

TOWN OF BROOKFIELD, CONNECTICUT

WATER POLLUTION CONTROL AUTHORITY

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* * * * *

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Operations Manager

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Chief of Maintenance

MARY RAJCULA ONGARO
Account Collection Specialist

TIM STRID
Inspector

STEPHEN G. HARDING, ESQ.
Commission Attorney

CONTRACT 2024-02

Phase II- 133 Pump Station

Langan Job No. 190093201

W. Charles Utschig, P.E.
License No. P.E.N. 19262
Langan CT, Inc.
White Plains, NY

Date: August 28, 2024

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ADVERTISEMENT FOR BIDS
TOWN OF BROOKFIELD, CT
WATER POLLUTION CONTROL AUTHORITY

CONTRACT 2024-02

Route 133 Pump Station, Brookfield, CT
Pump Station Improvements

Notice is hereby given that sealed bids will be received, publicly opened and announced by the Brookfield Water Pollution Control Authority (Authority), on Wednesday October 16, 2024 at 11:00 AM local time.

The work covered under this contract includes the retrofit of an existing 12-ft diameter precast concrete overflow structure into a pump pit at the 133 Pump Station. The project also includes the construction of a new valve pit, decommissioning of the existing pump pit and valve pit, and associated electrical modifications. Additionally, a proposed jib crane will be installed underneath a proposed roof structure.

Contract documents may be reviewed and downloaded at CTsource Bid Board at CT.gov or from the WPCA website: www.brookfieldwpc.org.

Upon request, copies may be obtained at the Authority office. If requested, make payment of \$100.00 for each set, with checks made payable to the Brookfield Water Pollution Control Authority. Contract documents may be obtained by mail upon payment of an additional \$15.00 for postage and handling. Refunds will not be granted.

A pre-bid meeting will be held on Tuesday September 17, 2024 at 10:00 AM at the Authority office. The meeting is not mandatory, but prospective bidders are urged to attend.

Bids must be submitted on standard proposal forms in the manner designated therein and be enclosed in a sealed envelope bearing the name and address of the bidder on the outside, addressed to the Brookfield Water Pollution Control Authority. The words "Phase II-133 Pump Station Contract 2024-02" must be printed on the face of the envelope.

Sealed bids will be received by the Authority at the Brookfield Water Pollution Control Authority, 53A Commerce Road, Unit 1, Brookfield, CT. prior to the date and time established for opening of bids. **No bids will be received by mail.**

Each individual Bid Proposal must be accompanied by a bid security in the amount of five percent (5%) of the bid, a certificate guaranteeing the furnishing of Performance and Payment Bonds (Consent of Surety), and all other documents identified in the Form of Proposal. Bid security may be in the form of a bid bond, cashier's check, or certified check. The successful bidder must furnish a Performance Bond and a Payment Bond, each in the full

amount of the contract price, issued by a surety company licensed to issue such bonds in the State of Connecticut, and having an A.M. Best & Co. rating of at least A-minus.

No bidder may withdraw his bid within 120 days after the date of the opening thereof. The Authority reserves the right to waive any informality in the bids, to reject any or all bids, and to make its awards in the best interests of the Town of Brookfield, CT.

Attention is called to the State requirements regarding employment, nondiscrimination, safety and wage scales.

Attention is called to provisions in the Contract Documents providing for preference to local laborers and subcontractors.

Brookfield Water Pollution Control Authority
By: Nelson Malwitz, Chairman

INFORMATION FOR BIDDERS

1. **RECEIPT AND OPENING OF BIDS** - The Brookfield Water Pollution Control Authority (hereafter called the "Authority" or the "Owner") will receive sealed bids for "Phase II- 133 Pump Station, Contract 2024-02" at the office of the Brookfield Water Pollution Control Authority, 53A Commerce Road, Unit 1, Brookfield, CT. until 11:00 AM local time on October 18, 2024 at which time they will be opened and announced.

Proposals shall be enclosed in opaque sealed envelopes plainly marked "Phase II - 133 Pump Station", with the name and address of the bidder.

No bids will be received by mail.

2. **CONTRACT DOCUMENTS** - Contract Documents may be reviewed and downloaded at CTsource Bid Board at CT.gov or from the WPCA website: www.brookfieldwpc.org.

3. **DESCRIPTION OF WORK** - The work covered under this contract includes the installation of approximately 50 linear feet of 6-inch force main, a pump station retrofit, valve pit, temporary bypass work, electrical modifications, and site restoration as required in the Contract Documents. Additional work includes, installation of a jib crane and a roof structure.

4. **ADDENDA AND INTERPRETATIONS** - No interpretations of the meaning of the Contract Documents will be made to any prospective bidder orally. Every request for such interpretation should be in writing addressed to Langan Engineering and Environmental Services, Inc., One North Broadway – Suite 910, White Plains, New York 10601, and to be given consideration must be received on or before the end of the business day on Friday September 27, 2024 via email or regular mail. Any and all such interpretations and any supplemental instructions will be in the form of written addenda to the Contract Documents which will be emailed with return receipt to all prospective bidders (at the respective email address furnished for such purposes) not later than the end of the business day on Friday October 4, 2024. Failure of any bidder to receive any such addenda or interpretations shall not relieve said bidder from any obligations under his bid as submitted. All addenda so issued shall become part of the Contract Documents.

5. **OBLIGATION OF BIDDER** - Each bidder must inform himself fully of the conditions relating to the construction and the labor provisions under which the work will be performed; failure to do so will not relieve a successful bidder of his obligation to furnish all material and labor necessary to carry out the provisions of the Contract Documents and to complete the contemplated work for the consideration set forth in his bid.

At the time of the opening of bids each bidder will be presumed to have inspected the sites and to have read and to be thoroughly familiar with the Contract Documents (including all addenda). The failure or omission of any bidder to receive or examine any form, instrument, or document shall in no way relieve any bidder from any obligation in respect to his bid.

Bidders are notified that it is obligatory upon them to obtain by their own means information which they may require as to the existing physical condition, and in particular as to subsurface and ground water conditions. The Owner will make available to the bidder all information obtained by investigations prior to the bid openings, but makes no guarantee with respect to the accuracy of such information, and each bidder in bidding represents that he relies exclusively upon his own investigations, and he makes his bid with a full knowledge of all conditions, and the kinds, quality, and quantity of work required.

6. SUBSURFACE UTILITIES - The approximate locations of certain existing subsurface pipes and structures are indicated on the drawings. The Owner does not guarantee that the locations and/or depths of such utilities are even approximately correct. Contractor must contact "Call Before You Dig" 1-800-922-4455, or 203-281-5435. In addition, the contractor is obligated to retain the services of a qualified utility locator company to have all existing utilities located on the project site. Refer to item 16 of "Information for Bidders."

7. INFORMATION NOT GUARANTEED - All information given on the drawings, or in the Contract Documents, relative to the existing utilities, existing pipes and other structures is from the best sources at present available to the Owner. All such information and the drawings of existing construction are furnished only for the convenience of bidders.

It is understood and agreed that the Owner does not warrant or guarantee that the materials, conditions, and pipes or other structures encountered during construction will be the same as those indicated by the boring samples or by the information given on the drawings. The bidder must satisfy himself regarding the character, quantities, and conditions of the various materials and the work to be done.

It is understood and agreed that the bidder or the Contractor will not use any of the information made available to him, or obtained in any examination made by him, in any manner as a basis or ground for claim or demand of any nature against the Owner or the Engineer, arising from or by reason of any variance which may exist between the information offered and the actual materials or structures encountered during the construction work.

8. PREPARATION OF PROPOSAL - Proposals must be submitted on the prescribed form. All blank spaces for unit prices, extended totals, and summations must be filled in, in ink or typewritten, in both words and figures. The bidder must sign the bid, and give his title and business address. All forms attached to the Proposal shall be completed by the bidder and submitted with the bid as well as any other documentation requested by these bid documents and required by law.

9. ERRORS IN BID - In the event there is a discrepancy between the unit prices (if any) and the extended totals, the unit price shall govern. In the event there is a discrepancy between prices written in words and written in figures, the prices written in words shall govern. In case of error in the bidder's extended summation, the computed total of the Engineer shall govern. If an error in any bid item is obvious, and is corroborated by extensions or additions, the Owner may make the appropriate correction and accept the bid.

10. **APPROXIMATE QUANTITIES** - The quantities given in the Proposal are approximate only, being given as a basis for the uniform comparison of bids, and the Owner does not expressly or by implication agree that the actual amount of work will correspond therewith.

11. **BIDDERS TO CHECK APPROXIMATE QUANTITIES** - Bidders must satisfy themselves by personal examination of the location of the proposed work, and by such other means as they may choose, as to the actual conditions and requirements of the work, and the accuracy of the estimate of the Engineer, and shall not, at any time after the submission of a bid, dispute or complain of such statement or estimate of the Engineer, nor assert that there has been any misunderstanding in regard to the nature or amount of the work to be done.

12. **PRICES NOT CHANGED BY CHANGE OF QUANTITIES** - An increase or decrease in the quantities listed in the Proposal for any item shall not be regarded as sufficient grounds for an increase or decrease in the unit price of that item, nor in the time allowed for the completion of the work, except as provided in the Contract. The Owner reserves the right to delete portions of the work, or to add to the work, as it deems necessary, and such changes shall be based upon the unit prices bid or upon reasonable prices established by the Engineer.

13. **INFORMAL BIDS** - The Owner may reject as informal, bids which are incomplete, conditional, or obscure, or which contain additions not called for, erasures not properly initialed, alterations or irregularities of any kind, or the Owner may waive such informalities.

14. **INTENT OF CONTRACT DOCUMENTS** - The intent of the Contract Documents is to obtain a complete job, satisfactory to the Owner and the Engineer. It shall be understood that the bidder is cognizant of the full requirements of the Contract, and has based his Proposal upon such understanding. Compensation for all work and materials required to complete the Contract shall be considered included in the price bid in the Proposal.

15. **RIGHT TO ACCEPT OR REJECT BIDS** - The Owner reserves the right to select the lowest responsive and responsible bid, to waive any informalities in the bids, to reject any or all bids, and to make its awards in the best interests of the Town of Brookfield. Conditional bids may be rejected.

16. **LOCATING UTILITIES** - The Contractor shall obtain advance information on the vertical and horizontal location of all utilities, structures, or other facilities located within the project area. Such information shall be obtained from utility mark-outs, test pits, or pipe locating devices, and the obtaining of such information is exclusively the Contractor's responsibility. Any conflicts must be reported to the Engineer sufficiently in advance of the work schedule to avoid delays or extra work. The cost of obtaining such advance information shall be included in the prices bid for the various items of work.

17. **BID SECURITY** - Each bid must be accompanied by a cashier's check, a certified check of the bidder or a bid bond issued by a surety company licensed to issue such bonds in the State of Connecticut in the amount of five percent (5%) of the amount of the bid, drawn to the benefit of the Brookfield Water Pollution Control Authority. Such checks will be returned to all except the three lowest responsive bidders within three days after the opening of bids. The remaining checks will be returned to the three lowest bidders within 48 hours after the Owner

and the accepted bidder have executed the Contract, or if no Contract has been so executed, within 120 days after the date of the opening of bids, upon demand of the bidder at any time thereafter, so long as he has not been notified of the acceptance of his bid. Bid bonds will not be returned, except on written request.

18. CONSENT OF SURETY/SURETY GUARANTEE - In addition to the checks or bid bonds for bid security, each bid must be accompanied by a guaranty from a surety company, qualified and authorized to do business in this State, and having an A.M. Best & Co. rating of at least A-minus, agreeing to furnish Performance and Payment Bonds, each in the full amount of the contract price in the event of award of Contract.

19. QUALIFICATION OF BIDDER - The Owner may make such investigations as are deemed necessary to determine the ability of the bidder to perform the work, and the bidder shall furnish to the Owner all such information and data for this purpose as the Owner may request. The Owner reserves the right to reject any bid if the evidence submitted by, or investigation of such bidder, fails to satisfy the Owner that such bidder is properly qualified and/or financially capable to carry out the obligations of the contract and to complete the work contemplated therein within the time limit stipulated.

20. WITHDRAWAL OF BIDS - Upon proper request and identification, a bidder may withdraw his bid prior to the scheduled time for the opening thereof. However, no bid may be withdrawn after the first bid has been opened and thereafter not for a period of 120 days after the date of the opening thereof.

21. LIQUIDATED DAMAGES FOR FAILURE TO ENTER INTO CONTRACT - The successful bidder, upon his failure or refusal to execute and deliver the Contract and the required Performance and Payment Bonds within eight (8) months after he has received notice of the acceptance of his bid, shall forfeit to the Owner as liquidated damages for such failure or refusal, the security deposited with his bid.

22. CONTRACT BONDS AND INSURANCE - Simultaneously with his delivery of the executed Contract, the successful bidder must deliver to the Owner Performance and Payment (labor and materials) bonds, each in the amount of one hundred percent (100%) of the accepted bid, as security for the faithful performance of his Contract, and for the payment of all persons performing labor or furnishing materials in connection therewith; prepared in a form acceptable to the Owner (see forms attached) and having as security thereon such surety company or companies as are acceptable to the Owner and as are authorized to transact business in this State, and having an A.M. Best & Co. rating of at least A-minus. The bonds shall comply with Section 49-41 et seq. of the Connecticut General Statutes.

Simultaneously with the delivery of the executed contract, the successful bidder must deliver approvable insurance certifications, as specified in Article 8 of the General Conditions.

The Contractor shall obtain and pay for, and shall provide proof of insurance for the types and limits of insurance as more particularly specified in Article 8 for the General Conditions.

23. **EXECUTION OF CONTRACT** - The bidder to whom the contract is awarded will be required to furnish the Contract Bonds duly executed by a satisfactory surety (as defined above), and to execute the contract within the time limit stated in the Proposal after notification that the contract is ready for signature.

24. **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.

25. **TIME FOR COMPLETION AND LIQUIDATED DAMAGES** - The bidder to whom the contract is awarded must agree to commence work within 8 months from the date of receipt of written notice to proceed from the Owner, and shall complete the work in all respects within 300 consecutive calendar days following the service of said notice. Liquidated damages for late completion shall be as stipulated in the Contract.

26. **LAWS AND REGULATIONS** - This contract will be governed by the laws of the State of Connecticut. The attention of the bidder is specifically directed to the provisions of the General Conditions relative to laws and ordinances, State Labor Standards, Non-discrimination Provisions and Safety Provisions.

27. **NON-DISCRIMINATION IN EMPLOYMENT** - Contracts for work under this proposal will obligate the contractors and subcontractors not to discriminate in employment practices. The Contractor must comply with all applicable State, Federal and Local statutes dealing with non-discriminatory practices.

The Contractor shall take affirmative action to insure that applicants for employment are employed, and that employees are treated during employment, except in the case of a bona fide occupational qualification or need, without regard to their race, color, religious creed, age, sex, sexual orientation, marital status, national origin, mental retardation, learning disability, or physical disability. Such action shall include, but not be limited to, the following: employment, upgrading, demotion, or transfer; recruitment or advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship.

The Contractor shall post in conspicuous places and make available to employees and applicants for employment, notices to be provided by the State setting forth the provisions of this nondiscrimination clause. The Contractor shall state that all qualified applicants will receive consideration for employment without regard to their race, color, religious creed, age, sex, sexual orientation, marital status, national origin, mental retardation, or physical disability.

The Contractor shall incorporate the requirements of this paragraph in all subcontracts for Work performed under this Agreement.

28. **WAGE RATES** - Where the project is for new public works construction greater than \$400,000 or repair or rehabilitation work is greater than \$100,000, the Contractor must abide by State Wage Rates as published by Department of Labor in accordance with Connecticut General Statute Sec. 31-53(g).

The wages paid on an hourly basis to any mechanic, laborer or workman employed upon the Work herein contracted to be done and the amount of payment or contribution paid or payable on behalf of each such employee to any employee welfare fund, as defined in Section 31-53 (h) of the Connecticut General Statutes, shall be at a rate equal to the rate customary or prevailing for the same work in the same trade or occupation in the town where the work is being performed. Any contractor who is not obligated by agreement to make payment or contribution on behalf of such employees to any such employee welfare fund shall pay to each employee as part of his wages, the amount of payment or contribution for his classification on each pay day.

29. OVERTIME AND HOLIDAY WORK - Bidders are advised that all bids are to be premised on the assumption that work will be performed during regular working hours, from 7 AM to 6 PM, Monday to Friday. Where overtime (after 6 PM), work on holidays, or work on weekends, is required, written permission must be obtained from the Owner or its delegated officials. The Contractor shall not be entitled to additional compensation for work outside regular working hours. Also note that required working hours, when construction is along state roads, shall meet the State Department of Transportation requirements.

30. TRAFFIC CONTROL - A Traffic Control Plan with advance notification, signage, temporary barricades, warning lights, cones, barriers, etc. must be submitted to the Town of Brookfield Police Department for approval, as required. The cost of traffic controllers must be included in the prices bid. Also as per DOT requirements the work performed on state roads will be between the hours of 9:00 AM and 4:30 PM.

31. NON-COLLUSION; NO KICKBACKS - The Contractor warrants that no person has been employed or retained to solicit or secure the Agreement upon an agreement or understanding for a commission, percentage, brokerage or contingent fee; and that no Commissioner or any employee of the Owner has any interest, financially or otherwise, in the Contractor's organization.

For breach or violation of this warranty, and without limiting any other remedies provided by law, the Owner shall have the right to terminate the Agreement without liability or at its discretion to deduct from the Contract Price or consideration, the full amount of such commission, percentage, brokerage or contingent fee.

32. PAYMENTS TO SUBCONTRACTORS - The Contractor must comply with Section 49-41a (as more fully provided in Article 39 of the General Conditions) of the Connecticut General Statutes, as to payment to subcontractors.

33. USE OF LOCAL LABOR - In the employment of mechanics, laborers, and workers, in the performance of the Contract, the Contractor shall give preference to citizens who are, and continuously for six months prior to the contract date, have been residents of the Town of Brookfield; and if no such persons are available; then to residents of the State of Connecticut, if no such persons are available, then to residents of other States, in accordance with Section 31-52, and 31-53 of the Connecticut General Statutes.

34. **SAFETY** - Bidders are notified that the Contractor shall be solely responsible for initiating, maintaining and supervising all safety precautions and programs necessary to the safe and proper performance of the work and that the Contractor shall be solely responsible for taking all necessary precautions to insure the safety of all employees, subcontractors and other persons, including the public, exposed to the contract work. The Contractor shall comply with all current safety requirements mandated by the Occupational Health and Safety Act (OSHA), the Connecticut Department of Transportation (DOT), and any other applicable State statutes.

In addition to any other indemnification provisions contained in the Contract Documents, the Contractor shall at all times indemnify and save harmless the Owner, the Town of Brookfield, The Water Pollution Control Authority, the Engineer, and their officers, agents and employees on account of and from any and all claims, damages, losses, judgments, worker's compensation payments, litigation expenses, and counsel fees arising out of injuries to any person (including death) or damage to property alleged to have been sustained by any person as a result of the acts, omissions, or neglect of the Contractor, its employees or subcontractors. The existence of insurance shall in no way limit the scope of this indemnification. The Contractor shall further be liable to the Owner, the Town of Brookfield, the Engineer, and their officers, agents and employees for all attorneys' fees, costs and other expenses incurred by it or them in enforcing this indemnity provision, provided however, that the Contractor is found to be liable for injury as a result of any act, omission or neglect by it or its employees or subcontractors.

Neither action nor inaction on the part of the Engineer or Owner, or their representatives, shall make them responsible for safe conditions, or make them liable for bodily injury or property damage on this project.

35. **STATE REQUIREMENTS** - If needed, the Contractor must obtain a General Permit for the Discharge of Stormwater and Dewatering Waste waters from construction activities, as issued by the State Department of Energy and Environmental Protection.

36. **INLAND WETLANDS COMMISSION REQUIREMENTS** – Not Applicable

37. **BORING LOGS** – Not Applicable

38. **PAYMENT OF TAXES, CHARGES AND ASSESSMENTS** - Each person who submits a bid shall be deemed to have agreed that the Owner may apply payments otherwise properly due to such person to the reduction of all real estate or personal property taxes and/or sewer charges and assessments (including interest, fees and penalties thereon) owed to the town or Owner by such person, which taxes are delinquent and have been so delinquent for a period of not less than one (1) year. Prior to making any payment to any person awarded the contract, the Owner shall ascertain from the Tax or Sewer Collector whether such person owes past due taxes on real or personal property or sewer charges or assessments and shall deduct from such payment the amount of taxes or charges (plus penalties, interest and fees thereon) which are delinquent and have been delinquent for a period of at least one (1) year as of the time of withholding.

39. **EXEMPTION FROM TAXES** - State and Local sales taxes on construction materials required for construction shall not be included in the bid. The Brookfield Water Pollution Control Authority is exempt from payment of State and Compensating Use Taxes of the State of Connecticut on all materials sold to it, or for the project pursuant to the provisions of the Contract Documents. The purchase by subcontractors of materials to be furnished pursuant to the provisions of the contract shall be a purchase for resale to the Contractor (either direct or through other subcontractors) and hence exempt from sales tax, regardless of the terms of the contract between the prime contractor and the subcontractor.

40. **WIDTH OF OPERATIONS** - The bidder's attention is directed to the width limitations for operations in various portions of the project.

During construction, the Contractor will be required to perform operations as follows:

- a) Where so indicated, no activities will be permitted outside the limits of disturbance. Work must be confined to in-line operation, unless otherwise authorized in writing.
- b) Limits of disturbance are to be clearly marked by snow fencing, or equivalent as shown on the drawings.
- c) Staging areas are to be established, in field consultation between the Contractor, the Engineer, and the WPCA representative. Such areas shall not exceed 2,000 sq. feet and are to be delineated by snow fencing.

TOWN OF BROOKFIELD, CONNECTICUT
Phase II- 133 Pump Station
Langan Job No. 190093201
WPCA CONTRACT NO. 2024-02
PROPOSAL

Brookfield Water Pollution Control Authority
 53A Commerce Road, Unit 1
 Brookfield, Connecticut 06804

Made by _____

P.O./ Address _____

Gentlemen:

Pursuant to and in compliance with your request for bids, the undersigned states that he has examined the Contract Documents and the site of the work, made all investigations which he has deemed necessary or desirable, and that he understands the purport and magnitude of the work intended, and the undersigned hereby offers to furnish all plant, labor, material, supplies, equipment, and other facilities and things necessary or proper for or incidental to the proper construction of the work advertised, and to construct the said work in strict accordance with the Contract Documents of which this Proposal is a part and such detailed directions, plans, and drawings as may be furnished from time to time during the progress of construction by the Engineer at the following prices, which prices include all incidental work including traffic control:

SCHEDULE OF PRICES

ITEM NO.	EST. QUANTITY	UNIT	ITEM WITH UNIT PRICES (IN WORDS)	UNIT PRICES (IN NUMBERS)		AMOUNT BID	
				Dollars	Cents	Dollars	Cents
1	1	L. S.	Mobilization and Demobilization (see max. bid price allowed)				
			L.S.				

