div.
 - 2. Wiring Devices for Hazardous (Classified) Locations:
 - a. Crouse-Hinds/Cooper Industries, Inc.; Arrow Hart Wiring Devices.
 - b. EGS/Appleton Electric Company.
 - c. Killark Electric Manufacturing Co./Hubbell Incorporated.

2.02 RECEPTACLES:

- A. Straight-Blade-Type Receptacles: Comply with NEMA WD 1, NEMA WD 6, DSCC W-C-596G, and UL 498.
- B. Straight-Blade and Locking Receptacles: Heavy-Duty grade.
- C. Straight-Blade Receptacles: Hospital grade.
- D. GFCI Receptacles: Straight blade, feed-through type, Heavy-Duty grade, with integral NEMA WD 6, Configuration 5-20R duplex receptacle; complying with UL 498 and

UL 943. Design units for installation in a 2-3/4-inch deep outlet box without an adapter.

- E. Industrial Heavy-Duty Pin and Sleeve Devices: Comply with IEC 309-1.
- F. Hazardous (Classified) Location Receptacles: Comply with NEMA FB 11.

2.03 SWITCHES:

- A. Single- and Double-Pole Switches: Comply with DSCC W-C-896F and UL 20.
- B. Snap Switches: Heavy-Duty grade, quiet type.

2.04 WALL PLATES:

- A. Single and combination types to match corresponding wiring devices.
 - 1. Plate-Securing Screws: Metal with head color to match plate finish.
 - 2. Material for Finished Spaces: Smooth, high-impact thermoplastic.
 - 3. Material for Unfinished Spaces: Galvanized steel.
 - 4. Material for Wet Locations: Thermoplastic with spring-loaded lift cover and listed and labeled for use in "wet locations."

2.05 FINISHES:

- A. Color:
 - 1. Wiring Devices Connected to Normal Power System: As selected by Architect, unless otherwise indicated or required by NFPA 70.

PART 3 - EXECUTION

3.01 INSTALLATION:

- A. Install devices and assemblies level, plumb, and square with building lines.
- B. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical, and with grounding terminal of receptacles on top. Group adjacent switches under single, multi-gang wall plates.
- C. Remove wall plates and protect devices and assemblies during painting.
- D. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.02 IDENTIFICATION:

- A. Comply with Section 16050 "Basic Electrical Materials."
 - 1. Receptacles: Identify panelboard and circuit number from which served. Use hot, stamped or engraved machine printing with black filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.03 CONNECTIONS:

- A. Connect wiring according to Section 16123 "Building Conductors and Cables."
- B. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.04 FIELD QUALITY CONTROL:

- A. Perform the following field tests and inspections and prepare test reports:
 - 1. After installing wiring devices and after electrical circuitry has been energized, test for proper polarity, ground continuity, and compliance with requirements.
 - 2. Test GFCI operation with both local and remote fault simulations according to manufacturer's written instructions.
- B. Remove malfunctioning units, replace with new units, and retest as specified above.

END OF SECTION

SECTION 16410

ENCLOSED SWITCHES AND CIRCUIT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

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

1.02 SUMMARY:

- A. This Section includes individually mounted enclosed switches and circuit breakers used for the following:
 - 1. Feeder and branch-circuit protection.
 - 2. Motor and equipment disconnecting means.
- B. Related Sections include the following:
 - 1. SECTION 16140 - "Wiring Devices" for attachment plugs, receptacles, and toggle switches used for disconnecting means.

1.03 DEFINITIONS:

- A. GFCI: Ground-fault circuit interrupter.
- B. SPDT: Single pole, double throw.

1.04 SUBMITTALS:

- A. Product Data: For each type of switch, circuit breaker, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
- B. Shop Drawings: For each switch and circuit breaker.
 - 1. Dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show tabulations of installed devices, equipment features, and ratings. Include the following:
 - a. Enclosure types and details for types other than NEMA 250, Type 1.
 - b. Current and voltage ratings.

- c. Short-circuit current rating.
 - d. UL listing for series rating of installed devices.
 - e. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
 - 2. Wiring Diagrams: Power, signal, and control wiring. Differentiate between manufacturer-installed and field-installed wiring.
 - C. Qualification Data: Submit data for testing agencies indicating that they comply with qualifications specified in "Quality Assurance" Article.
 - D. Field Test Reports: Submit written test reports and include the following:
 - 1. Test procedures used.
 - 2. Test results that comply with requirements.
 - 3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.
 - E. Manufacturer's field service report.
 - F. Maintenance Data: For enclosed switches and circuit breakers and for components to include in maintenance manuals specified in Division 1. In addition to requirements specified in SECTION 01770 - "Project Closeout" include the following:
 - 1. Routine maintenance requirements for components.
 - 2. Manufacturer's written instructions for testing and adjusting switches and circuit breakers.
 - 3. Time-current curves, including selectable ranges for each type of circuit breaker.
- 1.05 QUALITY ASSURANCE:
- A. Testing Agency Qualifications: Testing agency that is a member company of the International Electrical Testing Association and that is acceptable to authorities having jurisdiction.
 - 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 AB 1 and NEMA KS 1.
 - D. Comply with NFPA 70.
 - E. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

1.06 PROJECT CONDITIONS:

- A. Environmental Limitations: Rate equipment for continuous operation under the following conditions, unless otherwise indicated:
 - 1. Ambient Temperature: Not less than minus 22 deg F and not exceeding 104 deg F.
 - 2. Altitude: Not exceeding 6600 feet.