ITEM NO.	EST. QUANTITY	UNIT	ITEM WITH UNIT PRICES (IN WORDS)	UNIT PRICES (IN NUMBERS)		AMOUNT BID	
				Dollars	Cents	Dollars	Cents
2	1	L.S.	General Structural Work				
			L.S.				
3	1	L.S.	Pump Installation and Wet Well Modifications				
			L.S.				
4	1	L.S.	6" Dia. PVC Force Main				
			L.S.				
5	1	Ea.	Valve Pit				
			Ea.				
6A	60	L.F.	Silt Fence				
			L.F.				
6B	3	Ea.	Inlet Protection				
			Ea.				
6C	30	L.F.	Tree Protection				
			L.F.				

ITEM NO.	EST. QUANTITY	UNIT	ITEM WITH UNIT PRICES (IN WORDS)	UNIT PRICES (IN NUMBERS)		AMOUNT BID	
				Dollars	Cents	Dollars	Cents
7	1	Ea.	Decommissioning of Existing 7-Ft Diameter Pump Station				
			Ea.				
8	1	Ea.	Decommissioning and Abandonment of Existing Valve Pit				
			Ea.				
9	1	F.L.S.	Misc. Additional Work	\$50,000			
			Fifty Thousand Dollars				
10	1	L.S.	As-Built				
			L.S.				
11A	1	L.S.	Electrical Equipment				
			L.S.				
11B	1	L.S.	Electrical Demolition/ Installation				
			Ea.				
11C	1	L.S.	Electrical – Misc. Remaining Items				
			L.S.				
SUMMATION OF BASE BID ITEMS							
				DOLLARS			
				CENTS			
				(\$ _____)			

The summation of the bid for this contract is based on the prices for the various items. This summation is made with the understanding that it is not a part of the bid and is solely a matter of information for convenience in comparing the bids at the time of opening.

The undersigned proposes to commence work within eight (8) months of receipt of written notice from the Owner so to do, and shall complete the work in all respects except for maintenance and final pavement within 45 calendar days following service of said notice. The undersigned is also aware of the provision of payment to the Owner for liquidated damages should he fail to complete the work within the time stipulated above.

Accompanying this proposal, under separate cover, is a cashier's check, certified check or bid bond for _____ dollars (\$_____) payable to the Owner.

In case this Proposal is accepted by the Owner and the undersigned shall fail to execute the Contract with, and deliver Contract Bonds to the Owner in accordance with the information for Bidders, then the said cashier's check, certified check, or the amount of the Bid Bond shall become the property of the Owner and shall be the maximum obligation of the Contractor or his Surety for the aforesaid failure of the Contractor, otherwise it shall be returned to the undersigned upon request.

If written notice of the acceptance of this bid is mailed, telegraphed, or delivered to the undersigned within ninety (120) days after the date of opening of the bids, or any time thereafter before this bid is withdrawn, the undersigned shall, within eight (8) months after the date of such mailing, telegraphing, or delivering of such notice, execute and deliver a contract in the Form of Contract attached hereto, and Contract Bonds as hereinafter specified. The undersigned hereby designates the above address as his office to which such notice of acceptance may be mailed, telegraphed or delivered.

The bidder hereby acknowledges the receipt of the following issues of addenda, if any, distributed by the Engineer:

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

The Brookfield Water Pollution Control Authority reserves the right to reject any and all bids for any reason, to waive any informality in the bidding and to award the Contract to the lowest responsible and qualified bidder or the responsible and qualified bidder with the lowest combination of **Base Bid and Alternates, where applicable**, selected by the Authority.

INFORMATION SHOWING QUALIFICATIONS FOR WORK:

THE BIDDER SHALL SUBMIT WITH HIS BID HIS MOST RECENT CERTIFIED FINANCIAL STATEMENT

The bidder shall here furnish the following summary information relative to his ability and financial resources available for the fulfillment of the Contract, if such be awarded to him:

How many consecutive years has he or they been engaged in the construction business under the present firm name? _____

When organized? _____

Where incorporated? _____

Credit available for this Contract \$ _____

Contracts in hand- Number _____

Gross Amount _____

List Permanent Field Personnel _____

List Construction Equipment Owned _____

Has the firm ever refused to sign a Contract at the original bid? _____

Has the firm ever defaulted on a Contract? _____

Has the firm ever been adjudged a bankrupt or been subject to a receivership or an order of reorganization? If so, give details and particulars _____

Is the business at this time subject to any court order relating to bankruptcy, receivership, liquidation or reorganization? _____

Does the bidder hold a current "DAS Contractor Prequalification Certificate" from the Connecticut Department of Administrative Services?

If so, what is the single project limit for which the bidder is so qualified? _____

If so, what is the contractor category or categories in which the bidder is so prequalified? _____

Is the bidder, or any affiliated entity, or principal stockholder or officer, indebted to the Town of Brookfield or to the Brookfield Water Pollution Control Authority on account of unpaid real or personal property taxes or on account of Sewer charges or assessments?

Financial Resources- Information relative to the firm's financial resources can and may be obtained from the following: (Give name, business and address).

Listing of current contracts of comparable size:

Name or Location	Value	Contact & Tel. No.
<hr/>	<hr/>	<hr/>
<hr/>	<hr/>	<hr/>
<hr/>	<hr/>	<hr/>

Upon request, the bidder will be expected to amplify the foregoing statements as necessary to satisfy the Owner concerning the ability to successfully perform the work in a satisfactory manner.

The undersigned hereby certifies that no person interested in this proposal is directly or indirectly interested in or connected with any other bid or proposal for said work, and no member of the Owner or other officer or employee of the Owner is directly or indirectly interested therein, or in any portion thereof.

The undersigned hereby certifies that this bid is genuine and not collusive or sham; that said bidder has not colluded, conspired, connived, or agreed, directly or indirectly, with any bidder or person, to put in a sham bid, or that such other person shall refrain from bidding, and has not in any manner, directly or indirectly sought by agreement or collusion, or communication or conference, with any person, to fix the bid price of any other bidder, or to fix any overhead profit or cost element of said bid price, or of that of any other bidder, or to secure any advantage against the Owner or any person interested in the proposed Contract; and that all statements contained in said proposal or bid are true; and further, that such bidder has not, directly or indirectly submitted this bid, or the contents thereof, or divulged information or data relative thereto to any association or to any member or agent thereof.

The undersigned hereby certifies that neither he nor his agent nor any other party for him has paid or agreed to pay, directly or indirectly, a person, firm or corporation any money or valuable consideration for assistance in procuring or attempting to procure the contract herein referred to, and further agrees that no such money or reward shall be hereafter paid.

Date _____

Firm Name:** _____

By: _____

Title _____

Address _____

Seal

**Insert Bidder's name

If corporation, give the State of Incorporation, using the phrase "A corporation organized under the laws of

If a partnership, give names of the partners, using also, the phrase "Co-partners trading and doing business under the firm name and style of _____

If an individual using a trade name, give individual name, using also the phrase "An individual doing business under the firm name and style of _____

BIDDER'S AFFIDAVIT
(This Affidavit is part of the Proposal)

State of _____ SS:
County of _____

By: _____

being duly sworn, deposes and says that he resides at _____

that he is the _____ of the _____
(Title) (Name of Bidder)

who signed the above Proposal, that he was duly authorized to sign and that the bid is the true offer of the Bidder; that the seal attached is the seal of the Bidder and that all the declarations and statements contained in the Proposal are true to the best of his knowledge and belief.

(/s/) _____

Subscribed and Sworn to before me this _____ day of _____, 20__

(SEAL)

Notary Public

My Commission Expires

**FORM OF
CONSENT OF SURETY/SURETY GUARANTY**

(To accompany Proposal)

KNOW ALL MEN BY THESE PRESENTS, that for and in consideration of the sum of \$1.00, lawful money of the United -States, the receipt whereof is hereby acknowledged, paid the undersigned corporation, and for other valuable consideration, the _____

(Name of Surety Company)

a corporation organized and existing under the laws of the State of _____

and licensed to do business in the State of Connecticut certifies and agrees, that if _____(Contract)

is awarded to _____

(Name of Bidder)

the undersigned corporation will execute the Performance and Payment bond or bonds as required by the Contract Documents and will become surety in the full amount of the Contract price for the faithful performance of the Contract and for payment of all persons supplying labor or furnishing materials in connection therewith.

(To be accompanied by the usual proof of authority of officers of surety company to execute the same).

BID BOND

KNOW ALL MEN BY THESE PRESENTS, That we, the undersigned _____ as principal; and _____ as Surety, are hereby held and firmly bound unto the _____ in the penal sum of \$_____ for the payment of which, well and truly to be made, we hereby jointly and severally bind ourselves, our heirs, executors, administrators, successors and assigns.

Signed this _____ day of _____ 20__

The condition of the above obligation is such that whereas the Principal has submitted to the owner as defined, a certain Bid, attached hereto, and hereby made a part hereof, to enter into a contract in writing, for

NOW, THEREFORE,

- (A) If said Bid shall be rejected, or, in the alternate
- (B) If said Bid shall be accepted and the Principal shall execute and deliver a contract in the form of Contract attached hereto (properly completed in accordance with said Bid) and shall furnish a bond for his faithful performance of said Contract, and for the payment of subcontractors, laborers and material men, shall in all other respects perform the Agreement created by the acceptance of said Bid.

Then, this obligation shall be void, otherwise the same shall remain in force, and effect; it being expressly understood and agreed that the liability of the Surety for any and all claims hereunder shall, in no event, exceed the penal amount of this obligation as herein stated.

The Surety, for value received, hereby stipulates and agrees that the obligations of said Surety and its bond shall be in no way impaired or affected by any extension of the time within which the Principal may accept such Bid; and said Surety does hereby waive notice of any such extension.

IN WITNESS WHEREOF, the Principal and the Surety have set their hands and seals, and such of them as are corporations having caused their corporate seals to be hereto affixed and these presents to be signed by their proper officers, the day and year first set forth above.

Principal: _____ (L.S.)

Surety _____

By: _____

PERFORMANCE BOND

KNOW ALL MEN BY THESE PRESENTS:

THAT _____, as Principal, hereinafter called Contractor, and _____ as Surety, are held and firmly bound unto the Brookfield Water Pollution Control Authority as Oblige, hereinafter called the Owner, in the amount of _____ Dollars (\$_____), for the payment whereof Contractor and Surety bind themselves, their heirs, executors, administrators, successors, and assigns, jointly and severally, firmly by these presents.

WHEREAS, Contractor has by written agreement dated _____ entered into a contract with the Owner for the pump station improvement project entitled **Contract 2024-02 Route 133 Pump Station Improvements**, which contract with all its terms, covenants, conditions and stipulations is incorporated herein to form a part hereof as fully as if said contract was recited at length herein.

NOW, THEREFORE, the condition of this obligation is such that, if the Contractor shall promptly and faithfully perform said Contract, then this obligation shall be null and void; otherwise it shall remain in full force and effect.

PROVIDED, that any alterations which may be made in the terms of the contract, or in the work to be done under it, or the giving by the Owner of any extension of time for the performance of the contract, of any other forbearance on the part of either the Owner or the Contractor to the other shall not in any way release the Contractor and the Surety, or their successors or assigns from their liability hereunder. Notice to the Surety of any such alterations, extension or forbearance is hereby expressly waived.

WHENEVER Contractor shall be, and declared by the Owner to be, in default under the Contract, the Owner having performed the Owners obligations thereunder, the Surety, upon written notice of such default, may promptly remedy the default or shall promptly:

1. Complete the Contract in accordance with its terms and conditions, by another contractor acceptable to the Owner, said other contractor to act as an agent of the Surety, or
2. Obtain a bid or bids for submission to the Owner for completing the Contract in accordance with its terms and conditions, and upon determination by the Owner and Surety of the lowest acceptable and responsible bidder, arrange for a contract between such bidder and the Owner, and make available as work progress sufficient funds to pay the cost of completion less the balance of the contract price (even though there should be a default or a succession of defaults under the contract or contracts of completion arranged under this paragraph), but not exceeding, including other costs and demands for which the surety may be liable hereunder, the amount set forth in the first paragraph hereof. The term, "balance of the contract price" as used in this paragraph shall mean the total amount payable by the Owner to the Contractor under the Contract and any amendments thereto, less the amount properly paid by the Owner to Contractor.

IN WITNESS WHEREOF, the above-bounded parties have executed this instrument under their several seals this _____ day of _____, 20____, the name and corporate seal of each corporate party being hereto affixed and these presents signed by its undersigned representative, pursuant to authority of its governing body.

IN THE PRESENCE OF:

_____ L.S.
(Principal) (Affix Seal)

By _____
(Title)

_____ L.S.
(Surety) (Affix Seal)

By _____
(Attorney-in-fact)

ACKNOWLEDGMENT OF PRINCIPAL

STATE OF _____)
) ss.: _____, 20__ COUNTY OF
_____)

Personally appeared _____ who acknowledged himself to be the
_____ of _____ (Principal), that he knows the seal of said
Corporation; that the seal affixed to said instrument is such Corporate Seal, that it was so affixed to the
resolution of the Board of Directors of said Corporation, and that he, as such _____
being authorized to do so, executed the foregoing instrument for the purposes therein contained, by signing
the name of the corporation by himself as _____.

In witness whereof I hereunto set my hand and seal.

Notary Public

ACKNOWLEDGMENT OF SURETY COMPANY

STATE OF _____)
) ss.: _____, 20__
COUNTY OF _____)

Personally appeared _____ who acknowledged himself to be the
_____ of _____ (Surety), that he knows the seal of said
Corporation; that the seal affixed to said instrument is such Corporate Seal, that it was so affixed to the
resolution of the Board of Directors of said Corporation, and that he, as such _____ being
authorized to do so, executed the foregoing instrument for the purposes therein contained, by signing the
name of the corporation by himself as _____

In witness whereof I hereunto set my hand and seal.

Notary Public

(The Surety company must append statement of its financial condition and a copy of the resolution
authorizing the execution of Bonds by Officers of the company, and the power of attorney of the Surety
company's attorney in fact, authorized to act within the State of Connecticut).

Affix Corporate Seal

LABOR AND MATERIAL PAYMENT BOND

KNOW ALL MEN BY THESE PRESENTS:

THAT, of _____ as Principal, and _____, of _____ as Surety are held and firmly bound unto the Brookfield Water Pollution Control Authority as Obligee (hereinafter called Owner) for the use and benefit of claimants as hereinbelow defined, in the amount of _____ (\$ _____), for the payment of which the Principal and Surety bind themselves, their heirs, executor, administrators, successors, and assigns, jointly and severally, firmly by these presents.

WHEREAS, Principal has by written agreement dated _____, entered into a Contract with the Owner for the pump station improvement project entitled **Contract 2024-02 Route 133 Pump Station Improvements**, which contract is by reference made a part hereof, and is hereinafter referred to as the Contract.

PROVIDED, that any alterations which may be made in the terms of the Contract or in the work to be done under it, or the giving by the Obligee of any extension of time for the performance of the contract, or any other forbearance on the part of either Obligee or the Principal to the other shall not in any way release the Principal and the Surety or either or any of them, their heirs, executors, administrators, successors or assigns from their liability hereunder, notice to the Surety of any alterations, extension, modification or forbearance of said Contract being hereby waived.

Any party, whether a subcontractor or otherwise, who furnished materials or supplies or performs labor or services in the prosecution of the work under said Contract, and who is not paid therefore, may assert a claim for payment or bring a suit on this Bond, and in the name of the person or party suing, prosecute the same to a final judgment, and

NOW, THEREFORE, the condition of this obligation is such that, if Principal shall promptly make payment to all claimants as hereinafter defined, for all labor and material used or reasonably required for use in the performance of the Contract, then this obligation shall be void; otherwise it shall remain in full force and effect, subject, however, to the following conditions:

1. A claimant is defined as a person or party having a direct contract with the Principal or with a subcontractor of the Principal for labor, material, or both, used or reasonably required for use in the performance of the Contract, labor and material being construed to include that part of water, gas, power, light, heat, oil, gasoline, telephone service or rental of equipment directly applicable to the Contract.
2. The above named Principal and Surety hereby jointly and severally agree with the Owner that every claimant as herein defined, who has not been paid in full before the expiration of a period of ninety (90) days after the date on which the last of such claimant's work or labor was done or performed, or materials were furnished or provided by such claimant, may assert a claim for payment and prosecute a suit to final judgment for such sum or sums as may be justly due claimant, and have execution thereon. The Owner shall not be liable for the payment of any costs or expenses of any such suit.
3. No suit or action shall be commenced hereunder by any claimant.
 - a) Unless claimant, other than one having a direct contract with the Principal, shall have given written notice to any two (2) of the Principal, the Owner, or the Surety, within ninety (90) days after claimant did or performed the last of the work or labor, or furnished the last of the materials for

which said claim is made, stating with substantial accuracy the amount claimed and the name of the party to whom the materials were furnished, or for whom the work or labor was performed. Such notice shall be served by mailing the same by certified mail, postage prepaid, return receipt requested in an envelope addressed to the Principal, Owner or Surety, at any place where an office is regularly maintained for the transaction of business, or served in any manner in which legal process may be served in the State in which the aforesaid project is located.

b) After the expiration of one (1) year following the date on which Principal ceased Work on said Contract.

c) Other than in a state court of competent jurisdiction within and for the Judicial District in which the Project or Principal is located

4. The amount of this bond shall be reduced by and to the extent of any payment of payments made in good faith thereunder, inclusive of the payment by Surety of mechanics liens which may be filed of record against said improvement, whether or not claim for the amount of such lien be presented under and against this bond.

IN WITNESS WHEREOF, the above-bounded parties have executed this instrument under their several seals this _____ day of _____, 20__ the name and corporate seal of each corporate party being hereto affixed and these presents signed by its undersigned representative, pursuant to authority of its governing body.

IN THE PRESENCE OF:

_____	_____ L.S. (Principal) (Affix Seal)
_____	By _____ (Title)
_____	_____ L.S. (Surety) (Affix Seal)
_____	By _____ (Attorney-in —fact)

ACKNOWLEDGEMENT OF PRINCIPAL

STATE OF _____)
) ss.: _____, 20__
COUNTY OF _____)

Personally appeared _____ who acknowledged himself to be the _____ of _____ (Principal), that he knows the seal of said Corporation; that the seal affixed to said instrument is such Corporate Seal, that it was so affixed to the resolution of the Board of Directors of said Corporation, and that he, as such _____ being authorized to do so, executed the foregoing instrument for the purposes therein contained, by signing the name of the corporation by himself as _____.

In witness whereof I hereunto set my hand and seal.

Notary Public

ACKNOWLEDGEMENT OF SURETY COMPANY

STATE OF _____)
) ss.: _____, 20__
COUNTY OF _____)

Personally appeared _____ who acknowledged himself to be the _____ of _____ (Surety), that he knows the seal of said Corporation; that the seal affixed to said instrument is such Corporate Seal, that it was so affixed to the resolution of the Board of Directors of said Corporation, and that he, as such _____ being authorized to do so, executed the foregoing instrument for the purposes therein contained, by signing the name of the corporation by himself as _____.

In witness whereof I hereunto set my hand and seal.

Notary Public

(The Surety company must append statement of its financial condition and a copy of the resolution authorizing the execution of Bonds by Officers of the company, and the power of attorney of the Surety company's attorney in fact, authorized to act within the State of Connecticut).

Affix Corporate Seal

CONTRACT

THIS AGREEMENT, made this day _____ of _____, 2024 by and between the Town of Brookfield WPCA, a municipal corporation located in State of Connecticut, acting by the Brookfield Water Pollution Control Authority, a duly authorized agency of said Town, party of the first part, hereinafter called the "Owner"; and

of _____, County of _____ State of _____, hereinafter called the "Contractor".

WITNESSETH; That for and in consideration of the payments and agreements to be made and performed by the Owner, the Contractor hereby agrees with the Owner to commence and complete the work described as **"Route 133 Pump Station Improvements, Contract 2024-02"** as shown in the Contract Documents prepared by Langan CT, Inc., White Plains, New York. The Contract Documents include the Contract Drawings, General Specifications, Contract Items, the Advertisement, Information for Bidders, Proposal, Bidder's Affidavit, General Conditions, this Contract, and all addenda thereto and modifications thereof, incorporated in the said Documents before execution of this Contract.

The Contractor hereby agrees to commence the work under this Contract within eight (8) months of receipt of a written notice to proceed from the Owner and to fully complete all work except maintenance and final pavement within 300 consecutive calendar days thereafter. The Contractor shall pay the Owner liquidated damages in the amount of \$500.00 for each calendar day that the Contractor shall exceed the foregoing contract period in completing the work.

The Owner will pay and the Contractor shall receive the Contract Price of _____ dollars and _____ cents (in words) (\$ _____), based upon the bid prices in the Bid Proposal, as full compensation for:

- (a) Furnishing the security required for the faithful performance, and for the payment of all labor and material required under the Contract;
- (b) Performing and completing all work which is necessary or proper to be furnished and/or performed in order to complete the entire work as shown and described in the Contract Documents;
- (c) All losses or damages sustained by the Contractor:
 - (1) Arising out of the nature of the work aforesaid, or
 - (2) From the action of the elements, or
 - (3) From any unforeseen obstructions or difficulties encountered in the prosecution of the work, or
 - (4) From any encumbrances on the line of the work; and

- (d) All expenses incurred by or in consequence of the suspension or discontinuance of the work as specified.

The Owner shall pay the Contractor for performance of work in accordance with the unit prices or lump sums bid, and only for the work quantities actually required and performed. The Contractor will accept, as payment in full with no allowance for anticipated profit, the sum of:

- (a) The lump sum bid, less any approved credits for reduction in work;
- (b) The products of the quantities, as determined by the Engineer, multiplied by the unit prices bid or stipulated; and
- (c) Compensation for extra work, if any, as provided for in the General Conditions.

Such sum shall be subject to additions and deductions as provided in the Contract Documents, and shall be paid by the Owner to the Contractor in current funds, and only upon certificates of the Engineer, as provided in the General Conditions.

The Contractor represents and warrants:

- a) That the Contractor is financially solvent and experienced and competent to perform the contract work, and to furnish the labor, materials, supplies and equipment, to be so performed or furnished by the Contractor;
- b) That the Contractor is familiar with all federal, state, and municipal laws, ordinances, and regulations, which may in any way affect the work or those employed therein;
- c) That such temporary and permanent work required by the Contract Documents can be satisfactorily constructed and used for the purpose for which it is intended, and that such construction will not injure any person or damage any property; and
- d) That the Contractor will make no claims against the Owner if, in carrying out the project, the Contractor finds that the actual conditions encountered do not conform to the information shown in the Contract Documents, or to conditions to be expected from surface and/or subsurface indications and or investigations.

Liquidated Damages:

- A. The Owner and the Contractor recognize that "time is of the essence" on this project and that Owner will suffer financial loss apart from the costs described as Special Damages, if the Work is not complete within the time specified herein, plus any extensions allowed in accordance with the General Conditions. Owner and Contractor also recognize the delays, expense and difficulties involved in proving in a legal proceeding the actual loss or damages suffered to the Owner and/or its third part contract beneficiaries if the work is not complete on time. Accordingly, instead of requiring any such proof, Owner and Contractor agree that as liquidated damages for delay (but not as a penalty) Contractor shall pay Owner \$500.00 for each day that expires after the time specified herein for completion including any extensions thereof made in accordance with the General Conditions, until the work is complete.

Special Damages:

- A. In addition to the amount provided for liquidated damages, Contractor shall pay Owner the actual costs reasonably incurred by Owner for engineering and inspection forces employed on the Work for each day that expires after the time specified herein for completion, including any extensions thereof made in accordance with the General Conditions, until the work is complete.
- B. After completion if Contractor shall neglect, refuse or fail to complete the remaining Work within the Contract Time, Contractor shall pay Owner the actual costs reasonably incurred by Owner for engineering and inspection forces employed on the work for each day that expires after the time specified herein for the Work to be completed and ready for final payment (adjusted for any extensions thereof made in accordance with the General Conditions) until the Work is completed and ready for final payment.

The Owner may deduct the amount of Liquidated Damages and Special Damages from monies due the Contractor under this Contract.

This Contract shall bind the heirs, executors, administrators, successors and assigns of the respective parties hereto.

IN WITNESS WHEREOF, the parties to these presents have executed this Contract in four (4) counterparts, each of which shall be deemed an original, in the year and day first above mentioned.

(Seal)

Authority

Brookfield Water Pollution Control

ATTEST: _____

By: _____
Nelson Malwitz, Chairman

(Seal)

ATTEST: _____

(Contractor)

By: _____

(Title): _____

(Address): _____

NOTE: If Contractor is a Corporation,
Secretary should attest.

GENERAL CONDITIONS

GENERAL CONDITIONS

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GENERAL CONDITIONS

ART. 1 - DEFINITIONS

The term "Contract Documents" shall mean and consist of the Advertisement for Bids, Information for Bidders, Proposal, Bidder's Affidavit, executed Contract, General Conditions, General Specifications, Detailed Specifications, Contract Drawings entitled and all addenda thereto and modifications thereof incorporated in the Documents before execution of the Contract.

The term "Owner" shall mean the Brookfield Water Pollution Control Authority, Town of Brookfield, Connecticut, or its duly authorized representative.

The term "Engineer" shall mean Langan CT, Inc., One North Broadway – Suite 910, White Plains, New York 10601.

The Term "Contractor" shall mean the party or parties contracting with the Owner to perform a branch of the work herein specified or to the legal representative of such party or parties.

The term "Subcontractor" shall mean the party or parties having a contract or agreement with the Contractor to supply labor or materials, or both, for work at the site of the Project.

The term "Contract Bonds" shall mean the bonds furnished by the Contractor, as security for the faithful performance of his Contract and security for the payment of all persons performing labor or furnishing materials in connection therewith.

The term "Surety" shall mean the person, persons, or corporate body which is bound with and for the Contractor, and which binds itself or himself for the payment of all debts pertaining to, and for the acceptable performance of, the work for which he has contracted.

The term "Project" shall mean the entire work to be performed under the Contract.

The term "work" shall mean all plant, labor, materials and supplies (including their transportation to or from the site of the Project by employees of the Contractor or his subcontractors), structures or parts thereof on which work is underway or completed, equipment, rentals, insurance, Contract Bonds, and other facilities and things agreed to be furnished and done by the Contractor, and necessary and proper for or incidental to the carrying out and completion of the terms of this Contract, including all shop and field tests of equipment and structures, operating tests and maintenance for one year.

The term "extra work" shall mean work authorized by the Owner which, by his written direction, involves changes in, or additions to, the work required under the Contract at the time of its execution.

The term "drawings" shall mean the Contract Drawings, all details or working drawings furnished by the Engineer pertinent or supplemental thereto, and such supplemental detail drawings as the Contract Documents may require the Contractor to furnish, when such drawings have been duly approved.

The term "specifications" shall mean the General Specifications, Detailed Specifications, specifications contained in the Contract Items or shown on the drawings, and standard specifications referred to herein.

The term "provide" and/or "furnish" shall mean to supply, deliver, place, install, connect, and make ready for use or for the purpose intended.

The term "completion" shall mean the full and exact compliance and conformance with the provisions and requirements expressed and implied by the drawings, specifications, and Contract Documents.

The term "material" (or "materials") shall mean all the things of any kind, nature, and class as may be specified which become a part of or are used in the construction of the work, together with all manufactured or prepared materials, articles, equipment, accessories, appliances, appurtenances, supplies and parts used therein or placed thereon.

The term "structures" shall mean the pumping stations, chambers, manholes, conduits, pipe, electrical and other facilities, and other works which are to be built under this Contract or which may be encountered in the work and which are not otherwise classified herein.

The term "site" shall mean the area or areas which is the location for the performance of the work.

When referring to the work or its performance, the words "directed", "required", "permitted", "ordered", "designated", "prescribed", and others of like import, shall imply the direction, requirement, permission, order, designation or prescription of the Engineer; and "approved", "acceptable", "satisfactory", "in the judgment of", and words of like import shall mean approved by or acceptable to or satisfactory to the Engineer. Wherever in the specifications the words "detailed", "noted", "shown", or words of like import are used, it shall be understood that these words mean as detailed, noted, or shown on the drawings; and where the word "specified" is used, it shall be understood to mean as specified herein.

Whenever any article of equipment or material is specified by reference to the name of a manufacturer or dealer without the use of the terms "equal to", or "approved equal", the intent is to specify that equipment or material shall be the basis for the bid submitted in the proposal.

ART. 2 - HEADINGS

The headings of the articles herein are intended for convenience of reference only and shall not be considered as having any bearing on their interpretation.

ART. 3 - EXECUTION, CORRELATION AND INTENT OF DOCUMENTS

The Contract Documents shall be signed in quadruplicate by the Owner and the Contractor.

The Contract Documents are complementary, and what is called for by one shall be binding as if called for by all, The work herein described and/or shown on the drawings shall be complete in every detail notwithstanding that every item necessarily involved is or is not particularly mentioned or shown, and the Contractor will be held to provide all labor, materials, equipment and incidental accessories necessary for the entire completion of the work intended to be described or shown in finished form, tested and ready for operation, and shall not avail himself of any manifestly unintentional error or omission, should such exist.

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

If this Contract contains any unlawful provisions not an essential part of the general structure of the Contract and which shall not appear to have been a controlling or material inducement in the making

thereof, the same shall be deemed of no effect and shall be deemed stricken from the Contract without affecting the binding force of the remainder.

ART. 4 -CONTRACT SECURITY

Simultaneously with delivery of the executed Contract, the Contractor shall furnish and deliver to the Owner in quadruplicate an executed Performance Bond and Labor and Material Payment Bond, each in the amount of one hundred percent (100%) of the accepted bid as security for the faithful performance of his Contract, and in the amount of one hundred percent (100%) of the accepted bid as security for the payment of all persons performing labor or furnishing materials in connection therewith, prepared in a form and having as security thereon such Surety or Sureties as are acceptable to the Owner, are authorized to transact business within this State, and have at least an A Minus rating from A.M. Best & Company. The bonds shall be purchased through a surety company having a local agent upon whom service of process can be made. The bonds shall assure the Owner coverage for a one year maintenance period subsequent to completion of work.

If, at any time after execution and approval of this Contract and the Bonds required by the Contract Documents, the Owner shall deem any of the Sureties upon such bonds to be unsatisfactory, or if, for any reason, such bonds shall cease to be adequate security for the Owner, the Contractor shall, within five (5) days after notice so to do, furnish new or additional bonds, in forms, sums and signed by such Sureties as shall be satisfactory to the Owner. No further payment shall be deemed due nor shall any further payment be made to the Contractor unless and until such new or additional bonds shall be furnished and approved. The premium on such bonds shall be paid by the Contractor.

ART. 5- BREAKDOWN STATEMENT OF LUMP SUM BIDS

Simultaneously with his delivery of the executed Contract, the Contractor shall furnish and deliver to the Owner triplicate copies of a breakdown statement of his lump sums bid in the Proposal, in such detail and form as will be acceptable to the Engineer, for use in preparing the monthly estimates. The breakdown shall show the delivered price of material and the allowance for installation, which may be enumerated in any monthly estimate for payment as provided hereinunder; and shall be so made as to facilitate the preparation of monthly estimates.

ART. 6- OBLIGATION OF CONTRACTOR

The Contractor shall, under the bid prices, furnish all labor, materials, plant, power, light, heat, fuel, water, tools, appliances, equipment, supplies, and any and all other means of construction necessary or proper for performing and completing the work; restore to their original condition all surfaces disturbed; do all work and pay all costs of cutting, fitting, patching, protecting, supporting, maintaining, repairing if damaged, relocating and restoring all surface, subsurface and overhead structures, and all other property, including the work of other contractors, and pipe, conduits, ducts, tubes, chambers, and appurtenances, public or private in the vicinity of the work; bear all costs of insurance; bear all losses due to the nature of the work and costs incidental to suspension or discontinuance of the work, except as herein provided; take all risks of whatever nature; indemnify the Owner for all claims, as herein provided; conform to all federal, state, county, or municipal legislation and requirements; undertake all cutting, fitting, or patching of his work required to bring it into conformity with the Contract Documents; leave intact the work of adjoining contractors, unless otherwise ordered; perform and complete the work, including all operating tests, to the satisfaction of the Engineer, and in the manner best calculated to promote rapid construction and consistent with safety of life and property, and in strict accordance with the Contract Documents; protect the work during construction; clean up the work during and after construction; and maintain it until final acceptance and as provided hereinafter under "Maintenance."

The Contractor will supervise and direct the work efficiently and with his best skill and attention. He will be solely responsible for the means, methods, techniques, sequences, safety measures, and

procedures of construction. It is understood that neither the Owner nor the Engineer are responsible for the adequacy of construction methods or for the safety of Contractor's personnel.

Neither the action nor inaction of the Owner or the Engineer shall make them liable for injury or damage resulting from inadequate or improper construction methods. The Contractor shall indemnify the Owner and the Engineer from any action by his personnel or by others, as a result of injury or damage caused by improper construction methods, and shall provide the Owner and Engineer with suitable defense for any such action at his own expense.

It is intended that the unit prices and lump sum bids include all the work to be done which will result in a complete installation of first class workmanship and material ready for operation, and that any appurtenance, accessory, or work allied to any particular item of work and necessary for its proper operation or completion will be furnished and installed under the unit prices and lump sums or lump sum bid under this Contract.

ART. 7- START AND COMPLETION OF WORK

The Contractor shall commence work within eight (8) months from the date of receipt of a written notice from the Owner to commence work, and shall continue without interruption until work is completed, except as provided herein. The sequence of work shall conform to the construction program submitted by the Contractor and approved by the Engineer, provided however, that said schedule may be modified from time to time as directed or approved by the Engineer.

Modification of the schedule or sequence of construction by the Engineer shall not entitle the Contractor to extra compensation other than mobilization and demobilization costs, and only if such costs are in excess of normally anticipated costs as determined by the Engineer.

The Contractor shall complete the work in all respect, except for maintenance, within the number of consecutive calendar days stipulated in the Contract following the service of notice from the Owner to commence work.

ART. 8- CONTRACTOR'S AND SUBCONTRACTOR'S INSURANCE

The forms or amounts of insurance to be furnished by the Contractor and each subcontractor shall not in anyway operate to relieve or limit the liability of the Contractor or subcontractors as otherwise set forth in the Contract or any other sections of the Contract Documents.

The Contractor shall not commence work under this Contract until he has obtained all insurance required and such insurance has been approved by the Owner, nor shall the Contractor allow any subcontractor to commence work on his subcontract until all similar insurance required of the subcontractor has been obtained and approved. Approval of the insurance by the Owner shall not relieve or decrease the liability of the Contractor hereunder.

The Contractor shall purchase and maintain insurance with companies having a minimum A Minus rating from A.M. Best & Company, which are also satisfactory to the Owner.

Certificates from the insurance carrier shall be filed in quadruplicate with the Owner and shall state the limits of liability and the expiration date for each policy and type of coverage. Each certificate issued shall include a clause that the Owner will receive 30 days written notice if the insurance is terminated or canceled prior to the expiration date of the policy. Renewal certificates covering the renewal of all policies expiring during the life of the Contract shall be filed with the Owner not less than 10 days before the expiration of such policies.

The Contractor and each subcontractor shall take out and maintain during the life of this Contract such insurance as will protect him, the Owner, and the Engineer from claims for damages for bodily injury, including accidental or wrongful death, as well as claims for property damage, which may arise from operations under this Contract whether such operations be by himself or by any subcontractor or by anyone directly or indirectly employed by either party. A subcontractor may be excused from coverage only if he is a named insured on the prime contractor's policy or policies. The Owner, the municipality in which work is to be done, and the Engineer, shall be Additional Insured's on all policies. Such insurance shall be considered to provide coverage as required by the contract, or any other section of the Contract Documents.

All of the insurance to be provided shall be considered to be primary and non-contributory insurance as respects the Owner, the municipality in which the work is to be done, and the Engineer.

The Contractor and Subcontractor will save harmless, indemnify and defend the Owner, Engineer, the municipality in which the work is to be done, their agents and employees from any and all claims arising out of the Contractor's performance.

The amounts of such insurance shall be not less than the following limits of liability. Such limits of liability may be provided under a combination of primary and excess policies.

- A) Bodily Injury or Property Damage: Liability for bodily injury or property damage: \$3,000,000 on account of a single occurrence.
- B) Personal Injury: Liability for personal injury torts: \$3,000,000 each person.
- C) The limits of liability in (A) and (B) above shall be subject to the following annual aggregate limits:
 - (1) \$3,000,000 for products and completed operations. This aggregate limit must apply solely to this work and Project.
 - (2) \$3,000,000 for all other occurrences or offenses other than products and completed operations. This aggregate limit must apply solely to this project and Endorsement CG 25 03 03 97 Designated Construction Project(s) General Aggregate Limit or equivalent must be attached to the policies except the motor vehicle insurance policy.
 - (3) No aggregate shall apply to the motor vehicle insurance policy.

The following types of insurance shall be provided.

(a) Workers Compensation Insurance - The Contractor shall take out and maintain during the life of this Contract, Workers Compensation Insurance for all of his employees. On any work that is sublet, the Contractor shall require the subcontractor similarly to provide Workers Compensation Insurance for all of the subcontractor's employees.

(b) Contractor's Commercial General Liability Insurance - Liability for Bodily Injury, Property Damage and Personal Injury shall be not less than the amount required in (A), (B) and (C) specified hereinbefore. The "x" (blasting) "c" (collapse) and "u" (underground) exclusions or equivalents shall be removed from the policy.

(c) Owners Protective Liability Insurance - Liability for Owner's Protective Bodily Injury and Property Damage Insurance shall be not less than the amount required in (A) and (B) specified hereinbefore. A separate policy shall be furnished to the Owner for this coverage.

(d) Motor Vehicle Insurance - Bodily Injury and Property Damage Insurance covering the operation of all motor vehicles owned or used by the Contractor and/or subcontractor in the prosecution of the work under the Contract, shall be in the amount required in (A) specified hereinbefore.

(e) Property Insurance - The Contractor shall procure and maintain during the life of the Contract, Builder's Risk Completed Value coverage. The interest of the Owner, the Contractor and subcontractors shall be included and the insurance shall be written in an amount equal to 100% of the completed value. Coverage under the insurance will be written on a broad all risks of loss policy form including without limitation collapse, flood, earth movement, etc. A waiver of this coverage may be sought for less vulnerable sections of the work, such as buried pipelines but it shall be the Contractor's responsibility to request such waiver and to provide a breakdown of covered values.

(f) Contingent Liability - The above policies for Public Liability and Property Damage Insurance must be so written as to include Contingent Bodily Injury Liability and Contingent Property Damage Insurance to protect the Contractor against claims arising from the operation of Subcontractors. This coverage may be waived only if there will be no subcontractors on the project, or if the subcontractor will be separately covered with fully equivalent insurance.

(g) Insurance Covering Special Hazards - The following special hazards shall be covered by rider or riders to the Public Liability Insurance policy or policies herein elsewhere required to be furnished by separate policies of insurance, in amounts as set forth in (A), (B) and (C) specified hereinbefore.

Loading and Unloading
Hoisting and Rigging
Blasting, Collapse and Underground

(h) Insurance for Engineers Field Office - All Risks property insurance coverage for the Engineer's Field Office equipment shall be provided by the Contractor in the amount of \$5,000 and the insurance company or companies shall be as approved. The insurance coverage shall be payable in case of loss to the Owner and the Engineer. This coverage may be waived only if the Owner gives assurances that an Engineer's field office will not be required for the project.

(i) Completed Operations and Products Liability - The Contractor must furnish evidence of coverage under the Commercial General Liability Policy for not less than the amount required in (A), (B), and (C)(1) specified hereinbefore for a period of not less than 3 years after completion of the work under this contract. This coverage limit must apply solely to this work and Project, If such coverage is not furnished initially, it must be made available before Acceptance of the Work and final release, by the furnishing of a separate site specific policy.

ART. 9- CONSTRUCTION PROGRAM

Following award of his Contract, the Contractor shall attend a Project conference arranged by the Owner which will include representatives of the Owner, the Engineer, and all other contractors doing work on or about the site.

Within 8 months after notice to proceed with the work, the Contractor shall prepare and submit for approval six copies of a detailed chronological construction program or work progress schedule, setting forth clearly each stage including approximate delivery dates of materials, and the time allowed for the installation of materials, in order to complete all the work fully within the time fixed herein, and, if required, he shall revise and resubmit the program until it is approved. Confirmed delivery dates for materials shall be furnished as soon as practicable after the submission of the construction program.

The Critical Path Method will be permissible in preparation of the construction program, which must be adjusted and updated through a monthly narrative submission.

The Contractor, within 7 days after being notified of an unsatisfactory program, shall resubmit a revised program for approval. If, subsequent to the initial approval, unforeseen circumstances necessitate a modification of the approved construction program, as determined by the Engineer, the Contractor, within 7 days after such notification, shall submit a revised program for approval.

The Contractor shall adhere to such program, and, if necessary to do so, he shall supply, without increased cost to the Owner, additional labor and/or additional shifts of labor and overtime, and procure materials and equipment more promptly.

The Engineer shall have the right to order the Contractor to prosecute the work simultaneously at and from as many different points or parts as the Engineer may deem necessary to assure completion within the Contract time, or to assure minimum interference with the public. Failure to comply with any such work order shall constitute a breach hereof.

The Contractor shall also submit, with such construction program, his plans for plant and his specifications covering methods of construction and of handling materials which he proposes to use in the performance of work. Approval, however, of any proposed plans of plant and such specifications shall not be deemed to relieve the Contractor of any liability or responsibility placed upon him by this Contract or by law.

ART. 10- NOT USED

ART. 11- ACCEPTANCE OF DRAWINGS AND SPECIFICATIONS

The Contractor admits and agrees that he is satisfied with the drawings and specifications and agrees that he will at no time dispute or complain that there was any misunderstanding or any error in regard to the amount, quantities, materials to be furnished, and of the work to be done under this Contract, or in regard to the amount of compensation to be paid therefore; and he further covenants and agrees to completely execute and perform his Contract and to fully complete the said work or improvements to the satisfaction of the Owner and to strictly comply with these drawings and specifications and not to ask or demand, sue for or recover any further or extra compensation beyond the Contract price. He also further covenants and agrees that the Owner may accept any alternate listed at the time of submitting his proposal for the price set therein during the life of the Contract. It is intended that all said prices shall be the sole and only compensation to the contractor for the full and complete performance of this contract, and the full completion of said Contract or improvement. It is also understood and agreed that the price to be paid includes payment for all labor, materials, tools, equipment and permits therefor.

The Contractor accepts the drawings and specifications as complete and accurate and agrees that there is no conflict therein with permissible trade practices or methods. Any objections to the drawings and specifications that the Contractor may have must be called to the Engineer's attention and the matter resolved before submitting his Proposal.

The Contractor agrees that should there be conflicts or objections not called to the Engineer's attention and written decision rendered by the Engineer before signing the Contract the Engineer's decision with regard to such conflict or objection shall be final and binding on the Contractor.

ART. 12 - OMISSION OF DETAILS IN DRAWINGS AND SPECIFICATIONS

All work called for in the specifications applicable to each separate Contract, but not shown on the drawings in their present form, or vice versa, and work not specified in either the drawings or in the

specifications, but involved in carrying out their intent, or in the complete and proper execution of the work, shall be performed by the Contractor as though it were specifically delineated or described.

The apparent silence of the specifications as to any detail, or the apparent omission from them of a detailed description concerning any work to be done and materials to be furnished, shall be regarded as meaning that only the best general practice is to prevail and that only the best material and workmanship is to be used; and interpretation of these specifications shall be made upon that basis.

ART. 13- CONFLICTS ON DRAWINGS AND SPECIFICATIONS

In case of any conflict or inconsistency between the drawings and specifications, the matter shall be submitted by the Contractor to the Engineer, whose decision thereon shall be conclusive and binding on the Contractor as if same were specifically set forth in the Contract, and unless he shall have asked for and obtained a decision in writing from the Engineer before submitting his Proposal as to what shall govern, the Contractor shall be deemed to have estimated on the more expensive way of doing the work.

Any discrepancy between the figures on drawings shall be submitted by the Contractor to the Engineer, whose decisions thereon shall be conclusive and final.

When any detail of construction is not fully understood by the Contractor, he shall make application to the Engineer for such additional instructions as may be necessary and the Engineer's decision shall be final. In no case shall he proceed without such instructions.

Should anything be omitted from the drawings or specifications which is necessary to a clear understanding of the work, or should any errors appear either in any of the drawings furnished or in the work done by other contractors affecting the work included under this Contract, the Contractor shall promptly notify the Engineer of such omission or errors and in event of the Contractor's failure to do so, he shall make good any damages to or defect in his work caused thereby. He will not be allowed to take advantage of any error or omission on the drawings, as full instructions will be furnished by the Engineer, should such error or omission be discovered, and the Contractor shall carry out such instructions as if originally specified.