1.07 COORDINATION:

- A. Coordinate layout and installation of switches, circuit breakers, and components with other construction, including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

1.08 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. Spares: For the following:
 - a. Fuses and Fusible Devices for Fused Circuit Breakers: one each type
 - b. Fuses for Fused Switches: one each type

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

- A. 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:
 - 1. Fusible Switches:
 - a. Eaton Corp.; Cutler-Hammer Products.
 - b. General Electric Co.; Electrical Distribution & Control Division.
 - c. Siemens Energy & Automation, Inc.
 - d. Square D Co.

2.02 ENCLOSED SWITCHES:

- A. Enclosed, Non-fusible Switch: NEMA KS 1, Type HD, with lockable handle.

- B. Enclosed, Fusible Switch, 800 A and Smaller: NEMA KS 1, Type HD, with clips to accommodate specified fuses, lockable handle with two padlocks, and interlocked with cover in closed position.

2.04 ENCLOSURES:

- A. NEMA AB 1 and NEMA KS 1 to meet environmental conditions of installed location.
 - 1. Outdoor Locations: NEMA 250, Type 3R.
 - 2. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
 - 3. Hazardous Areas Indicated on Drawings: NEMA 250, Type 7C.

2.03 FACTORY FINISHES:

- A. Manufacturer's standard prime-coat finish ready for field painting.
- B. Finish: Manufacturer's standard color paint applied to factory-assembled and -tested enclosures before shipping.

PART 3 - EXECUTION

3.01 EXAMINATION:

- A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION:

- A. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

3.03 IDENTIFICATION:

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in SECTION 16050 - "Basic Electrical Materials".
- B. Enclosure Nameplates: Label each enclosure with engraved metal or laminated-plastic nameplate mounted with corrosion-resistant screws.

3.04 CONNECTIONS:

- A. Install equipment grounding connections for switches and circuit breakers with ground continuity to main electrical ground bus.
- B. Install power wiring. Install wiring between switches and circuit breakers, and control and indication devices.
- C. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.05 FIELD QUALITY CONTROL:

- A. Prepare for acceptance tests as follows:
 - 1. Test insulation resistance for each enclosed switch, circuit breaker, component, and control circuit.
 - 2. Test continuity of each line- and load-side circuit.
- B. Testing: After installing enclosed switches and circuit breakers and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements.
 - 1. Procedures: Perform each visual and mechanical inspection and electrical test indicated in NETA ATS, Section 7.5 for switches and Section 7.6 for molded-case circuit breakers. Certify compliance with test parameters.
 - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

3.06 ADJUSTING:

- A. Set field-adjustable switches and circuit-breaker trip ranges.

3.07 CLEANING:

- A. On completion of installation, inspect interior and exterior of enclosures. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

END OF SECTION

SECTION 16442

PANELBOARDS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

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

1.02 SUMMARY:

- A. This Section includes load centers and panelboards, overcurrent protective devices, and associated auxiliary equipment rated 600 V and less for the following types:
 - 1. Lighting and appliance branch-circuit panelboards.
 - 2. Distribution panelboards.
 - 3. Transient voltage surge suppressor panelboards.
- B. Related Sections include the following:
 - 1. All Division 16 Sections

1.03 DEFINITIONS:

- A. GFCI: Ground-fault circuit interrupter.
- B. SPDT: Single pole, double throw.
- C. TVSS: Transient voltage surge suppressor.

1.04 SUBMITTALS:

- A. Product Data: For each type of panelboard, overcurrent protective device, TVSS device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
- B. Shop Drawings: For each panelboard and related equipment.
 - 1. Dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings. Include the following:
 - a. Enclosure types and details for types other than NEMA 250, Type 1.
 - b. Bus configuration, current, and voltage ratings.