Errors in the specifications and/or drawings which are purely typographical shall be interpreted as would be the logical conclusion or brought to the attention of the Engineer for interpretation.

The Contractor is required to check all dimensions and quantities on the drawings or schedules given to him by the Engineer, and shall notify the Engineer of all errors therein which he may discover by such examination and checking. The Contractor will not be allowed any extra payment for work he alleges to be due to any error or omission in these specifications, nor in the drawings or schedules, as full directions will be furnished by the Engineer should such error or omission be discovered, and the Contractor shall carry out such instructions as if originally specified.

Figured dimensions on drawings shall take precedence over measurement by scale and detailed working drawings shall take precedence over general drawings and shall be considered as explanatory of them and not as indicating extra work.

ART. 14- DRAWINGS, DIAGRAMMATIC REPRESENTATION

Where drawings are shown in diagrammatic form they are intended to convey scope of work and to indicate general arrangement of equipment, ducts, conduits, piping and fixtures.

Locations of all items, shown on drawings or called for in specifications that are not definitely fixed by dimensions are approximate only. Exact locations necessary to secure the best conditions and results shall be submitted to the Engineer for approval before installation.

When directed by the Engineer, reasonable modifications in layout shall be made as required to prevent conflict with work of other trades or for proper execution of work, without additional cost to the Owner.

ART. 15- STANDARD SPECIFICATIONS AND ABBREVIATION

Where reference is made in the Contract Documents to the standard specifications of any technical society, Federal Specification Board, or other recognized organization, these shall be construed to mean the latest standard adopted and published at the date of advertisement for bids and such specifications are made part hereof to the extent which is indicated.

The following abbreviations are used throughout the specifications to refer to organizations publishing specifications that are widely accepted as standards:

AASHTO	American Association of State Highway and Transportation Officials
ACI -	American Concrete Institute
AGA -	American Gas Association
AGMA -	American Gear Manufacturers Association
AHDGA-	American Hot Dip Galvanizing Association
AIEE -	American Institute of Electrical Engineers
AISC -	American Institute of Steel Construction
AISI -	American Iron and Steel Institute
AMCA -	Air Moving and Conditioning Association
ANSI -	American National Standards Institute
ASCE -	American Society of Civil Engineers
ASHRAE-	American Society of Heating, Refrigerating and Air Conditioning Engineers
ASME -	American Society of Mechanical Engineers
ASTM -	American Society for Testing and Materials
AWPA -	American Wood Preservers' Association
AWS -	American Welding Society
AWWA -	American Water Works Association
F.S. -	Federal Specifications
IBR -	Institute of Boiler and Radiator Manufacturers
IEEE -	Institute of Electrical and Electronic Engineers
IPCEA-	Insulated Power Cable Engineers Association
NBFU -	National Board of Fire Underwriters (American Insurance Association)
NEC -	National Electrical Code
NEMA -	National Electrical Manufacturer's Association
SBI -	Steel Boiler Institute
SSPC -	Steel Structures Painting Council
UL -	Underwriters Laboratories, Inc.

ART. 16 - DATUM

The figures given in the Contract and specifications or upon the Contract Drawings after the word "elevation" or an abbreviation of it, shall mean distance in feet above United States Coast and Geodetic Survey Datum, for mean sea level.

ART. 17- DRAWINGS AND SPECIFICATIONS TO BE FURNISHED TO CONTRACTOR

The Contractor will be furnished with four white prints on paper, of each of the numbered drawings and a title sheet, and four sets of specifications. Additional prints and specifications will be furnished the Contractor upon application, at cost of reproduction.

Where a revision of a drawing becomes necessary, four copies of only the revised drawing will be furnished to the Contractor for inclusion with the previously issued drawings.

Supplementary drawings will be issued by the Engineer to the Contractor from time to time, where the Contract Drawings require supplementing, to explain the work more fully or to show changes which have been ordered by the Owner. Four white prints on paper, of each supplementary drawing will be furnished to the Contractor. These supplementary drawings shall have the same force and effect as any other Contract Documents.

The Contractor shall keep one (1) copy of all drawings and specifications including the latest revised drawings and supplementary drawings, at the job site, in good legible condition, available to the Engineer and to his representatives.

ART 18 – RE-USE OF DRAWINGS AND SPECIFICATIONS

All drawings, specifications and copies thereof furnished by the Engineer are not to be used on any other work.

ART 19 - ENGINEERING REPRESENTATION

During the life of the Contract, there will be representation by the Engineer and his authorized agents who will define the meaning and intent of the drawings and specifications, pass upon materials and workmanship, and determine that the work is proceeding in accordance with the Contract Documents. He may reject such work as in his opinion is not in accordance with the drawings and specifications.

The Engineer's representation is for the purpose of assuring that the work described by the drawings and specifications is being properly executed. If an Engineer's field representative is employed he shall act as the Engineer's agent, serve as liaison between the Engineer and the Contractor generally through the Contractor's field superintendent, conduct on-site observations and keep records of the work in progress, give assistance in interpreting the drawings and specifications, transmit orders by the Engineer to the Contractor, review applications by the Contractor for payment, conduct final inspection of the work in the company of the Engineer and the Owner and perform other field representative duties as required.

Neither the Engineer, his field representative, or other authorized agents shall authorize any deviation from the Contract Documents without the knowledge and consent of the Owner, nor undertake any of the responsibilities of the Contractor, his subcontractors, or his field superintendent, nor expedite or superintend the Contractor's work, nor advise on or issue directions relative to any aspect of construction technique or method unless such technique or method is called for in the drawings and specifications.

The Engineer and his authorized agents shall have authority to stop the work of the Contractor whenever such stoppage is necessary to insure compliance with the Contract Documents.

The Engineer shall judge as to what constitutes a reasonable notice, and whether or not workmanship or materials incorporated in the work meet the standards and intent of the drawings and specifications, or of the kind of quality of materials that must be submitted to the Engineer for approval. His decision as to these questions must be accepted as final.

ART. 20 - INSPECTION

The Engineer, his authorized agents, or the Owner will inspect materials furnished and the work done under this Contract, and he is also hereby authorized and empowered to reject and refuse all work;

materials and equipment, and the method of application of any part thereof, under or in fulfillment of this Contract, that does not comply in kind, quality, quantity, time, place or performance, with the specifications and the drawings. The inspection, approval or acceptance of any part of the work herein contracted for, or the materials used therein, or any payment on account thereof, shall not prevent the rejection of said work or materials at any time thereafter during the existence of this Contract and prior to the final payment should said work or materials be found to be defective or not in accordance with the requirements of the drawings and specifications.

Inspection, test, or acceptance of any materials prior to shipment shall not be deemed as a final acceptance of the materials. The Engineer may inspect or require tests or analyses of any portion of the materials at any time, after delivery at the site of work, either before or after installation, and any material which is found to be defective or which does not otherwise conform to the requirements of the specifications shall be rejected and removed forthwith from the site of the work, as provided in the Contract.

The Contractor will be required to pay for all costs of engineering field work and inspection which is:

- (a) Performed on Saturdays, Sundays, or legal holidays, and which is made necessary by the Contractor's operations on such days and
- (b) Performed between the completion date specified and the actual completion of the Contract, regardless of whether or not an extension of time may be approved.

ART. 21 - ACCESS TO WORK

Agents, authorized representatives, and employees of participating Federal Agencies, the State, the Owner, and the Engineer, shall for any purpose have access to the work and the premises used by the Contractor, and the Contractor shall provide safe and proper facilities therefor, including ladders and scaffolds. Other parties who may enter into contracts with the Owner for doing work within the territory covered by this Contract, shall, for all purposes which may be required by their contracts, be accorded the rights of access to the site of those parts of the work for which they are under contract.

Furthermore, the said agencies, the Owner, the Engineer, and their inspectors and agents shall, at all times, have immediate access to all places of manufacture where materials are being made for use under this Contract and the Contractor shall provide full facilities for determining that all such materials are being made strictly in accordance with the specifications and drawings. Records of payrolls, personnel, invoices, bills of lading and other relevant data shall also be made available by the Contractor for inspection upon request.

ART. 22 - PERSONAL LIABILITY

In carrying out the provisions of this Contract or in exercising any power or authority granted them by their position there shall be no liability upon the appointed officials, the Engineer or their authorized representatives or assistants, either personally or as officials of the Owner, it being understood that in such matters they act as agents and representatives of the Owner.

ART 23 - TESTING OF MATERIALS

If the Engineer so requires, either prior to, beginning, or during the progress of the work, the Contractor shall submit samples of materials for such special tests and analyses as may be necessary to demonstrate that they conform to the specifications. The Owner will select and pay for testing laboratories to perform tests and analyses on concrete aggregates, mixed and placed concrete and similar materials. Such samples shall be furnished, taken, stored, packed, and shipped as directed at the expense of the Contractor.

The Contractor shall submit data and samples, or place his orders, sufficiently early to permit consideration, inspection, testing, and approval before the materials and equipment are necessary for incorporation in the work. Any delays resulting from his failure so to do shall not be used as a basis of a claim against the Owner or the Engineer.

If the Engineer orders sampling and analyses or tests of materials which are usually accepted on certification of the manufacturer but which appear defective or not conforming to the requirements of the specifications, the Owner will bear the costs of tests and analyses if material is found to be sound and conforming to the specifications; if found defective or not conforming to the specifications, the Contractor shall bear all of the costs.

ART. 24 - CERTIFICATES OF MANUFACTURERS

For pipe, cement, steel reinforcement, paint and similar materials which are normally tested in the shop by the manufacturer, the Contractor shall furnish the Engineer certified records of physical, chemical, and other pertinent tests, and/or certified statements from the manufacturer that the materials have been manufactured and tested in conformity with the specifications. Where such a small quantity of material is required as to make physical tests or chemical analyses impractical, a certificate from the manufacturer stating the results of such tests or analyses of similar materials which were concurrently produced, may at the discretion of the Engineer, be considered as the basis for the acceptance of such materials.

ART. 25 - DEFECTIVE WORK OR MATERIALS

The inspection of the work by the Engineer or Owner shall not relieve the Contractor of any of his obligations to fulfill his Contract as herein prescribed and defective work shall be made good, and unsuitable materials may be rejected, notwithstanding that such work and materials may have been previously inspected by the Engineer or Owner and accepted or estimated for payment.

If at any time before the final acceptance of the work, materials or workmanship should be discovered which do not comply with the specifications and drawings, they shall be immediately removed by the Contractor when notified to do so by written notice from the Engineer or Owner and shall be replaced at the Contractor's expense. Any work rejected by the Engineer or Owner as unsuitable or improperly done shall be removed and repaired, or otherwise remedied, as the Engineer or Owner may direct.

Any material rejected by the Engineer or Owner shall be removed from the site of the work within two days if and after notice to that effect is given.

Should defective work be suspected and the Engineer or Owner so require, the Contractor shall uncover, take down or make openings in the finished work for the purpose of examining at such points as said Engineer or Owner designates.

Should the work thus exposed or examined prove satisfactory, the uncovering, taking down or making openings in and replacing of the covering or the making good of the parts removed shall be paid for in accordance with the contract unit prices and/or as provided hereinafter under "Extra Work and Changes in the Work", for the items involved; but should the work exposed or examined prove unsatisfactory, the uncovering, taking down, replacing and making good shall be at the expense of the Contractor. However in no event shall the Owner pay for any costs of uncovering and covering work where the Contractor has covered the work without its being inspected by the Owner or the Engineer.

If the Contractor shall fail or neglect to replace any defective work or to discard rejected materials within 10 days after the service by the Engineer of an order to replace such defective work or discard such materials, or to prove to the satisfaction of the Owner that he is initiating effective efforts to

replace defective materials, the Owner may cause such defective work or materials to be replaced or removed, and acceptable materials provided, and the expense thereof shall be deducted from the moneys as are or may become due under this Contract, or if such moneys are not sufficient to meet said expense the additional moneys shall be furnished by the Contractor or his Surety. If during the maintenance period provided for hereinafter, any work done in accordance with that article shall be found defective before the end of the maintenance period; such defective work shall be made good in the same manner as provided herein. The Owner will have the option at all times to allow the defective or improper work to stand and to accept an equitable deduction from the Contract Price therefor.

ART. 26 - WEIGHING AND MEASURING

Whenever requested by the Engineer, the Contractor shall provide personnel and all required weighing and measuring devices for determining the quantity of materials. For estimating quantities in which the computation of areas by geometric methods would, in the opinion of the Engineer, be comparatively laborious, it is stipulated and agreed that the planimeter shall be considered an instrument of precision adaptable to the measurements of such areas.

ART. 27 - DRAWING AND PRINTED MATTER FURNISHED BY THE CONTRACTOR

After approval of the list of manufacturers, the Contractor shall submit for approval, working drawings and shop drawings and descriptions of all materials and equipment which he is to furnish such as steel reinforcement, structural details, layout and support of sheeting and bracing, wiring, and details of supporting and relocating utilities or other adjacent structures, if he intends to deviate from the details shown or if the details are not shown. The Contractor, on approval of the Engineer, may submit manufacturers' literature as a substitute for, or supplement to, the shop drawings. The minimum size for any submission shall be 8 1/2 inches by 11 inches. All drawings and printed matter submitted shall clearly indicate the section of the Contract Items to which they correspond (e.g. G 2.08). Erection drawings may also be required.

Drawings or printed matter shall give all dimensions and sizes to enable the Engineer to consider the suitability of the material or layout for the purpose intended. The working drawings shall, where needed for clarity, include outline and sectional views, and detailed working dimensions and designations of the kind of materials and the kind of machine work and finish required. Drawings for submission shall be coordinated by the Contractor with the drawings heretofore approved, and with the design and function of any equipment or structure. All measurements shall be field checked by the Contractor, who shall not rely on the contract drawings for any dimension that can be measured in the field.

Material shall not be purchased or fabricated for equipment or structures until the Engineer has reviewed the working drawings, which shall represent all materials and work involved in the construction. No materials or equipment shall be delivered to the site until working drawings have been reviewed.

Work shall not be done upon any part of a structure, the design or construction of which is dependent upon the design of equipment or other features, until a review has been made by the Engineer.

Six copies of drawings and printed matter shall be submitted to the Engineer for review. Upon review by the Engineer, the Contractor shall furnish the Engineer with four prints on paper of each approved drawing, and four copies of approved manufacturer's printed literature. Only drawings which have been checked and corrected by the material fabricator shall be submitted. The Contractor shall be responsible for the prompt submission of all working drawings, so that there shall be no delay in the work due to the absence of such drawings.

All shop drawings submitted must bear the approval stamp of the Contractor as evidence that the drawings have been first checked by the Contractor. Any drawings submitted without this stamp of

approval will not be considered and will be returned to the Contractor for resubmission. If the shop drawings show variations from the requirements of the Contract Documents because of standard shop practice or other reasons, the Contractor shall make specific mention of such variation in his letter of transmittal in order that, if acceptable, suitable action may be taken for proper adjustment; otherwise the Contractor will not be relieved of the responsibility for executing the work in accordance with the Contract Documents even though such shop drawings have been reviewed.

Where a shop drawing as submitted by the Contractor indicates a departure from the Contract, which the Engineer deems to be a minor adjustment, in the interest of the Owner not involving a change in Contract price or extension of time, the Engineer will review the drawing but such review implies the following:

"The modification shown on the attached drawing has been reviewed in the interest of the Owner to effect an improvement for the Project and is accepted with the understanding that it is subject generally to all Contract stipulations and covenants; and that it is without prejudice to any and all rights of the Owner under the Contract and bond or bonds."

Where additional working drawings are required, the Contractor shall submit same upon the request by the Engineer.

Any review or lack of same by the Engineer of such working drawings, manufacturer's literature or other data related to the work or material to be furnished for the Contract shall not be construed as in any way relieving the Contractor from his full responsibilities under the terms of the contract.

ART. 28 – NOT USED

ART. 29 - PATENTS AND ROYALTIES

The Contractor shall indemnify and save harmless the Owner and his officers and agents, from all damages, judgment, claims and expenses arising from the infringement of any letters of patent, or patent right or because of any royalty, fee or license for the use, arrangement or operation of any tools, machinery, appliances, devices, materials, process or processes which may be used by the Contractor or furnished by him in fulfillment of the requirements of this Contract. In the event of any claim or action at law on account of such patents or fees, it is agreed that the Owner may retain out of moneys which are or which may become due the Contractor under this Contract, a sum of money sufficient to protect himself against loss, and to retain the same until said claims are paid or satisfactorily adjusted.

ART. 30 - DESIGN OF EQUIPMENT

All parts of the equipment furnished under the Contract shall be amply proportioned for all stresses that may occur during fabrication, shipment, erection, and intermittent or continuous operation. Identical parts shall be interchangeable.

The equipment to be furnished under the Contract shall be of an approved type, and the product of manufacturers who have successfully built equipment of the same size, capacity, and type for at least 5 years unless otherwise specified. The Contractor shall submit any information that the Engineer may consider necessary in order to determine the ability of the manufacturer to produce the equipment as called for by the specifications.

Unless other specific requirements are noted under the Contract Items, the Contractor shall provide the services of an accredited representative of the manufacturer to supervise the installation, testing and placing of equipment in satisfactory operation. This representative shall also make final adjustments and shall instruct designated employees of the Owner in the proper operation and maintenance of the equipment.

The Contractor shall obtain from each manufacturer a warranty for equipment replacement and repair in the event of malfunction, which shall extend for one year from the date of "acceptance of the work".

The minimum manufacturing experience requirement is for five years, as specified herein. In other sections of the Contract Documents, manufacturers are required to "have regularly engaged in the manufacture and installation of comparable systems". In all such cases, consideration will be given to alternative equipment which does not meet the specified experience period if the equipment supplier or manufacturer provides a bond from acceptable surety, or a cash deposit, for the value of the equipment being supplied, plus installation costs, removal costs, overhead and profit. The bond or deposit shall be maintained for a period of time equal to the experience period specified and must be available as a guarantee for replacement within thirty days after declaration by the Engineer that the alternative equipment has failed to meet with specified requirements. All such alternative equipment must be submitted to the Engineer for review so as to assure that all technical requirements are met.

The manufacturer's nameplate, name or trademark shall be permanently affixed to all equipment and material furnished. Nameplate of subcontractor or distributor will not be acceptable.

The Contractor shall furnish and install identifying tags and nameplates on all equipment, valves, ducts, dampers, motors, heating and ventilating and electrical work, bearing name and number indicated on the drawings and the function. Unless otherwise specified, tags shall be Seton Name Plate Co. aluminum type with black enamel background and etched or engraved aluminum lettering, or laminated Bakelite or Lamicold.

Nameplates shall be secured with screws, or nuts and bolts where possible, or wired securely elsewhere. The Contractor shall furnish four copies of a list of all nameplates and their location.

ART. 31 - GREASE FITTINGS AND LUBRICATION

The Contractor shall ensure that all grease fittings on each piece of equipment furnished under the Contract are standardized so that only the "Alemite" button-head type of fitting is utilized, except as otherwise specified or required. Fittings shall be standard or giant size according to the type of service performed.

The Contractor shall furnish and use, for each piece of equipment, the type of lubricant recommended by the manufacturer of the equipment. He shall furnish a schedule, in triplicate, listing the type, frequency of application, and manufacturer of the lubricant recommended for each piece of equipment. At the time of turning the installation over to the Owner, the Contractor shall furnish one year's supply of each type of lubricant in unopened containers.

ART. 32 - SPARE PARTS, SERVICING TOOLS, MANUALS AND PARTS LISTS

Each piece of equipment shall be furnished with a dozen lot assortment of keys, bolts, nuts, lock washers and pins, in tagged sacks. Each piece of equipment having shear pins shall be furnished with two dozen shear pins of each size used, in tagged sacks. Each piece of equipment having leather or rubber washers shall be furnished with two extra washers of each size and material required.

The Contractor shall furnish, with each piece of equipment, the complete set of tools including three sets of spare bulbs and fuses normally furnished by the manufacturer for the servicing of the equipment.

Each major piece of equipment shall be furnished with the spare parts listed in the specifications for the equipment or, if no such list is provided, with the standard set of spare parts recommended by

the manufacturer of the equipment. The recommended list of spare parts shall be submitted to the Engineer prior to the delivery of the equipment.

All spare parts shall be plainly tagged and marked for identification and ordering. They shall be treated with suitable preservatives, wrapped and packaged to provide adequate protection during storage.

The Contractor shall furnish and deliver to the Engineer, prior to the installation of any piece of equipment, three complete neatly bound sets of instruction books or trade literature for such equipment to enable the operator to understand the mechanism and its maintenance. Automatic control diagrams and complete numbered parts lists shall be supplied with the instruction books. The books shall contain clear and concise instruction for operation, adjustment, lubrication (including a lubrication chart) and maintenance of the equipment.

The Contractor shall furnish three sets of parts drawings of all equipment, including minor parts and sub-assemblies, in such detail as will permit disassembly and assembly of the equipment.

The list of all parts for the equipment, shall have the part or catalog number, name of actual manufacturer as well as supplier and other data necessary for ordering replacement parts. Part or catalog number shall be listed according to both supplier and actual manufacturer.

Such instructions and parts lists have been prepared for the specific equipment furnished and shall not refer to other sizes and types or models of similar equipment.

ART. 33 - NOTICES TO CONTRACTOR

The residence or place of business given in the bid or proposal upon which this Contract is founded, is hereby designated as the place where all notices, letters and other communications shall be served, mailed to, or delivered. Any notice, letter or other communication addressed to the Contractor and delivered at the above named place or deposited in a prepaid wrapper in any post office box regularly maintained by the United States Post Office Department shall be deemed sufficient service thereof upon the Contractor, and the date of mailing shall be the date of service. The place name may be changed at any time by an instrument in writing, executed and acknowledged by the Contractor and delivered to the Engineer. Nothing herein contained shall be deemed to preclude or render inoperative the service of any notice, letter or other communication upon the Contractor personally.

ART. 34 - RESPONSIBILITY OF CONTRACTOR

The Contractor shall take all responsibility of the work, shall bear all losses resulting to him on account of the amount or character of work, or from any unforeseen obstructions, encumbrances, or difficulties which may be encountered, or from the breaking of or leakage from any pipe, water mains or sewers, or because the nature of the land in or on which the work is done is different from what is assumed, or on account of the weather, floods or other causes, or from delayed deliveries of equipment required for any related or adjoining contract, or from damage or injury from any cause to property or persons used or employed on or in connection with the work; and he shall assume the defense of and indemnify and save harmless the Owner and its officers, and agents, from all claims of any kind arising from the performance of this Contract, except claims for injuries to or death of employees of the Owner, which injury or death is not due to negligence of, or breach of contract by, the Contractor or of any subcontractor performing any portion of the work included in this Contract.

ART. 35 - SUPERINTENDENCE BY CONTRACTOR

The Contractor shall employ at the site of the work during the performance of any part thereof, a competent foreman or superintendent who shall be satisfactory to the Engineer and who shall have full

authority to act for the Contractor, and all directions given such foreman or superintendent shall be as binding as if given to the Contractor.

ART. 36 - COMPETENT MEN TO BE EMPLOYED

The Contractor shall employ only competent, skillful men to do the work, and whenever the Engineer shall notify the Contractor, in writing, that any man on the work is, in his opinion, incompetent, unfaithful, disorderly, or otherwise unsatisfactory, the Contractor shall take such measures as are deemed necessary by the Engineer.

ART. 37 - CONCURRENT CONTRACTS AND OTHER CONTRACTORS

The right is reserved by the Owner to do work using other contractors and to permit public utility companies and others to do work during the progress and within the limits of or adjacent to the Project, and the Contractor shall conduct his work and cooperate with such other parties so as to cause as little interference as possible with such other work, as the Engineer may direct.

It is agreed that the Contractor shall not be entitled to any damages or extra compensation from the Owner on account of any work performed by other contractors, that in any way affects the work under this Contract. The Engineer shall decide all questions between the Contractor hereunder, and the other contractors, and the order of carrying on the work shall always be subject to his direction and approval.

When the territory of one contract is the necessary or convenient means of access for the transportation of men, materials, equipment or appliances for the execution of work by others, the privilege of access thereon or trespass thereon or any other reasonable privilege may be granted by the Engineer. Employees of the Contractor shall not enter upon adjoining property to underpin or protect adjoining structures or for any other purpose whatsoever except with the written permission of the owners or lessees as provided by law.

If, in the judgment of the Engineer, the joint occupation of the site of the work by the Owner or by two or more contractors working on different contracts at the same time, actually impedes progress in the work herein described, then upon the recommendation of the Engineer, the Owner may extend the time for the completion of the work in the amount which accords with and compensates for the delays so caused.

In case the Contractor, by his own acts or the acts of any person or persons in his employ, shall unnecessarily delay, in the opinion of the Engineer, the work of the Owner or other contractors, by not properly cooperating with them or by not affording them sufficient opportunity or facility to perform work as may be specified, the Contractor shall, in that case, pay all cost and expenses incurred by such parties due to any such delays and he hereby authorizes the Owner to deduct the amount of such cost and expenses from any moneys due or to become due the Contractor under this Contract. The Engineer, subject to the approval of the Owner, shall decide the extent of such delay or delays, and the amount of such costs and expenses, and his decisions shall be binding upon all parties concerned. Nothing contained in this paragraph shall, however, relieve said Contractor from any liability or damage resulting to the Owner on account of such delay or delays.

Where the work of the Contractor adjoins other adjacent concurrent contracts, the Contractor doing the latest work is responsible for making all final connections to the work of other adjacent concurrent contracts, as directed by the Engineer.

ART. 38 - MUTUAL RESPONSIBILITY OF CONTRACTORS

Should the Contractor cause damage to any other contractor on the work, Contractor agrees, upon due notice, to settle with such Contractor by agreement or arbitration, if he will so settle. If such other contractor sues the Owner on account of any damage alleged to have been so sustained, the

Owner shall notify the Contractor, who shall defend such proceedings and, if any judgment against the Owner arises there from, the Contractor shall pay or satisfy it and pay all costs incurred by the Owner.

ART. 39 - SUBCONTRACTS

The Contractor shall, within thirty days after signing of the Contract, notify the Engineer in writing of the names of subcontractors he proposes for principal parts of the work.

The Contractor shall not enter into contract with any subcontractor until he receives the Owner's or Engineer's approval as to the firm's competence, experience, financial capability and municipal tax clearance. Subcontractors will be required to carry insurance equal to that of the prime contractor, or must be a named insured on all of the Contractor's policies.

The Engineer shall, on request, furnish to any subcontractor, wherever practicable, evidence of the amounts certified for payment on his account.

Each payment requisition submitted by a subcontractor to Contractor shall include a statement showing the status of all pending construction change orders, other pending change directives and approved changes to the original subcontract. Such statement shall identify the pending construction change orders and other pending change directives, and shall include the date such change orders and directives were initiated, the costs associated with their performance and a description of any work completed. As used herein, "pending construction change order" or "other pending change directive" means an authorized directive for extra work that has been issued to a subcontractor.

The Contractor agrees that he is as fully responsible to the Owner for the acts and omissions of his subcontractors and of persons either directly or indirectly employed by them as he is for acts and omissions of persons directly employed by him. He further agrees that he will bind his subcontractors to each and every part of the Contract Documents.

The Contractor shall comply with Connecticut General Statutes: Sec. 49-41a as to payment to subcontractors and material men, which provides as follows:

"The general contractor, within thirty (30) days after payment to the Contractor, shall pay any amounts due any subcontractor, whether for labor performed or materials furnished, when the labor or materials have been included in a requisition submitted by the Contractor and paid by the Owner.

The general contractor shall include in each of its subcontracts a provision requiring each subcontractor to pay any amounts due any of its subcontractors, whether for labor performed or materials furnished, within thirty (30) days after such subcontractor received a payment from the general contractor which encompasses labor or materials furnished by such subcontractor."

Nothing contained in the Contract Documents shall create any contractual relation between any subcontractor and the Owner.

ART. 40 - RELATIONSHIP OF CONTRACTOR AND SUBCONTRACTORS

The Contractor agrees to bind every subcontractor and every subcontractor agrees to be bound by the terms of the Contract, the General Conditions, the drawings and specifications, and other Contract Documents as far as applicable to his work, including the following provisions of this article, unless specifically noted to the contrary in a subcontract approved in writing as adequate by the Engineer.

The Contractor and the subcontractor agree that:

- (1) Nothing in this article shall create any obligation on the part of the Owner to pay to or to see to the payment of any sums to any subcontractor.
- (2) All Contractors and subcontractors shall cooperate with each other and must conform to the directions of the Engineer, in order that all parts of the work may progress harmoniously and expeditiously.
- (3) Each subcontractor must aid the others in as far as his services may be reasonably required. All Contractors will be required to make themselves familiar with the requirements of the drawings and specifications for the entire work.
- (4) The Contractor on one branch of the work shall allow the subcontractor for other branches of the work free access to the project and grounds in order that they may execute their work properly and promptly.

All subcontractors shall read the entire General Conditions and specifications and shall be held responsible for all items called for in them whether specifically mentioned under their particular headings or not.

IT IS UNDERSTOOD THAT THE ENGINEER WILL SUPPLY ALL INFORMATION TO CONTRACTORS ONLY AND NOT TO SUBCONTRACTORS. THE CONTRACTOR SHALL NOT ACCEPT THE STATEMENT OF ANY SUBCONTRACTOR THAT THE ENGINEER HAS APPROVED ANY SUBCONTRACTORS, HIS WORK OR ANY OF HIS DRAWINGS, AS THE ENGINEER WILL MAKE ALL SUCH APPROVALS TO THE CONTRACTOR IN WRITING.

ART. 41 - ASSIGNMENTS

The Contractor or his thoroughly qualified and designated representatives shall give his personal attention constantly to the faithful prosecution of the work.

He shall not sell, transfer, assign or otherwise dispose of this Contract or any part thereof to any third party. The Contractor shall perform with his own organization and with the assistance of workmen under his immediate superintendence work amounting to not less than forty percent (40%) of the total price bid for the Project. Subject to the above provision and to the consent of the Owner, work may be sublet. It is understood, however, that any consent of the Owner for the subletting of any of the work under the Contract in no way relieves the Contractor of his full obligations under the Contract. The consent to sublet any part of the work and the acceptance by the Owner of the surety bond shall not be construed to be an approval of the said subcontract or of any of its terms, but shall operate only as an approval of the making of a subcontract between the Contractor and subcontractor. The subcontractor shall look only to the Contractor for the payment of any claims of any nature whatsoever arising out of the said Contract, and said subcontractor agrees, as a condition of the granting by the Owner of the consent to the making of said subcontract, that neither the subcontractor, his agents or employees shall make any claim whatsoever against the Owner for any work performed or thing done by reason of said subcontract. The Owner will not consent to the making of any subcontract unless the proposed subcontractor furnishes a statement to the effect that said subcontractor is acquainted with all the provisions of the Contract Documents and agrees thereto.

The Contractor shall not assign, by power of attorney or otherwise, any of the moneys to become due and payable under this Contract, unless by and with the written consent of the Owner, and such consent of approval, if given, will in no way relieve the Contractor from any of the obligations of said Contract.

Assignment of this Contract or any part thereof or of any funds to be received thereunder by the Contractor shall contain a clause to the effect that it is agreed that the funds to be paid the assignee under the assignment are subject to a prior lien for services rendered or materials supplied for the performance of the work called for in said Contract in favor of all persons, firms, or corporations rendering such services or supplying such materials.

If the Contractor shall, without previous written consent, assign, transfer, convey, sublet, or otherwise dispose of the Contract in whole or in part of his right, title or interest therein, or any of the monies to become due under the Contract from any person, firm, or corporation, the Contract may at the option of the Owner, be revoked and annulled and the Owner thereupon is relieved and discharged from any and all liability and obligations growing out of same to the Contractor and to his assignee or transferee; and no right under this Contract or to any money to become due hereunder, shall be asserted against the Owner in law or in equity by reason of any so-called assignment of this Contract or any part thereof, or any monies to grow due hereunder unless authorized as aforesaid by the written consent of the Owner.

ART. 42 - SAVE OWNER HARMLESS

The Contractor shall, from time to time, as required by the Owner, furnish satisfactory evidence that all persons who have done work or furnished materials under this Contract, or have suffered damage on account of the Contractor's operations, have been fully paid or secured.

The Contractor shall indemnify and save harmless the Owner, its Engineer, officers, agents and servants and each and everyone of them against and from all suits, and costs of every kind and description, including court costs and attorney's fees, and from all damages to which the Owner or any of its officers agents or servants may be subjected by reason of injury to the person or property of others resulting from the performance of the Project, or through the negligence of the Contractor, or through any improper or defective machinery, implements or appliances used by the Contractor in the project, or through any act of omission on the part of the Contractor or his agents, employees or servants, whether or not caused by or contributed to by the Owner, Engineer, their agents, employees, or others; and he shall further indemnify and save harmless the Owner; its officers, agents, and servants from all suits and actions of any kind or character whatsoever which may be brought or instituted by any subcontractor, material-man or laborer who has performed work or finished materials in or about the Project or by, or on account of, any claims or amount recovered from infringement of patent, trade-mark or copyright. The cost thereof shall be included in the prices bid for the various parts of the work. So much money due to the Contractor under and by virtue of the Contract as shall be considered necessary by the Owner may be retained by the Owner and held until such bids, actions, claims or amounts shall have been settled and suitable evidence to that effect furnished to the Owner. It is understood and agreed, however, that the Owner hereby assumes no obligations toward such claimants, nor in any way undertakes to pay such claims out of any funds due or that may become due the Contractor, or out of its own funds.

ART. 43 - LIABILITY OF CONTRACTOR IS ABSOLUTE

The liability of the Contractor hereunder for all injuries to persons or damages to property is absolute and is not dependent upon any question of negligence on his part or on the part of his agents, servants, or employees, and neither the approval of the Engineer of the methods of doing work nor the failure of the Engineer to call attention to improper or inadequate methods or to require a change in methods, nor the neglect of the Engineer to direct the Contractor to take any particular precautions or to refrain from doing any particular thing shall excuse the Contractor in case of any injury to persons or damages to property.

ART 44 - PERMITS

The Owner has obtained the following permits, approvals and certifications, copies of which are attached or will be provided for the Contractor's information: ACOE Permit, CT DEEP Permit, Inland Wetland Permit.

Although the permits or approvals cited above have been acquired by the Owner, the Contractor shall comply with the conditions and provisions of each that relate to the construction. Where special bonds, escrows and/or other forms of payments and guarantees are required, the Contractor shall provide these items at no additional cost to the Owner.

The Contractor shall obtain and pay for all other permits required for the prosecution of the work under the Contract. He shall pay all charges and expenses and shall furnish all bonds and insurance stipulated in the permits, and shall indemnify and save harmless the Owner from all claims for damages and any actions that may arise thereunder. Before the final acceptance of the work, and as a prerequisite to the release of the semi-final payment, the Contractor shall secure a written release from the authorities having jurisdiction over the lands occupied by him certifying to the satisfactory restoration of all pavements and other surfaces and the utility structures removed or safeguarded for the work.

ART. 45 - LAWS AND ORDINANCES

The Contractor will be required to comply with all federal, state, and municipal laws, ordinances and regulations in any manner affecting those persons engaged or employed in the work, or the materials used in the work, or in any way affecting the conduct of the work, either with respect to hours or labor or otherwise, and of all such orders and decrees of bodies or tribunals having any jurisdiction or authority over the same. If any discrepancy or inconsistency is discovered in the drawings, specifications, or Contract for this work in relation to any such law, ordinance, regulation, order, or decree, he shall forthwith report the same to the Engineer in writing. He shall at all times himself observe and comply with, all such laws, ordinances, regulations, orders and decrees, and shall protect and indemnify the Owner and his agents against any claim or liability arising from or based on the violation of any such law, ordinance, regulation, order, or decree, whether by himself or his employees.

The Contractor shall comply in particular to the following:

- Rules and Regulations of the Town of Brookfield, W.P.C.A.

The Contractor hereby agrees to comply with all said legal requirements and agrees that upon his failure to comply with the provisions thereof, this contract may be voidable at the option of the Owner.

ART. 46 - STATE LABOR STANDARDS/WAGE RATES

The Contractor shall comply with all requirements of the labor laws of this State applicable to contracts for construction, alteration or repair of any public work.

Where the project is for new public works construction greater than \$400,000 or repair or rehabilitation work greater than \$100,000, the Contractor must abide by State Wage Rates as published by the Department of Labor in accordance with Connecticut General Statute Sec. 31-53(g).

In the event that any of the provisions contained herein or any other labor standards subsequently made applicable by passage of State Law during the life of this Contract differ from standards in effect now or modified during the life of this Contract, then the more rigorous standards shall take precedence and prevail.

The wages paid on an hourly basis to any mechanic, laborer or workman employed upon the Work herein contracted to be done and the amount of payment or contribution paid or payable on behalf of each such employee to any employee welfare fund, as defined in Section 31-53 (h) of the Connecticut General Statutes, shall be at a rate equal to the rate customary or prevailing for the same work in the same trade or occupation in the town where the work is being performed. Any Contractor who is not obligated by agreement to make payment or contribution on behalf of such employees to any such

employee welfare fund shall pay to each employee as part of his wages, the amount of payment or contribution for his classification on each pay day.

The Contractor and all his subcontractors shall keep accurate records showing the name, craft or trade, and actual hourly rate of work under the Contract and shall preserve said records for two years from date of payment. The records shall be open at all reasonable hours to the inspection of the Owner and the Commissioner of Labor or their duly authorized representatives. One copy of weekly payroll records shall be filed with the Owner as required by law.

In the event it is found that any workman employed by the Contractor or his subcontractors has been paid less than the prevailing wage listed therein for the class of work performed, the Owner may terminate the Contractor's or Subcontractors right to proceed within the work, or such part of the work as to which there has been a failure to pay required wages and to prosecute the work to completion or otherwise. The Contractor and his surety shall be liable to the Owner for any excess costs occasioned thereby.

Before final payment is made by the Owner of any sum or sums due on account of work performed under the Contract, the Contractor and his subcontractors shall file written statements with the Owner certifying to the amounts then due and owing to any and all workmen for wages earned. The statements shall set forth the names of the persons whose wages are unpaid and the amount due each. The statements shall be verified by the oaths of the Contractor or subcontractor, as the case may be.

The Contract will not be awarded to any contractor who has failed to pay prevailing wages, and no subcontractor will be approved who has failed to pay prevailing wages.

ART. 47 -NONDISCRIMINATION PROVISIONS

The Contractor and all subcontractors shall not discriminate in employment practices. The Contractor must comply with all applicable State and Federal laws and regulations dealing with non-discriminatory practices.

The Contractor shall take affirmative action to insure that applicants for employment are employed, and that employees are treated during employment, except in the case of a bona fide occupational qualification or need, without regard to their race, color, religious creed, age, sex, sexual orientation, marital status, national origin, mental retardation, learning disability, or physical disability. Such action shall include, but not be limited to, the following: employment, upgrading, demotion, or transfer; recruitment or advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship.

The Contractor shall post in conspicuous places and make available to employees and applicants for employment, notices to be provided by the State setting forth the provisions of this non-discrimination clause. The Contractor shall state that all qualified applicants will receive consideration for employment without regard to their race, color, religious creed, age, sex, sexual orientation, marital status, national origin, mental retardation, learning disability or physical disability.

ART. 48 - SOCIAL SECURITY ACT

The Contractor shall be and remain an independent contractor with respect to all services performed hereunder and agrees to and does hereby accept full and exclusive liability for the payment of any and all contributions or taxes for social security, unemployment insurance, or old age retirement benefits, pensions or annuities now or hereafter imposed under any state or federal law which are measured by the wages, salaries, or other remuneration paid to persons employed by the Contractor on

work performed under the terms of this Contract, and further agrees to obey all lawful rules and regulations and to meet all lawful requirements which are now or hereafter may be issued or promulgated under said respective laws by any duly authorized state or federal officials; and said Contractor also agrees to indemnify and save harmless the Owner from any such contributions or taxes or liability therefor.

ART. 49 - SAFETY PROVISIONS

It is understood that the Contractor will be solely responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the work. He will take all necessary precautions for the safety of, and will provide the necessary protection to prevent damage, injury or loss to all employees on the work and other persons who may be affected thereby.

The Contractor will comply with all applicable laws, ordinances, rules, regulations and orders of any public body having jurisdiction for the safety of persons or property, or to protect them from damage, injury or loss. He will erect and maintain, as required by the conditions and the progress of the work, all necessary safeguards for safety and protection and in addition he will comply with all applicable recommendations of the Manual of Accident Prevention in Construction of the Associated General Contractors of America, Inc.

If at any time, in the opinion of the Engineer, the work is not properly safe in respect to public travel, persons on or about the work, or public or private property, the Engineer shall have the right to order such safeguards to be erected and such precautions to be taken as he deems advisable and the Contractor shall comply with such orders. If, under such circumstances, the Contractor does not or cannot immediately put the same into proper and approved condition or if the Contractor or his representative is not upon the site so that he can be immediately notified of the insufficiency of safety precautions, then the Engineer may cause the work to be put into such a condition that it shall be, in his opinion, in all respects safe, and the Contractor shall pay all expenses of such labor and materials as may have been used for this purpose by him or by the Engineer. Such actions of the Engineer, or his failure to take such action, shall in no way relieve the Contractor of the entire responsibility for any cost, loss or damage by any party sustained on account of the insufficiency of the safety precautions taken by him or by the Engineer acting under authority of this section.

The Contractor shall comply with the Department of Labor Safety and Health regulations for construction promulgated under the Occupational Safety and Health Act of 1970 (PL91-596) and under Section 107 of the Contract Work Hours and Safety Standards Act (PL 91-54), or subsequent amendments to such regulations.

This project is subject to all of the Safety and Health Regulations (See 29 CFR 1518) as promulgated by the U.S. Department of Labor on April 17, 1971. Contractors are urged to make themselves familiar with the requirements of these regulations.

The Contractor shall comply with the Owner's Confined Space Entry Program, and no personnel will be permitted to participate in any work or interact with the Contractor if the Contractor does not have the appropriate equipment in compliance with said program.

The Contractor is responsible for establishing and maintaining a health and safety program throughout the course of the project so as to meet all Local, State, Federal and OSHA requirements.

The Contractor shall keep in his office, ready for immediate use, all articles necessary for giving first aid to the injured. He shall also have standing arrangements for the immediate removal and hospital treatment of any employees or persons who may be injured on or about the work.

ART. 50- LAND FOR CONTRACTOR'S USE

Land and easements for the purpose of this Contract will be provided by the Owner. If the Contractor desires the temporary use, during construction, of land or lands to which the Owner has no rights, he shall secure written permission from the owners and shall file a duplicate copy of such permission with the Engineer and Owner. Land shall not be used or occupied by the Contractor prior to the securing of permission. The Contractor shall at all times save harmless the Owner, from actions by third parties by reason of any acts or omissions by the Contractor.

Delays in easement acquisition shall act only to extend the contract period, as reviewed in other sections of the contract documents. No guarantees are given herein that all needed lands will be available at the time of contract award. Should it be required as a part of this Contract to perform work within the limits of private property, or in rights-of-way, such work shall be done in conformity with all permits and agreements between the Owner and the owners of such property, and whether or not such a condition be part of the agreement, care shall be taken to avoid injury to the premises entered, which premises shall be left in a neat and orderly condition by the removal of rubbish and the grading of surplus materials and the restoration of said private property to the same general conditions as at the time of entry for work to be performed under this Contract.

ART. 51- USE OF PREMISES

The Contractor shall confine his materials and their storage and the operation of his workmen to limits indicated by law, ordinances, permits, or directions of the Engineer, and shall not unreasonably encumber the premises with such materials, but shall store them in orderly fashion, so that they will not interfere with the work under this or other contracts. The Contractor shall not load or permit any part of the work to be loaded with a weight that will endanger its safety or unduly affect the structure or any part thereof. The Contractor shall enforce the instructions of the Engineer regarding signs advertisements, fires, and smoking.

ART. 52- PROTECTION OF PREMISES

The Contractor shall properly protect the Owner's and adjoining property from injury or damage. Any damage to same must be made good without delay. The Contractor shall make good, at his own expense, any such injury or damage done and shall leave all in as good condition as found when operations were started.

ART. 53- SANITARY FACILITIES

The Contractor shall provide and maintain in a strictly sanitary manner toilet facilities for his workmen, which shall be screened from public view. The location and the method of waste disposal shall be approved. The Contractor shall observe and enforce all sanitary regulations and maintain satisfactory sanitary conditions around and on all parts of the work.

ART. 54- TEMPORARY WATER

The Contractor shall provide and maintain temporary potable water service connections and fixtures as specified for his own use and the use of other contractors doing work at the site. The cost of temporary water meters, if required, and service charges for all water will be paid by the Contractor.

When work is completed, the Contractor shall remove all temporary water connections and fixtures as required.

The Contractor shall furnish at his own expense all water required during the performance of work under the Contract, including testing, paying for the expense and charges of same, and installing and paying for a meter if it is required.

ART. 55- TEMPORARY LIGHT, POWER, AND TELEPHONE

The Contractor shall be responsible for the furnishing of temporary light and power.

The Contractor, at his own expense, shall arrange with the local telephone company for all telephone service required by him in the performance of the work.