- c. Short-circuit current rating of panelboards and overcurrent protective devices.
 - d. UL listing for series rating of installed devices.
 - e. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
 - 2. Wiring Diagrams: Diagram power, signal, and control wiring and differentiate between manufacturer-installed and field-installed wiring.
 - C. Qualification Data: Submit data for testing agencies indicating that they comply with qualifications specified in "Quality Assurance" Article.
 - D. Field Test Reports: Submit written test reports and include the following:
 - 1. Test procedures used.
 - 2. Test results that comply with requirements.
 - 3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.
 - E. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.
 - F. Maintenance Data: For panelboards and components to include in maintenance manuals specified in Division 1. In addition to requirements specified in Section 01770 - "Project Closeout," include the following:
 - 1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
 - 2. Time-current curves, including selectable ranges for each type of overcurrent protective device.
- 1.05 QUALITY ASSURANCE:
- A. Testing Agency Qualifications: Testing agency that is a member company of the International Electrical Testing Association and that is acceptable to authorities having jurisdiction.
 - 1. Testing Agency's Field Supervisor: Person currently certified by the International Electrical Testing Association or National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.
 - 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 PB 1.

D. Comply with NFPA 70.

1.06 COORDINATION:

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, and encumbrances to workspace clearance requirements.

1.07 EXTRA MATERIALS:

A. Keys: Six spares of each type of panelboard cabinet lock.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

A. 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:

1. Panelboards, Overcurrent Protective Devices, Controllers, Contactors, and Accessories:

- a. Eaton Corp.; Cutler-Hammer Products.
- b. General Electric Co.; Electrical Distribution & Control Div.
- c. Siemens Energy & Automation, Inc.
- d. Square D Co.

2. TVSS Panelboards:

- a. Current Technology, Inc.
- b. Liebert Corporation.

2.02 FABRICATION AND FEATURES:

A. Enclosures: Flush- and surface-mounted as noted cabinets. NEMA PB 1, Type 1, to meet environmental conditions at installed location.

1. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.

B. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.

- C. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
- D. Finish: Manufacturer's standard enamel finish over corrosion-resistant treatment or primer coat.
- E. Directory Card: With transparent protective cover, mounted inside metal frame, inside panelboard door.
- F. Bus: Hard-drawn copper, 98 percent conductivity.
- G. Main and Neutral Lugs: Compression type suitable for use with conductor material.
- H. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment ground conductors; bonded to box.
- I. Service Equipment Label: UL labeled for use as service equipment for panelboards with main service disconnect switches.
- J. Future Devices: Mounting brackets, bus connections, and necessary appurtenances required for future installation of devices.
- K. Skirt for Surface-Mounted Panelboards: Same gage and finish as panelboard front with flanges for attachment to panelboard, wall, and ceiling or floor.
- L. Gutter Barrier: Arrange to isolate individual panel sections.
- M. Column-Type Panelboards: Narrow gutter extension, with cover, to overhead junction box equipped with ground and neutral terminal buses.

2.03 PANELBOARD SHORT-CIRCUIT RATING:

- A. UL label indicating series-connected rating with integral or remote upstream devices. Include size and type of upstream device allowable, branch devices allowable, and UL series-connected short-circuit rating.
- B. Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.04 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS:

- A. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.
- B. Doors: Front mounted with concealed hinges; secured with flush latch with tumbler lock; keyed alike.

2.05 ACCESSORY COMPONENTS AND FEATURES:

- A. Fungus Proofing: Permanent fungicidal treatment for panelboard interior, including overcurrent protective devices and other components.

PART 3 - EXECUTION

3.01 INSTALLATION:

- A. Install panelboards and accessories according to NEMA PB 1.1.
- B. Comply with mounting and anchoring requirements specified.
- C. Mounting Heights: Top of trim 74-inches above finished floor, unless otherwise indicated.
- D. Mounting: Plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish.
- E. Circuit Directory: Create a directory to indicate installed circuit loads after balancing panelboard loads. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.
- F. Install filler plates in unused spaces.
- G. Wiring in Panelboard Gutters: Arrange conductors into groups and bundle and wrap with wire ties after completing load balancing.

3.02 IDENTIFICATION:

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 16 Section "Basic Electrical Materials and Methods."
- B. Panelboard Nameplates: Label each panelboard with engraved metal or laminated-plastic nameplate mounted with corrosion-resistant screws.

3.03 CONNECTIONS:

- A. Install equipment grounding connections for panelboards with ground continuity to main electrical ground bus.
- B. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.04 FIELD QUALITY CONTROL:

- A. Prepare for acceptance tests as follows:
 - 1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
 - 2. Test continuity of each circuit.
- B. Testing: After installing panelboards and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements.
 - 1. Procedures: Perform each visual and mechanical inspection and electrical test indicated in NETA ATS, Section 7.5 for switches and Section 7.6 for molded-case circuit breakers. Certify compliance with test parameters.
 - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
- C. Balancing Loads: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes as follows:
 - 1. Measure as required during period of normal system loading.
 - 2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data-processing, computing, transmitting, and receiving equipment.
 - 3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
 - 4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.

3.05 ADJUSTING:

- A. Set field-adjustable switches and circuit-breaker trip ranges.

3.06 CLEANING:

- A. On completion of installation, inspect interior and exterior of panelboards. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

END OF SECTION

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