ART. 56- TEMPORARY HEATING

Each Contractor, at his own expense, shall provide, install, and maintain approved heating devices as required for supplying temporary heat of sufficient volume to protect the work under his Contract and to assure suitable working conditions for his workmen. Such devices shall be installed and operated in such manner that no hazards will result and that no damage will be done to any part of his work or the work of other Contractors.

ART. 57- CARE AND PROTECTION OF WORK AND MATERIALS

From the commencement of the work until its completion, the Contractor shall be solely responsible for damages caused to the property of the Owner, for the care and protection of the work covered by the Contract, and for the materials and equipment delivered at the site or incorporated in the work.

All excavated materials, construction equipment, and materials and equipment to be incorporated in the work, shall be so placed as not to injure the work and so that free access may be had at any time 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 and conveniently stored so as to inconvenience as little as possible public travel and adjoining tenants.

All loss, injury, or damage to the work or materials, from whatever cause, shall be made good at the expense of the Contractor.

The Contractor shall provide suitable and adequate storage room for materials and equipment during the progress of the work, including approved weathertight storage for all materials and equipment which might deteriorate if left uncovered. He shall provide protection against damage or deterioration for all equipment during storage, and after installation, until the equipment is put to use by the Owner.

During adverse weather, the Contractor shall take all necessary precautions so that the work may be properly done and be satisfactory in all respects. When required, protection shall be provided by use of tarpaulins, wood building shelters, or other approved means.

During cold weather, materials shall be preheated, if required, and the materials and adjacent structure into which they are to be incorporated shall be made and kept sufficiently warm so that a proper bond will take place and proper curing, aging and drying will result. Protected spaces shall be artificially heated by approved means which will result in a moist or a dry atmosphere according to the particular requirements of the work being protected.

The Engineer may suspend construction operations at any time, when in his judgment, the conditions are unsuitable or the proper precautions are not being taken.

The Contractor shall at all times have, as directed or approved, a sufficient number of watchmen to protect the property of the Owner, to exclude unauthorized persons from the work and to protect traffic on the public highways.

ART. 58- OWNERSHIP OF MATERIALS

Nothing in the Contract shall be considered as vesting in the Contractor any right of property in materials used, after they shall have been attached or affixed to the work or the soil, nor in materials which have been accepted for partial payment at the site of the work, as provided hereinafter, but all

such materials shall upon being so attached or affixed, or so accepted, become the property of the Owner.

ART. 59- CHATTEL MORTGAGES

No materials or supplies for the work shall be purchased by the Contractor or by any subcontractor subject to any chattel mortgage or under a conditional sale or other agreement by which an interest is retained by the seller. The Contractor warrants that he has clear title to all materials and supplies used by him in the work.

ART. 60- LINES AND GRADES

All work shall be constructed according to the lines and grades shown and approved. At the site, the Engineer will lay out and mark upon the ground a base line and bench mark, from which the Contractor shall be responsible for staking out the construction lines. For sewers, the Engineer will lay out and mark suitable number of control points and bench marks. The Contractor shall employ the services of a land surveyor, licensed to practice in this state, for laying out the work, including setting of key or principal stakes, markers and levels, and preparation of cut sheets, if required, on a form approved by the Engineer.

The Contractor shall furnish all stakes, markers, and other materials, and shall furnish any assistance that the Engineer may require in laying out the base lines and establishing the bench marks, and in checking and measuring the work. Whenever the Engineer finds it necessary to carry on his operations on Sundays, legal holidays, or other times when the work of the Contractor is not in progress, the Contractor shall furnish all necessary service and assistance. He shall not proceed until he has received from the Engineer such points and instructions as may be necessary for the progress of the work. Any work improperly done without lines or levels or instructions shall be removed and replaced by the Contractor at his own expense.

No direct payment will be made for the cost to the Contractor of any of the work or delay occasioned by giving lines and grades, or making other necessary measurements, or by inspection, compensation therefor being considered as having been included in the bid or stipulated prices.

ART. 61- PRE-CONSTRUCTION AND CONSTRUCTION PHOTOGRAPHS

The Contractor shall furnish a series of photographs, taken by a commercial photographer, to show the site of the work before construction. Photographs shall be taken at such locations as may be determined by the Engineer, or at a spacing of approximately 50 feet apart in streets and 100 feet in easements and wetland areas. Two glossy prints of each picture shall be submitted to the Engineer before construction.

The Contractor shall also furnish a series of construction photographs, to show the progress of the work. At least 6 photographs shall be taken monthly at such locations as may be determined by the Engineer. Two glossy prints of each picture taken during the month shall be submitted to the Engineer at the time of the monthly estimate for progress payment. Email of photos will also be accepted.

Prints for submission shall not be less than 8 in. by 10 in. in size, and inserted in a clear plastic sleeve for binding, properly identified by text and dates on the reverse side. Negatives of all photographs, including identifications shall be furnished to the Engineer.

ART. 62- RECORD DRAWINGS

Concurrent with progress of installation, the Contractor shall maintain a set of as-built record drawings, consisting of a reproducible marked set of Engineer's drawings with additional sketches as required, denoting and dimensioning accurately all changes in elevation, location and size, of all items

deviating from Engineer's drawings. The set shall be kept in the Contractor's field office and be made available for inspection by the Engineer upon request.

Upon completion of work, the Contractor shall deliver to the Engineer one up-to-date set of these as-built record drawings, prepared by a Connecticut State licensed land surveyor.

ART. 63- TIME OF THE ESSENCE

Inasmuch as the provisions of this Contract relating to the time for performance and completion of the work are for the purpose of enabling the Owner to proceed with the construction of a public improvement in accordance with a predetermined program, and inasmuch as failure to complete the work within the period specified may result in a loss to the Owner, such provisions are of the essence of this Contract.

ART. 64- NIGHT, SUNDAY AND HOLIDAY WORK

Unless otherwise especially permitted by the Engineer, no work shall be done between the hours of 6:00PM and 7:00AM, nor on Sunday or Legal Holidays, except as necessary for the proper care and protection of the work already performed. The Engineer shall be informed a reasonable time in advance of the beginning of performance of such work. Only such work will be permitted at night as can be done satisfactorily and in a first class manner and without disturbance to adjoining property owners. Good lighting and all other facilities for carrying out and inspecting the work shall be provided and maintained at all points where such work is being done. Work performed after regular working hours, on Sundays, or Legal Holidays, shall cause no additional expense to the Owner.

ART. 65- WORK IN FREEZING WEATHER

Unless written permission is given, work liable to be affected by frost shall be suspended during freezing weather. When work proceeds in such weather, the Contractor shall provide sufficient and approved facilities for creating workable conditions and protecting the work after its completion, as approved by the Engineer.

ART. 66- UNNECESSARY NOISE

The Contractor shall use every effort and means possible to minimize or eliminate noise caused by his operations, which the Engineer may consider objectionable. The Contractor shall provide working machinery, equipped with silencers or mufflers where required, designed to operate with the least possible noise.

ART. 67- WORK IN STREETS AND HIGHWAYS

The Contractor shall obtain from the proper authorities, permission to open any State, County or Municipal highway. The Contractor shall file with the Engineer, and with the agencies having jurisdiction, triplicate copies of sketches and descriptions showing the exact location and size of the opening or excavation, the time during which it is proposed to make such opening or excavation, and the proposed method of maintaining traffic during construction. The Contractor shall not make any such opening or excavation until written permission has been granted by the agencies having jurisdiction and the Engineer. If such agencies require inspection, traffic control, signaling or other work to be done by its own forces, the Contractor shall arrange for and pay for the same.

The Contractor shall not close or obstruct any portion of a street, road, or private way without obtaining permits therefor from the proper agencies. If any street or private way shall be rendered unsafe by the Contractor's operations, he shall make such repairs or provide such temporary ways or guards as shall be acceptable to the Engineer.

After the completion of backfilling in public highways, the Contractor shall remove all surplus material, regrade, and leave in good order and dust-free condition all roadways disturbed by his operations.

He shall maintain the surface of the street over the trenches in good condition, promptly filling in all depressions caused by settlement of the backfill.

ART. 68- MAINTAINING AND SAFEGUARDING TRAFFIC

The Contractor as directed, shall build and maintain such temporary roads, passageways, trestles, and bridges as shall be deemed necessary for the accommodation of traffic on streets and roadways interfered with by the Contractor's operations, for convenient access to the various parts of the work, for access to adjacent buildings and properties, and for other necessary purposes incidental to the work. He shall erect such temporary guards, fences, warning signs, lights, and signals as may be necessary or required to protect all traffic on the streets and roadways. He shall not obstruct vehicular traffic unless he has permission from the agencies having jurisdiction to bar temporarily all traffic from the site of the work. He shall not deprive any building or property of safe and proper access except with the consent of the occupant and after due notice to the Engineer. Free access must be given to every fire alarm box, fire hydrant, valve box, or valve chamber. The temporary roads and the Contractor's access roads shall be located where directed or approved and shall be maintained in good condition. Calcium chloride or other approved means, shall be used to maintain the roads in a dust-free condition. The Contractor shall indemnify and save harmless the Owner from any expense whatsoever due to his operations in streets and highways.

ART. 69 - HAULING MATERIALS

Before starting any work, the Contractor shall arrange with the municipal, County, or State officials having jurisdiction for the use of routes of travel for hauling materials that will result in minimum inconvenience to the traveling public. Routes of travel so scheduled shall be adhered to throughout the course of the work.

The Contractor shall, at his own expense, handle, haul and distribute all materials and all surplus materials on the different portions of the work as required. Delays in handling involving storage charges and demurrage charges by the railroad and other companies shall be at the expense of the Contractor.

ART. 70- OBSTRUCTIONS ENCOUNTERED

In addition to showing structures to be built under this Contract, the drawings show certain information regarding the pipe lines and other structures which exist at the site of the work, both at and below the surface of the ground. The Owner expressly disclaims any responsibility for the accuracy or completeness of the information given on the drawings with regard to existing structures and pipe lines, and the Contractor will not be entitled to any extra compensation on account of inaccuracy or incompleteness of such information, said structures and pipe lines being shown only for the convenience of the Contractor, who must verify the information to his own satisfaction. The giving of this information upon the Contract Drawings will not relieve the Contractor of his obligation to support and protect all pipe lines and other structures which may be encountered during the construction of the work, and to make good all damages done to such pipe lines and structures, as provided in these specifications.

ART. 71- EXISTING UTILITIES

The Contractor will be required, at his own expense to do everything necessary to protect, support and sustain all sewers, water or gas pipes, railroad tracks, or telegraph poles, conduits and other fixtures laid across or along the site of the work. The Engineer, as well as the company or corporation owning said pipes, poles, or conduits must be notified of same by the Contractor before any such fixtures are removed or molested. In case any of the said sewer, gas or water pipes, service pipes,

electric lights, power, telephone or telegraph poles, conduits or other fixtures are damaged, they shall be repaired by the authorities having control of the same, and the expense of said repairs shall be deducted from the moneys which are due or become due said Contractor under this Contract.

Should it become necessary to change the position, or temporarily remove any electric conduits, water pipes, gas pipes, or other pipes, or wire, in order to permit the Contractor to use a particular method of construction or in order to clear the structure being built, the Contractor shall notify the Engineer of the location and circumstances, and shall cease work if necessary, until satisfactory arrangements have been made by the owners of the said pipes or wires to properly care for the same. No claims for damages will be allowed on account of any delay occasioned thereby. The entire cost of the changes or temporary removal must be included in the unit or lump sum prices stipulated for the various items of work to be done under this Contract.

ART. 72- CONTINUITY OF UTILITY SERVICES

In all cases where temporary pipes must be installed or where sewage, water, or drainage must be pumped or otherwise carried over or around excavations or any other portions of the work, the Contractor shall furnish such pipes, pumps, and all other materials, equipment, and labor as are required to maintain continuity of service in the utilities affected.

ART. 73- PROTECTING EXISTING STRUCTURES

The Contractor shall, at his own expense, shore up and protect any buildings or structures which may be encountered or endangered in the prosecution of the work, and he shall repair and make good any damages caused to any such property by reason of his operations.

ART. 74- PROTECTING EXISTING TREES AND SHRUBBERY

The Contractor shall protect trees, shrubs, and grassed areas on the lands of the Owner, and on adjacent lands, from being cut, trimmed, or injured, unless specifically ordered otherwise, for clearing the site of the work. Any damage to trees, shrubs, or grassed areas shall be made good by the Contractor, at his own expense, to the satisfaction of the owners thereof.

Tree roots shall not be mutilated nor shall they be cut except by permission of the Engineer. When the Contractor is permitted to cut tree roots, he shall cut the ends off smoothly, without splitting or shattering them. The trunks of the trees shall be carefully protected from damage, and if unavoidable damage occurs, the injured portions shall be neatly trimmed and covered with an application of grafting wax. Excavating machinery, cranes, etc., shall be handled with care to prevent damage to shade trees, particularly to overhanging branches, and branches shall not be cut off except by special permission of the Engineer. No special compensation will be made for the protecting of existing trees and shrubbery, but such cost shall be considered as having been included in the lump sum prices or unit prices as stipulated for the work to be done under the Contract.

ART. 75- MONUMENTS AND LANDMARKS

When any bench mark or monument, whether of stone, concrete, pipe, or a mark on the pavement, designating the lines of the streets or highways or of private property, is in the line of any trench or other construction work and may have to be removed, the Contractor shall notify the Engineer in writing at least 24 hours in advance. Under no circumstance shall such monument be removed or disturbed by the Contractor or by any of his men without a written order from the Engineer. The Contractor shall furnish the necessary labor which may be required in resetting any monument, under the direct supervision of the Engineer. Should any monument be destroyed through accident or neglect, the Contractor shall be required, at his own expense to employ a licensed surveyor acceptable to the Engineer, to re-establish the monument.

ART. 76- SEWAGE, SURFACE AND FLOOD FLOWS

The Contractor shall furnish all the necessary equipment, shall take all necessary precautions, and shall assume the entire cost of handling any sewage, seepage, storm, surface and flood flows which may be encountered at any time during construction of the work. The manner of providing for these flows shall meet with the approval of the Engineer, and the entire cost of said work shall be considered as included in the prices bid for work to be done under this Contract.

ART. 77- SUSPENSION OF WORK

If the Engineer deems it advisable, or upon a determination by the Owner that all or any portion of the Work should be suspended, delayed or interrupted, then the Engineer may order the Contractor in writing to stop work on all or any part of the Contract, and the Contractor shall do no work when so ordered until he has received written notice from the Engineer to resume work. When work is suspended as above provided, payments for the completed parts of suspended work will be made as provided hereinafter and a suitable extension of time for completing the work will be granted. No payment will be made for work done by the Contractor when done in violation of said order by the Engineer.

ART. 78- ABANDONMENT OF WORK

Should the Contractor abandon or in any manner fail to complete the work under this Contract, the Owner is hereby authorized and empowered to pay any laborers or mechanics for work done who may have been employed by said Contractor upon the work herein, and to pay any claims against the Contractor for materials furnished, out of any funds that would otherwise be due or become due said Contractor under this Contract, and in every such case the Owner is hereby authorized and empowered to ascertain through the Engineer, the amount or amounts due or owing to such labor or laborers, or for materials, from said Contractor, in such manner and upon such proof as said Owner may deem sufficient. And the amount or amounts so found by the Engineer to be due and payable to such labor or laborers, or for materials furnished, shall be final and conclusive against the Contractor, and may thereafter be paid by the Owner to said labor or laborers, or to liquidate claims for material furnished; and any payment may be withheld from said Contractor until all such claims for labor or material on the Contract have been satisfied.

ART. 79- DEFAULT OF CONTRACTOR

The Owner may terminate this Contract upon the occurrence of any one of the following events of Contractor default:

- (1) If the Contractor shall fail, within the time required, to begin the work to be done under this Contract, or
- (2) If the work to be done under this Contract shall be abandoned, or
- (3) If the Contractor shall be adjudged bankrupt or make an assignment for the benefit of creditors, or
- (4) If a receiver or liquidator shall be appointed for the Contractor or for any of his property and shall not be dismissed within 20 days after such appointment, or the proceedings in connection therewith shall not be dismissed within 20 days after such appointment, or the proceeding in connection therewith shall not be stayed on appeal within the said 20 days, or,
- (5) If the Contractor shall fail to or refuse to regard laws and ordinances, and such orders as may from time to time be given by the Owner or the Engineer with respect to the work, or
- (6) If the Contractor shall refuse or fail, after notice from the Engineer, to supply enough properly skilled workmen or proper materials, or

- (7) If the Contractor shall violate any of the provisions or covenants of this Contract or shall not perform the same in good faith in accordance with the terms hereof, or
- (8) If the Contractor shall refuse or fail to prosecute the work or any part thereof with such diligence as will insure its completion within the period specified (or any duly authorized extension thereof) or shall fail to complete the work within said period, or
- (9) If the Contractor shall fail to make prompt payment to persons supplying labor, material or equipment for the work, or
- (10) If the Contractor shall assign or sublet the work otherwise than as specified, or
- (11) If the Engineer should be of the opinion and shall certify in writing to the Owner that the work or any part thereof is unnecessarily or unreasonably delayed, or that the Contractor is not complying with his orders, or is not executing the Contract in good faith, or that suitable and sufficient workmen, material, plant, power tools, supplies, or other means of carrying on the work are not provided to carry out all requirements of the Contract.
- (12) If the Contractor disregards laws, ordinances, rules, regulations, or orders of any public jurisdiction.
- (13) If the Contractor disregards the authority of the Engineer.

ART. 80- UNFINISHED WORK COMPLETED BY THE OWNER

Upon a declaration of default of the Contractor and termination as hereinbefore provided, the Owner shall, by written notice, order the Contractor not to begin, or not to resume, or to discontinue all work under this Contract or any part of such work, and thereupon the Contractor shall not begin, or shall not resume, or shall discontinue all work or such part thereof, and the Owner shall thereupon have the power, in the manner prescribed by law, to contract for the completion of the work or such part thereof, or to place such and so many persons as they may deem advisable by contract, or call on Surety to complete the work or otherwise to work at and to complete the work or part thereof, or so much of the work or part thereof, as the Owner may direct or may place under contract, and take possession of and use any or all plant, tools, appliances, equipment, supplies, property, and materials as they may find upon the site of the work, and procure or cause to be procured, by contract or otherwise, all plant, tools, appliances, equipment, supplies, property, and materials for the completion of the same, and charge the whole expense of the completion of the work, or part thereof, to the Contractor or his Surety.

The expense so charged, together with the administrative, legal, engineering, and other costs associated with terminating the Contract and re-contracting the Work, and also liquidated damages for delay in the completion of the work, if any, as provided, shall be deducted and paid by the Owner out of such moneys as may be then due or may at any time thereafter become due under and by virtue of this Contract or any part thereof. In case such expense and liquidated damages, if any, shall exceed the sum which would have been payable under this Contract, if the same had been completed by the Contractor, he shall and will pay the amount of such excess to the Owner; and in case such expense and liquidated damages, if any, shall be less than the sum which would be payable to the Contractor, if the Contractor had completed the Contract, he shall be entitled to the difference, subject to all the other terms, covenants and conditions of this Contract.

ART. 81- CERTIFICATE OF COST OF WORK COMPLETED BY OWNER

In the event of the Owner's undertaking, by contract or otherwise, to perform the work or any part thereof as hereinbefore described, the certificate of the Engineer, as to the amount of work done, the cost and amount of excess cost, if any, of performing or completing the work called for by this Contract, and as to the amount of liquidated damages hereunder, shall be binding and conclusive upon

the Contractor, his Sureties, successors, assigns, lienors and to all claimants of any part of the moneys payable hereunder.

ART. 82- CONTINUATION OF WORK BY CONTRACTOR

When any particular part of this work is being carried on by the Owner, by contract or otherwise, under the provisions of this Contract, the Contractor agrees to continue the remainder of the work in conformity with the terms of this Contract and in such manner as not to hinder or interfere with the persons or workmen employed by the Owner.

ART. 83- THE OWNER'S RIGHT TO DO WORK AND THREE DAY CLAUSE

If the Contractor or his subcontractors should neglect to prosecute the work properly or fail to perform any provisions of the Contract, the Owner, after three (3) days written notice to the Contractor, may without prejudice to any other remedy he may have, make good such deficiencies and may deduct the cost thereof from the payment then or thereafter due the Contractor; provided, however, that the Engineer shall approve both such action and the amount charged to the Contractor.

ART. 84- CONTRACTOR'S RIGHT TO STOP WORK OR TERMINATE

If, through no act or fault of the Contractor, the Work is suspended for a period of more than ninety days by the Owner or under an order of court or other public authority, or the Engineer fails to act on any Application for Payment within thirty days after it is submitted, or the Owner fails for 45 days to pay the Contractor any sum finally determined to be due, then the Contractor may, upon seven days' written notice to the Owner and the Engineer, and provided the Owner does not remedy such suspension or failure within that time, terminate the Contract and recover from the Owner payment as provided herein. In lieu of terminating the Contract and without prejudice to any other right or remedy, if the Engineer has failed to act on an Application for Payment within thirty days after it is submitted, or the Owner has failed for 45 days to pay the Contractor any sum finally determined to be due, the Contractor may upon seven days' written notice to the Owner and the Engineer stop the Work until payment of all such amounts due the Contractor, including interest thereon.

In the event the Contractor properly terminates the Contract pursuant to this article, then in such case, the 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 amounts paid in settlement of terminated contracts with Subcontractors, manufacturers, fabricators, suppliers or distributors and others (including but not limited to fees and charges of engineers, architects, attorneys and other professionals and court and arbitration or other dispute resolution costs incurred in connection with termination of contracts with Subcontractors and manufacturers, fabricators, suppliers or distributors); and
4. For reasonable expenses directly attributable to termination.

The Contractor shall not be paid on account of loss of anticipated profits or revenue or other economic loss or any consequential damages arising out of such termination.

ART. 85- ESTIMATE OF QUANTITIES

Wherever the estimated quantities of work to be done and materials to be furnished under this Contract are shown in any of the Contract Documents including the Proposal, they are given for use in

comparing bids and the right is especially reserved, except as herein otherwise provided, to increase them or diminish them as may be deemed reasonably necessary or desirable by the Owner to complete the work contemplated under this Contract, and such increase or diminution shall in no way vitiate this Contract, nor shall any such increase or diminution give cause to the Contractor for claims or liability for damages.

ART. 86- EXTRA WORK AND CHANGES IN THE WORK

Without invalidating the Contract, the Owner may order deletions or deductions in the contract Work or may order extra work or changes involving alterations or additions to the work, the Contract price being adjusted accordingly. Such ordered deletions or increases in the work shall be executed under the conditions of the Contract except that any claim for extension of time caused thereby shall be adjusted at the time of ordering such change.

No extra work or changes in the work covered by the Contract Documents shall be done or made by the Contractor without the written approval by the Owner or the Engineer, acting officially for the Owner, and unless subject to an established unit price, not until the price for doing or making such change is agreed upon in writing.

Changes or credits for the work so ordered and approved shall be determined by one or more, or a combination of three methods, as approved by the Owner as follows:

- (a) By such applicable unit prices, if any, as are set forth in the Contract; or
- (b) If no such unit prices are set forth, then by unit prices or by a lump sum mutually agreed upon by the Owner and the Contractor; or
- (c) If no such unit prices are set forth and if the parties cannot agree upon prices or a lump sum, then, for work performed the Contractor shall receive as compensation the actual cost to him, which cost shall include:
 - 1. Labor, including foreman;
 - 2. Materials entering permanently into the work;
 - 3. The ownership or rental cost of construction plant and equipment during the time of use on the extra or changed work;
 - 4. Power and consumable supplies for the operation of power equipment during the above time;
 - 5. Insurance;
 - 6. Social Security and old age and unemployment contributions;
 - 7. Plus a fixed fee to be agreed upon but not to exceed 15 percent of the summation of Items 1 through 6 above, which fee shall be compensation to cover the cost of supervision, overhead, bond, profit, and any other general expenses.

If all or part of the extra work is done by a subcontractor, subcontractor's overhead in the amount of 5 percent may be added to cost of labor and materials, if methods (b) or (c) above are used.

The Contractor shall give the Engineer access to all accounts, bills, payrolls, and vouchers relating to such extra work and he agrees that he shall have no claim for compensation for such work unless a statement in writing of the actual cost of the same, fully itemized as to labor, materials, and other allowable costs is presented to the Engineer before the fifteenth day of the month following that during which each specific order was complied with by him.

It is understood and agreed by the Contractor that the Owner reserves the right to have such extra work done by any persons, person, or corporation other than the Contractor, unless an agreement upon the prices to be paid for such extra work can be promptly reached between the Owner and the Contractor. Should said extra work be done by any person, persons, or corporation other than the Contractor, all of the provisions as hereinbefore provided shall apply and the Contractor agrees to make no claim for damages or for any privileges or rights, other than that provided in the Contract, by reason of such work by others, except for an extension of time to perform this Contract as may be certified to the Owner by the Engineer, and approved by the Owner.

Should the Contractor consider himself entitled to extra compensation on account of the before mentioned alterations or changes, he shall notify the Owner by making his claim in writing to the Engineer before proceeding with the work in question. Should the Contractor proceed with the said work in compliance with the written order of the Engineer, it is to be construed as his acceptance of the order and the stipulated compensation for the said work.

ART. 87- CLAIMS FOR EXTRA WORK

If the Contractor claims that any instructions issued by drawings or otherwise involve extra cost under this Contract, he shall give the Engineer written notice thereof within 48 hours after the receipt of such instruction, and in any event before proceeding to execute the work; except in emergency endangering life or property, the procedure shall then be as provided for in the preceding section. No such claim shall be valid unless so made.

ART 88 -SUPPLEMENTARY CONTRACT

Where conditions require an unforeseen and major change in, and addition to the work after the Contract has been signed, the Contractor will undertake to enter into a Supplementary Contract at agreed prices, to cover the cost of said changed work, and shall, if requested, waive any right to do such work as extra work.

ART. 89-CONTRACTOR'S CLAIM FOR DAMAGES

If the Contractor shall claim compensation for any damage sustained by reason of the acts of the Owner or its agents, he shall, within seven days after sustaining of such damage, make a written claim and statement to the Engineer of the nature of damage sustained. On or before the fifteenth day of the month sustained, the Contractor shall file with the Engineer an itemized statement of the details and the amount of such damage alleged to have been sustained and unless such statement is made as thus required, his claim for compensation will not be considered by the Owner.

In addition to the foregoing statements, the Contractor shall, upon notice from the Owner, produce for examination by the representatives of the Owner, all his books of accounts, bills, invoices, payrolls, subcontracts, time books, daily reports, bank deposit books, bank statements, check books, and canceled checks, showing all of his acts and transactions in connection with or relating to or arising by reason of this Contract, and submit himself and persons in his employ for examination under oath by any person designated by the Owner to investigate claims made against the Owner. Unless the aforesaid statements shall be made and filed within the time aforesaid and the aforesaid records submitted for examination, and the Contractor and his employees submit themselves for examination as aforesaid, the Owner shall be released from all claims arising under, relating to or by reason of this Contract, except for the sums certified by the Owner to be due under the provisions of this Contract.

ART. 90- RESOLUTION OF DISPUTES

This Contract shall be interpreted in accordance with the laws of the State of Connecticut.

All unresolved claims, disputes and other matters in question between OWNER and CONTRACTOR arising out of, or relating to the Contract Documents, or the breach thereof, shall be

resolved as follows: a) the parties may agree to submit any such claim, dispute or matter in question to mediation before a mediator acceptable to the parties; b) if the parties do not agree to submit such dispute to mediation, or if such mediation fails to result in resolution of such claim, dispute or matter in question, then by a State court of the jurisdiction in which the Project is located.

ART. 91- EXTENSION OF TIME FOR COMPLETING THE WORK

If the Contractor be delayed in completion of the work under the Contract by any act or neglect of the Owner or of any other Contractor employed by the Owner, or by changes in the work, or by any priority or allocation order duly issued by the Federal government, or by any unforeseeable cause beyond the control and without the fault or negligence of the Contractor, including, but not restricted to, acts of God or of public enemy, fires, floods, epidemics, quarantine restrictions, strikes, freight embargoes and severe weather, or by delays of subcontractors or suppliers occasioned by and of the causes described above, or by delay authorized by the Engineer for any cause which the Engineer shall deem justifiable, then:

For each day of delay in the completion of the work so caused, the Contractor shall be allowed one day additional to the time limitation specified in the Contract, it being understood and agreed that the allowance of same shall be solely at the discretion and approval of the Engineer.

No such extension of time shall be made for any delay unless the Contractor, within 5 days after the beginning of the delay, shall have informed the Owner or Engineer in writing of the nature of the delay, its cause, and its estimated duration. The Engineer will ascertain the facts regarding the delay and notify the Contractor within a reasonable time of its decision in the matter.

The Contractor shall use all honorable and reasonable means to prevent strikes, to avoid violations of labor agreements or other actions calculated to create dissatisfaction with working conditions. Should strikes occur, he shall make all proper and reasonable efforts to effect early settlement and resumption of the work. Should collusion by the Contractor be proven in the case of strikes or lockouts, then no extension of time for completion of the Contract will be given. Burden of proof in this case shall rest entirely with the Contractor.

No claim for damages or any claim other than for extensions of time as herein provided shall be made or asserted against the Owner by reason of any delays caused by the reasons hereinabove mentioned.

ART. 92- LIQUIDATED DAMAGES

It is hereby understood and mutually agreed, by and between the Contractor and the Owner, that the date of beginning and the time for completion as specified in the Contract of the work to be done thereunder are essential conditions of this Contract; and it is further mutually understood and agreed that the work embraced in this Contract shall be commenced on or before a date to be specified in the Owner's written notice to commence the work.

The Contractor agrees that said work shall be prosecuted regularly, diligently, and uninterruptedly at such rate of progress as will insure full completion thereof within the time specified. It is expressly understood and agreed, by and between the Contractor and the Owner, that the time for the completion of all work described in the Contract Documents is a reasonable time for the completion of same, taking into consideration the average climatic range and usual industrial conditions prevailing in this locality.

If the said Contractor shall neglect, fail, or refuse to complete the work within the time specified in the Contract, or within such further time as may be properly granted by the Owner in accordance with the provisions of this Contract, 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 Contractor shall exceed the time stipulated in the Proposal for completing the work.

The said amount is fixed and agreed upon by and between the Contractor and the Owner because of the impracticability and extreme difficulty of fixing and ascertaining the true value of the damages which the Owner and third parties who are eligible to receive sewer service, will sustain by failure of the Contractor to complete the work on time, such as loss of revenue from service charges, additional costs of interest charges, delays caused to other work by failure to perform this Contract, and other damages, some of which are indefinite and not susceptible of easy proof, and said amount is agreed to be the amount of damage which the Owner will sustain and said amount shall be recovered by the Owner by deducting the same out of any monies due or that may become due the Contractor, and if said monies are insufficient to cover said damages, then the Contractor or his Surety shall pay the amount of the difference.

As specified under "Inspection", the costs of engineering and inspection performed during overtime hours, or after the specified date of completion (regardless of the granting of extensions of time), shall be deducted from funds owed to the Contractor, as damages sustained by the Owner caused solely by actions of the Contractor.

It is further agreed that time is of the essence of each and every portion of this Contract and of the specifications, wherein a definite and certain length of time is fixed for the performance of any act whatsoever; and where under the Contract an extension of 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.

It is also understood and agreed that the Contractor will not be charged with liquidated damages when the Owner determines that the Contractor is without fault and that the Contractor's reasons for requesting a time extension are acceptable to the Owner. If an extension of time is approved, said liquidated damages will be charged the Contractor from the end of such extension to the completion of the work. However, whether or not an extension of time is granted by the Owner, the Contractor shall pay to the Owner all costs of engineering field work and inspection from the completion date, as determined from the number of days specified for completing the work, to the date of actual completion.

ART. 93- PREPARATION OF ESTIMATES FOR MONTHLY PAYMENTS

Preliminary drafts of estimates for partial or monthly payment for work done and materials delivered shall be delivered to the office of the Engineer no later than the fifth day of the month following the period covered by such estimate.

Each preliminary or final draft payment requisition submitted by the Contractor to Owner shall include a statement showing the status of all pending construction change orders, other pending change directives and approved changes to the original contract. Such statement shall identify the pending construction change orders and other pending change directives, and shall include the date such change orders and directives were initiated, the costs associated with their performance and a description of any work completed. As used herein, "pending construction change order" or "other pending change directive" means an authorized directive for extra work that has been issued to the Contractor.

After the preliminary drafts have been approved, final drafts of such estimates shall be prepared by the Contractor, and delivered to the office of the Engineer no later than the tenth day of the month following the period covered by such estimate. Classes of work listed on a partial estimate shall be only those approved, and in the quantities so approved. Equipment, materials and work shall conform to the approved breakdown statement, and shall be considered only the extent, approved by the Engineer, as indicated on daily work report sheets, as of the date on which the work was done.

On each estimate where pipe and conduits in paved streets are included for payment and the proposal does not contain a separate line item for pavement restoration, the Contractor shall deduct \$15.00 per square yard of permanent pavement area until such time as the permanent pavement is placed and approved. In unpaved areas, the deduction shall be \$10.00 per foot of trench until permanent restoration is completed and releases are obtained from the affected property owners. Deductions for incomplete testing shall be in accordance with the article entitled 'Materials Included in Monthly Estimates. All such deductions shall be made from the Value of Work Completed, before calculation of retention's.

No estimate or payment shall be required to be made when, in the judgment of the Engineer, the total value of the work done since the last estimate amount to less than One Thousand Dollars (\$1000.00).

Deviation from the above procedure by the Contractor will result in disapproval of the estimate. The work and materials included on such disapproved estimate shall not be submitted for consideration until the next monthly estimate is submitted.

ART. 94- DAILY WORK REPORTS AND DELIVERY SLIPS

Daily work reports shall be prepared by the Contractor on forms acceptable to the Engineer, and shall be submitted to the Engineer on or before noon of the day following the day's work reported, properly prepared and signed.

The Contractor shall furnish the Engineer with copies of delivery slips covering all material delivered to the site of the work, which is to be included in any monthly estimate. All materials delivered to the site of the work, whether from a supplier's warehouse or from the Contractor's stock, shall be covered by such delivery slips. Delivery slips shall be submitted daily with the daily work report sheets.

Deviation from the above procedure by the Contractor, as to daily work reports and delivery slips, will result in disapproval of items of work. Such disapproved items shall not be included in any monthly estimate until properly reported on daily work reports and/or on approved delivery slips.

ART. 95- MATERIALS INCLUDED IN MONTHLY ESTIMATES

Allowances for payment to the extent listed herein, for equipment and materials specifically listed on the approved breakdown statement of the lump sum bid, may be included in the next monthly estimate after the stages herein have been reached:

- | | | |
|-----|--|--|
| (a) | Upon completion of delivery | 75% of the equipment or material price shown in the breakdown statement. |
| (b) | Upon completion of erection or installation (including subsurface pipe installation) | Not more than 90% of the installed price shown in the breakdown statement, or in the unit price bid. |
| (c) | Upon successful completion of acceptance tests | 100% of the price shown in the breakdown statement, or in the unit prices bid. |

All such equipment and materials included for payment in the monthly estimate shall be and become the property of the Owner and, on demand, the Contractor at his own expense shall promptly execute, acknowledge, and deliver or cause to be executed, acknowledged, and delivered to the Owner

for any and all such equipment and materials included in any monthly estimate, proper bills of sale or other instruments in writing in a form and as required by the Owner from the Contractor and from any person, firm, or corporation manufacturing for, or selling or shipping or delivering to the Contractor any such equipment and materials, conveying and assuring to the Owner title to such materials included in such estimate free from all liens and encumbrances; and the Contractor at his own expense shall mark such materials as the property of the Owner and shall take such other steps, if any, as the Owner may require or regard as necessary to vest title in the Owner to such equipment and materials free from all liens and encumbrances. The Contractor shall, however, notwithstanding such transfer of title to the Owner be absolutely responsible to the Owner for any loss or damage to such equipment and materials until the same shall have been completely installed and tested, all work under the Contract completed and accepted, and shall at his own cost replace any equipment and materials lost or damaged.

ART. 96- PAYMENTS

Not later than 45 days after receipt of the monthly estimate, the Owner will make partial payment to the Contractor on the basis of the estimate of the work performed during the preceding calendar month by the Contractor, and duly approved and certified by the Engineer, which estimate includes the allowances set forth hereinbefore. All such payments shall be considered tentative only, subject to correction in the final estimate, and need not be based on accurate measurement. These payments are to be made purely to aid the Contractor to meet his current bills and for no other purpose.

The Owner will retain the following amounts from each estimate, in addition to payments withheld for payment of claims, defective work, etc., as specified elsewhere:

- a) During construction a retention of 5% payments claimed will be held until completion at "semi-final" payment, after which 2.5% will be retained until completion of the maintenance period, provided that the Contractor is making satisfactory progress and there is no specific cause for greater withholding.
- b) Retentions for payment of claims, defective work, potential losses, etc., as specified elsewhere, may also be withheld.

Failure by the Contractor to pay subcontractors and material men within the time provided by Article 39 and Section 49-41a of the Connecticut General Statutes, shall constitute an event of default and grounds for disapproval by the Engineer of the current periodical estimate for partial payment.

ART. 97-OWNERS RIGHT TO WITHHOLD PAYMENTS AND MAKE APPLICATION THEREOF

The Owner may withhold from the Contractor as much as any approved payments due him as may in the opinion of the Owner be necessary:

- a) To assure the payment of just claims of any persons supplying labor or materials for the work then due and unpaid;
- b) To protect the Owner from loss due to defective work not remedied; or
- c) To protect the Owner from loss due to injury to persons or damage to the work or property of other contractors, subcontractors, owners of utilities, or others caused by the act or neglect of the Contractor or any of his subcontractors.

The Contractor shall, at the request of the Owner, furnish satisfactory proof that all obligations of the nature hereinabove described have been paid, remedied, discharged, or waived. If the Contractor fails to do so, then the Owner may, after having served written notice, withhold from Contractor's unpaid compensation a sum of money deemed reasonably sufficient to cover any and all such lawful claims until

satisfactory evidence is furnished that all liabilities have been fully discharged, whereupon payment to the Contractor shall be resumed in accordance with the terms of this Contract, but in no event shall the provisions of this article be construed to impose any obligations upon the Owner to either the Contractor or his Surety.

In paying any unpaid bills or obligations of the Contractor, the Owner shall be deemed the agent of the Contractor and any payments so made by the Owner shall be considered a payment made under this Contract by the Owner to the Contractor, and the Owner shall not be liable to the Contractor for any such payments made in good faith.

If the moneys retained under this Contract are insufficient to pay the sums found by the Owner to be due under the claims for labor and materials, the Owner may, at his discretion, pay such sums, and the Contractor or his Surety shall repay to the Owner all sums so paid out.

ART. 98- OPERATING TESTS

Prior to and as a requirement for receiving semi-final payment, the Contractor shall conduct all operating tests called for in the specifications, including but not limited to, watertightness tests of piping systems, tests of motorized and pneumatic equipment and their controls, tests of meters, gages and other instruments, tests of all control systems, pump tests and other tests as specified or directed. Testing shall be performed in the presence of the Engineer or his authorized representatives.

In the event that any tests fail to meet the requirements of the specifications, the Contractor shall make alterations, repairs or replacements as required in order that all systems equipment and appurtenances meet the operating tests as specified. The intent of the Contract is to provide a complete installation in accordance with the drawings and specifications, in working order, and ready for operation.

ART. 99- CLEANING UP

The Contractor shall expressly undertake at his own expense:

- a) Frequently to clean up all refuse, rubbish, scrap materials, and debris caused by his operations to the end that at all times the site of the work shall present a neat, orderly, workmanlike appearance;
- b) Before semi-final payment, to remove all surplus material, false work, temporary structures, including foundations thereof, plant of any description, and debris of every nature resulting from his operations and to put the site in a neat orderly condition; and
- c) Before semi-final payment, he shall restore all areas which have been used for storage of materials and equipment, and all areas which have been disturbed by his operations to their original conditions, or to a condition satisfactory to and approved by the Owner. He shall seed or sod any grassed area damaged by his operations (except for delayed seeding as provided in the Contract), and shall maintain such areas until the expiration of the maintenance period. Any such areas which fail to show a uniform stand of grass shall be reseeded or resodded until an acceptable stand of grass exists.

ART. 100- CERTIFICATE OF COMPLETION

Upon completion of all work required, or assigned during the contract period, except maintenance, as explained under "Maintenance", and final pavement, when applicable, the Engineer shall prepare a Certificate of Completion certifying that all work has been performed and materials supplied in full accordance with the terms of the Contract. Acceptance of the Certificate of Completion by the Owner shall constitute "acceptance of the work".

After completion and acceptance of the Certificate of Completion by the Owner, the retention previously held, will be reduced as indicated in Article 96.

ART 101- FINAL ESTIMATE AND SEMI-FINAL PAYMENT

Upon completion of all work required, except maintenance, the Engineer shall file with the Owner a "Final Estimate" stating, from actual measurements or observation, the entire amount of work performed and compensation earned by the Contractor, including Extra Work and compensation therefor, under and according to the terms of the Contract. The Owner reserves the right to disregard claims for compensation submitted by the Contractor after the date of final estimate.

Within 45 days after the filing of the final estimate, the Owner will pay to the Contractor the amount therein stated, less retainage, and less all prior payments and advances whatsoever to or for the account of the Contractor. All prior estimates and payments shall be subject to correction by this payment, which is throughout this Contract called the semi-final payment. In any event, the semi-final payment will not be released to the Contractor until all outstanding claims against the Contractor shall have been satisfied.

ART. 102- ACCEPTANCE OF SEMI-FINAL PAYMENT CONSTITUTES RELEASE

The acceptance by the Contractor of the semi-final payment shall be and shall operate as a release for all things done or furnished in connection with this work and for every act of the Owner and others relating to or arising out of this work. No payment, however, semi-final or otherwise, shall operate to release the Contractor or his Sureties from any obligations under this Contract or the Contract Bonds.

ART. 103- MAINTENANCE

During a period of one year subsequent to the date of the acceptance of the work by the Owner, or as provided below, the Contractor agrees to replace the material which does not conform to the Contract requirements, and to repair any defects in materials or the work, or to make any changes required without cost to the Owner, to the satisfaction of the Engineer, and in conformity with the Contract Documents, provided that orders for such replacements, repairs or changes are received by him in writing within the one year period. The Contractor is not obligated thereby to do any work of replacement or repair that he may prove, to the satisfaction of the Engineer, to have resulted from abuse of the work, or materials by parties other than the Contractor, after the date when the Owner puts to use that part of the work requiring replacements or repairs, or has approved the Certificate of Completion, and has accepted the work.

If the Owner shall deem it necessary and shall so order, such replacement, changes or repairs shall be undertaken within 24 hours after service of notice. If the Contractor unnecessarily delays or fails to make the ordered replacements, changes or repairs within the time specified, or if any replacements, changes or repairs are of such nature as not to permit the Contractor to undertake them within 24 hours, then the Owner shall have the right to make such replacements, changes, or repairs and the expense thereof shall be paid by the Contractor or deducted from any moneys due the Contractor, or from any moneys of the Contractor retained by the Owner.

If the Owner puts to use for which it is built or installed, any structure or equipment prior to the acceptance of all work under the Contract, the maintenance period for such structure or equipment shall be calculated from the time when such use begins.

ART. 104- SURETY DURING MAINTENANCE PERIOD

The Performance Bond and Labor and Material Payment Bond submitted with the executed contract shall remain in full force and effect for the duration of the maintenance period.

ART. 105- FINAL CERTIFICATE AND FINAL PAYMENT

Twelve months after the acceptance of the work by the Owner, the Engineer shall file with the Owner a "final certificate" certifying that all work has been performed and materials supplied in full accordance with the terms of the Contract and stating therein the amount retained. Upon approval of the final certificate by the Owner, the Owner will pay to the Contractor the amount therein stated.

Final payment, however, will not be released to the Contractor until:

- a) He presents proof that all claims against the Contractor have been satisfied;
- b) He executes and delivers a release substantially in the following form: "In consideration of the above payment we hereby release the Owner and his agents from all claims and liability of whatsoever nature for anything done or furnished or in any manner growing out of the doing of the work."
- c) He secures and files with the Owner statements from Officials that the highway surfaces, if any, under their jurisdiction have been restored satisfactorily.

ART. 106- NO WAIVER OF CONTRACT

Neither an extension of time for any reason beyond the date fixed herein for the completion of the Contract, nor the delivery and acceptance of any articles or materials, nor any payment for, nor acceptance of the whole or any part of the work by the Engineer, or any possession taken by the Owner or its employees or agents, shall be deemed to be a waiver by the Owner of the right to abrogate this Contract for abandonment or delay or non-performance in the manner therein provided, nor shall it operate to void or annul any of the terms of this Contract.

ART. 107- NO ESTOPPEL

Neither the Owner nor any of his officers, shall be precluded or estopped by any certificate made or given by the Owner, the Engineer, or other officer, agent or appointee of the Owner under any provision of this Contract, from at any time (before the completion and acceptance of the work and payment therefor, or before the end of the maintenance period) showing the true and correct amount and character of the work done and materials furnished by the Contractor or any other person under this Contract, or that any such certificate is incorrect or improperly made in any particular, or that the work and materials, or any part thereof, do not in fact conform to the specifications and drawings, and the Owner shall not be precluded or estopped, notwithstanding any such certificate and payment in accordance therewith, from demanding and recovering from the Contractor such damages as it may sustain by reason of his failure to comply with the Contract Documents.

ART. 108- OTHER PROHIBITED INTERESTS

No official of the Owner who is authorized in such capacity and on behalf the Owner to negotiate, make, accept or approve, or to take part in negotiating, making, accepting, or approving any architectural, engineering, inspection, construction or material supply contract or any subcontract in connection with the construction of the project, shall become directly or indirectly interested personally in this Contract, in any part hereof. No officer, employee, architect, attorney, engineer or inspector of or for the Owner who is authorized in such capacity and on behalf of the Owner to exercise any legislative, executive, supervisory, or other similar functions in connection with the construction of the Project shall become directly or indirectly interested personally in this Contract or in any part thereof, any material supply contract, subcontract, insurance contract, or any other contract pertaining to the Project.

ART. 109- USE AND PROTECTION OF WATER

For all work required in crossing or paralleling streams and waterways, the Contractor shall abide by the Rules and Regulations for Stream Encroachment Protection issued by the State. Work shall also meet the requirements of the Brookfield Inland Wetlands and Watercourse Commission.

The Contractor will submit his methods and timetable for construction adjacent to or across waterways to the agencies having jurisdiction. Submissions must be made at least ten days before any such work is started.

Prior to commencement of stream crossing operation, the Contractor shall submit construction drawings of each stream crossing to the Engineer for his approval. The drawings shall show the following information:

- a) Proposed methods of construction
- b) Details of sequence of construction, including time frames
- c) Proposed methods for maintaining flows during construction operations
- d) Proposed methods for preventing damage to property in the event of sudden or heavy storms.

The Contractor shall be responsible for the preservation of all stream banks within and adjacent to the limits of his work.

Any stream bank disturbed by the Contractors operations will be rip-rapped as specified under the contract item.

When the top of excavation is within ten (10) feet of the top of any stream bank, the Contractor shall provide protection for the stream bank as approved by the Engineer.

All work shall meet the following standards:

- a) The project shall not obstruct the upstream or downstream movement of the fish.
- b) Sufficient flow of water shall be maintained at all times to sustain aquatic life downstream.
- c) Any culvert, box culvert or bridge floor shall be designed to provide a V or dish-shaped channel, to concentrate flow during periods of low water and facilitate the movement of fish.
- d) Disturbance of the stream bed shall be kept at an absolute minimum, and stream shall be returned as nearly as possible to its original condition or better. (Where possible, in modifying a stream bed the centerline shall be 8 to 12 inches lower than the toe of the channel bank, to concentrate the flow of water.)
- e) Where work necessitates disturbing banks, they shall be graded to a 1 vertical to 3 horizontal slope, and rip-rapped or planted with shrubs, as specified under the contract item, so as to prevent erosion. All tree and brush removal shall be kept to a minimum.
- f) Any dike or cofferdam required to facilitate construction shall be erected in such a manner that stream flow will not be sufficiently reduced to endanger fish life downstream and such dike or cofferdam shall be erected of materials that will not contribute substantially to the turbidity or siltation of the stream.
- g) During the project, care shall be taken to prevent or reduce to a minimum any damage to any stream from pollution by debris, sediment or other material, or from the manipulation of equipment and/or materials in or near such streams. Water that has been used for washing or processing, or that contains oils or sediments that will reduce the quality of the water in the stream shall not be directly returned to the stream. Such waters will be diverted through a setting basin or filter before being directed into the streams.
- h) If water is taken from a stream for construction purposes and an impounding structure is necessary, such structure shall be erected in a manner causing the least possible disturbance to the stream.
- i) In all cases involving work in a stream, every effort should be made to return the stream to the highest possible standard for aesthetic value, water quality, and fish habitat.
- j) Conditions of all permits.

ART. 110- CONFORMANCE WITH MUNICIPAL AND STATE REQUIREMENTS

Prior to commencement of any work, the Contractor shall obtain all permits and approvals required to be acquired by the Contractor by the State Department of Transportation or the Township agencies having jurisdiction.

Contractor shall pay all fees, establish escrows and provide insurance and bonds required by these permits and approvals.

All State and local requirement shall be satisfied prior to commencement of work.

ART. 111- EXEMPTION FROM SALES AND COMPENSATING USE TAXES

In computing their bids, bidders are not to include the sales and compensating use taxes of the State or of any city and county in the State on any supplies or materials to be sold to the Owner, which is exempt from such taxes.

GENERAL SPECIFICATIONS

SECTION S-1 EARTHWORK AND BACKFILL

S 1.01 CLEARING AND GRUBBING

The Contractor shall clear and grub as required. Trees, bushes, stored material, vegetation, stumps, and roots on these areas shall be disposed in a manner satisfactory to the WPCA and to responsible officials. Brookfield WPCA Inspector will determine in the field the existing root structures and stumps to remain where necessary, material shall be stored off-site, then replaced when work is complete.

Where trees are designated to remain, or when ordered by the WPCA, the Contractor shall refrain from removing or harming trees so designated, or shall tunnel under them as required.

S 1.02 STRIPPING

After clearing and grubbing, the site of the work within the limits indicated shall be stripped to a depth of 6-inches. From the top layer of stripped material, all material which is of acceptable quality for use in the work as topsoil, shall be stored separately until needed. All other stripped material shall be considered as surplus and shall be disposed of as directed by the WPCA.

All stockpiled topsoil shall be seeded with temporary vegetative cover.

Stripped areas shall be backfilled and filled to final rough grades with bank run sand and gravel as specified in Section S1.11 of this specification.

S 1.03 LIMITS OF DISTURBANCE

The Contractor shall limit all work to the limits designated on the drawing or 10' from either side of the centerline of the proposed pipe. The limits shall be staked with clearly flagged stakes prior to the start of construction, where appropriate. The WPCA shall be contacted for inspection of the staked limits.

Snow fence shall be installed along the limits of disturbance, where practical. The snow fence shall be installed to protect all areas that will be disturbed during that workday which includes areas that vehicles and equipment will travel. It is the contractor's responsibility to install and maintain the snow fence during construction.

Silt fence shall be installed by the contractor prior to construction as shown on the drawings. It is the contractor's responsibility to maintain the silt fence.

S 1.04 EXCAVATION

Excavation shall mean the removal from place of all materials including rock, pavement, sidewalks, topsoil, boggy waste, rubbish, ashes, cinders and organic material such as peaty or humus material.

S 1.05 UNAUTHORIZED EXCAVATION

All excavation carried beyond the lines and grades shown, specified or established by the Engineer, together with its disposal, shall be at the Contractor's expense. All such spaces shall be filled by the Contractor, at his own expense, with concrete, foundation material, or compacted suitable material as directed.

S 1.06 STORAGE AND DISPOSAL

Excavated material, which is suitable and approved for backfill and fill shall be placed in storage piles unless or until it can be placed in the work. It shall not be placed close to the sides of excavations, where the weight of the material could create a surcharge on such sides, whether sheeted or not. Places for storage shall be only where approved.

Unsuitable material, or material in excess of that required for fill, backfill or other purposes, including any stored surplus, shall be disposed of off the site, by the Contractor at his own expense, unless needed for municipal fill purposes.

S 1.07 SHEETING AND BRACING

Where excavation are made with sides which require supporting, sheeting and bracing shall be used, of sufficient strength to sustain the sides of the excavations and to prevent movement which could in any way injure the work, or diminish the working space sufficiently to delay the work. Sheeting shall be of a material that will not split while being driven. Special precautions shall be taken where there is additional pressure due to the presence of other structures, and in such case, the Contractor shall submit, for the Engineer's approval, an outline plan showing the lines on which he proposes to drive sheeting and the method proposed for bracing against the loads imposed by the structure. Such plan shall be prepared by a Registered Professional Engineer of this State and said plan shall bear the signature and seal of said Engineer. Sheeting and bracing shall be removed before the completion of the work, unless otherwise specified.

S 1.09 BACKFILL AND FILL

All backfill and fill under pipes and structures shall consist of suitable approved foundation material. All other backfill and fill, in unpaved areas unless otherwise specified or required, shall consist of a suitable selected and approved earth or sand generally from storage of approved suitable excavated material, free from rejected organic matter, boggy, peaty humus or other unsuitable material such as unconsolidated silt, rubbish, waste, ashes, or cinders and with less than 15% of size 200 sieve material. If sufficient suitable material for backfill is not available from the excavated material in unpaved areas, as determined by the Engineer, the Contractor shall procure elsewhere a sufficient quantity of suitable bank run sand and gravel and shall furnish and place such material. No frozen earth shall be used for backfill, and all stones more than 6 inches in the largest dimension shall be removed from acceptable earth for fill

S. 1.10 PLACING AND COMPACTING BACKFILL AND FILL

Backfills and fills shall be made to the slopes, grades, and elevations shown, specified, or

required. Backfills shall be compacted, as hereunder specified, to a density at least equal to that of the adjacent undisturbed soil, so as to avoid future unequal settlement.

No backfill shall be placed until the structure has been inspected in place and approved. Backfilling shall be carried out as soon as possible after such approval, and the amount of trench left open shall be kept to a maximum length of 50 feet except that not more than 25 feet shall be left open at the end of the work day. Excavations left open overnight shall be fenced or barricaded on all sides, and shall be lit with warning lights, so as to avoid hazard to pedestrians or vehicles.

In certain locations, or where ordered by the Engineer, where pipes are to be laid across the roadway, any trenches not completely backfilled by the end of the working day, shall be covered with steel plates sufficiently strong to carry roadway traffic.

Trenches shall be backfilled with bank run sand and gravel to a depth of 12 inches over the pipe, and compacted with mechanical tampers. After a compacted coverage of 12 inches has been made, the remainder of the trench shall be completely filled in an approved manner. Puddling from compaction will not be permitted except with coarse to medium granular materials and as approved by the Engineer. Bulldozing of backfill material into trenches will be prohibited unless it is done in uniformly spread layers, not over 12 inches thick and immediately machine tamped.

The Contractor shall provide material as required to compensate for settlement of backfill and fill.

When sheeting is being withdrawn, if applicable, all cavities left thereby shall be filled with suitable granular earth, hosed or tamped in place so as to fill all voids thoroughly.

Backfill or fill shall be carried to a subgrade that permits topsoil of the required depth to be placed to bring it to the finished grade. As far as practicable, the underlying backfill or fill shall be given time to settle through several heavy rains or by artificial wetting before the new topsoil is placed.

Backfilling shall be completed using the method of construction for sewer pipes and manholes in accordance with ASTM D2321. Compaction of backfill material shall be in accordance with ASTM D1557.

Backfill in the area between the bedding and the pavement subbase course shall be compacted to ninety-five percent (95%) maximum dry density as determined by the ASTM D-1557 test procedure. Backfilling shall progress to the springline of the pipe, then between the springline and the crown of the pipe, and then backfill from the crown of the pipe to a point twelve inches (12") above the top of the pipe. After that, individual lifts of initial backfill shall be no greater than twelve inches (12") in thickness.

Trench backfill material shall be best excavated dry material or suitable imported material where determined necessary by the engineer.

All unsuitable or excess excavated material is to be directly loaded on trucks and removed from the site of work and disposed of legally at no additional cost to the OWNER.

S 1.11 SAND, STONE AND GRAVEL

Bank run sand and gravel shall consist of hard, sharp, clean granular material, free of organic matter. The material shall be free of any considerable amount of flat, laminated or elongated particles and shells, silt, clay, limestone, shale or other deleterious matter. The material must be capable of compaction to the density specified or required by the Engineer. The material shall contain no stones larger than 3 inches in their largest dimension, and no more than 15% of the material by weight shall pass a No. 200 sieve.

Gravel and crushed stone shall consist of hard, sharp, clean material. The material shall be free from fines, shells, clay, limestone, shale or other deleterious matter. Material shall be supplied as a mixture of sizes with 5% to 10% of the material passing a No. 40 sieve and the remainder ranging in size from 3/8-inch to 1-inch.

Foundation material shall be placed and firmly compacted by mechanical tamping equipment. Care shall be taken to place and compact material under pipe haunches.

Foundation material shall consist of clean gravel or crushed stone, as specified above and as approved; it shall not include bank run or excavated material.

S 1.12 TOPSOIL

Where topsoil on the areas to be excavated is of acceptable quality for use in the work, it shall be stripped therefrom to a depth directed, cleared of stumps and roots, and stored at approved locations separate from other storage until required to be placed on top of the backfill, fill or other areas, as shown, specified or directed.

In areas where seeding or sodding is required, the Contractor shall furnish and spread a minimum of 4 inches of topsoil.

New topsoil shall consist of natural loam obtained from an area that has never been stripped, and shall be free from hard clods, stiff clay, partially disintegrated stone, cement, ashes, roots, or other undesirable material.

During the period of settlement, the Contractor shall maintain all trenches and provide for additional backfill to keep the finished grade of such trenches as near as possible to the original ground elevation. When ordered by the Engineer, but not before trench settlement has substantially ceased, the Contractor shall proceed with and complete all property restoration.

S 1.13 ROCK EXCAVATION

Rock excavation shall mean removal of boulders or pieces of concrete or masonry exceeding one cubic yard in volume, and solid ledge rock and masonry, which in the opinion of the Engineer requires for its removal, drilling and blasting, wedging, sledging, barring, or breaking

up with a power operated tool. Soft or disintegrated rock which can be removed with a pick or power operated excavator or shovel, loose, shaken or previously blasted rock, broken stone in rock fill or elsewhere, and rock exterior to the maximum limits allowed, or which may fall into the excavation, shall not be included as rock excavation. Pavements, curbs, gutters, sidewalks and driveways shall not be included as rock excavation.

When rock is encountered, the Contractor shall completely expose the rock surface, within the trenching payment limits shown on the contract documents, and notify the Engineer. Rock excavation if any, shall be paid at the prices bid for this item in the proposal. The limits of rock to be exposed shall not exceed the pay limits described in the contract documents unless approved by the engineer.

The Contractor shall notify the Engineer before starting any excavation, so that elevations and the measurements of the excavation area may first be obtained. When ledge rock is encountered, the Contractor shall notify the Engineer and shall strip or expose the rock to such an extent that in the Engineer's opinion the necessary measurements can be taken. If the Contractor fails to give such notice or notices, or removes any material prior to the taking of measurements, the Engineer may presume that measurements taken at the time he first saw the material in question indicates the true quantity of excavation.

No blasting shall be performed by the Contractor except upon written permission of the Engineer. Any request by the Contractor for permission to blast must be submitted to the Engineer at least 24 hours prior to start of said proposed blasting.

If blasting permission is granted, the Contractor shall adhere strictly to all required State and local safety regulations governing blasting and storage of explosives. In no case shall blasting caps or other exploders be kept at the same place where dynamite or other explosives are stored. A watchman shall be stationed at all times at the place of storage of explosives.

The prepared blast shall be carefully covered with a heavy woven wire blasting mat and placed so that the area affected by the explosion is positively confined. Should a gas, water or any other conduit intersect the line of trench, the rock must be removed without blasting from a distance of ten (10) feet on each side of such pipe or conduit.

The Contractor shall be responsible for any damage to adjacent structures and property caused by his operations. He shall inspect all structures adjacent to the site of blasting and, when ordered by the Engineer, he shall take clear, close-up photographs of these structures before and after blasting. Copies of all photographs shall be submitted to the Engineer.

S 1.14 LIMITS OF EXCAVATION

Excavations shall be made to the approved lines which shall be of sufficient width outside the structure to give room for placing and removing forms for concrete and for forming the pipe joints. Excavations for all structures shall not be plowed, scraped, or machine-dug closer than 3 inches to the finished subgrade. The last 3 inches of depth for all structures including pipe shall be removed with pick and shovel to the exact lines and grades just before placing foundation material, or pipe supports. The pipe elevations noted refer to the center lines and inverts and

due allowance shall be made for excavating to a lower depth to accommodate foundation material or pipe supports. Bell holes shall be hand excavated for any pipe with a bell dimension larger than the pipe barrel.

Excavations made adjacent to or in the proximity of existing structures shall be made with special care and in such a manner as not to damage the structures or disturb the supporting backfill and foundations of such structures.

Trench Excavation

- (1) Excavation shall be accomplished using suitable equipment for the conditions anticipated for the work. Excavation shall not progress more than fifty feet (50') ahead of pipe laying operations. Not more than fifty feet (50') of open trench shall be left uncovered following pipe installation, unless specifically required.
- (2) Extreme care shall be exercised in excavating in the vicinity of existing sanitary, gas or drain pipes, and service connections. These facilities shall be properly protected or support as necessary. Where such pipes or conduits form an obstruction to the line and grade of the sewer main, any removal, alternation or rearrangement of utilities shall be completed by the CONTRACTOR in a manner acceptable to the ENGINEER.
- (3) Trenches shall first be excavated to the top of the Pipe Embedment Zone (12 inches above the crown of the pipe). Excavation for other appurtenances shall have twelve inches (12") minimum and twenty-four inches (24") maximum clearance on all sides. The ground surface adjacent to all open trenches shall be graded to prevent surface water from entering the excavation, as required.
- (4) Excavation of the Pipe Embedment Zone shall be carefully progressed to the depth of bedding and shall not exceed the maximum trench width as follows:

<u>Diameter of Pipe</u>	<u>Maximum Trench Width</u>
4" – 12"	3 ft. – 0 in.
14" – 18"	3 ft. – 6 in.
20" – 24"	4 ft. – 0 in.

- (5) Should the excavated width of the Pipe Embedment Zone exceed the maximum values listed above, the pipe shall be constructed in higher class bedding, or the class of pipe shall be increased, or both in accordance with the loading conditions at that specific location.
- (6) Where the bottom of the trench will not support the pipe in the opinion of the Engineer, the Contractor shall furnish and install additional foundation material under the bedding. The Contractor shall make such additional excavation and construct foundation of the thickness directed by the Engineer.

Excavation limits above the pipe embedment zone shall be follows;

For pipe diameters less than 8-inch the maximum trench width shall be 5 feet from the top of the pipe embedment zone to finished grade and the minimum trench width shall be 3 feet.

Final pavement disturbance areas will be measured based on the actual field measurements; however, pavement disturbances beyond the maximum width indicated above plus 1 foot cut back on either side of the trench will not be considered by the Authority for payment unless these limits of disturbance have been approved by the Engineer or the Authorities Representative (in writing) prior to disturbance activity. For pavement areas that have been disturbed beyond the maximum limits of 5 feet that were not approved as noted above will be paid based on the 5 foot maximum trench width plus the 1 foot cut back on either side of the trench for the liner feet measured in the field.

S 1.15 SEEDING

All areas to receive new topsoil shall be seeded. After the area to be seeded has been graded to the required elevation, the surface shall be raked to true lines. All objectionable material, which would interfere with a finely pulverized seed bed, shall be removed. The surface shall be seeded in accordance with the permanent ground stabilization notes on the Contract Drawings. An approved fertilizer shall be applied with the grass seed at the rate of 500 lbs. per acre.

Grass seed shall be sown in the Fall from August to October, or in the Spring between March and May. Seeding shall be done in dry or moderately dry soil at times when the wind velocity does not exceed 5 mph. After seeding, the surface shall be evenly raked with a fine toothed rake, than rolled with an approved roller, and finally watered with a fine spray. During dry weather, grassed areas shall be watered daily with sprinklers until grass is firmly rooted.

The Contractor shall maintain all seeded areas without additional payment until the expiration of the maintenance period. Any areas that fail to show a uniform stand of grass will be reseeded and refertilized at the Contractor's expense, until an acceptable stand of grass is established.

S 1.16 SUBMITTALS

Certifications. Tests and Inspections required under this Section shall be certified in accordance with the Contract Documents and shall be submitted for review by Engineer.

Shop Drawings. Shop Drawings are required for the following:

- (1) Sheeting and Bracing design by a CT Licensed Engineer, if applicable
- (2) Silt Fencing
- (3) Filter Fabric

END OF SECTION S-1

SECTION S-4 PIPES, SUPPORTS AND APPURTENANCES

S 4.01 PIPE MATERIALS

Forcemain pipe material utilized in the Contract shall be Polyvinyl Chloride (PVC) or Ductile Iron (DI) as designated on the Contract Drawings. Pipe materials, fittings, appurtenances and installation shall conform to the applicable provisions of the following paragraphs of Section S4 and the WPCA Rules and Regulations. It should be noted that the more restrictive requirement will apply.

S 4.02 DUCTILE IRON

Ductile iron pipe and fittings shall be flexible joint or flanged. In general, flexible joints shall be used for outside piping and flanged joints shall be used for inside piping except as otherwise shown. Ductile Iron Pipe and Fitting shall conform in all respects to ANSI Standard A21.51 for thickness Class 52. Flanged ductile iron pipe shall be minimum class 53. All ductile iron pipes shall be flexible joint with mechanical joints or Tyton Joints equal to United States Pipe and Foundry Co. Mechanical Joints shall conform to the requirements of ANSI Standard A21.11. Gaskets shall be full faced, furnished with plain tips. Gasket dimensions shall be in accordance with the manufacturer's standard design of dimensions and tolerances. Flanges and flange ends shall conform to the requirements of ASA Standard B 16.11.

Plain ends of pipe for coupling joints shall be prepared in strict accordance with the requirements and instructions of the manufacturer of the coupling to be used.

All ductile iron pipe and fittings shall have a double cement mortar lining and interior seal coat.

Exposed pipe and fittings furnished for interior applications shall not receive an outside protective coating, but shall be painted as specified in General Specifications, Section S7. All other pipe and fittings shall be coated with an approved coat of coal tar pitch varnish.

Joints subjected to unbalanced thrust conditions shall be restrained as required, see Section S4.08.

S 4.03 PVC GRAVITY SEWER PIPE - NOT USED

S 4.04 RIGID POLY VINYL CHLORIDE (PVC) FORCE MAIN

Forcemain pipe, outside of the valve pit, shall be Schedule 80 PVC, as identified on the drawings. Pipe shall be furnished in maximum lengths to reduce jointing in the field. Pipe shall be joined by means of rubber ring bell joint which shall be an integral and homogeneous part of the pipe barrel.

PVC Pipe shall conform to the following standards:

1. ASTM D2467-20 – Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
2. ASTM D1784- Standard Specification for Rigid Poly (Vinyl Chloride) (PVC)

- Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds
3. ASTM D3139- Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
 4. ASTM F477 – Standard Specifications for Elastomeric Seals (Gaskets) for Joining Pipe.
 5. AWWA C900 – Standard for Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings.

Care should be taken during unloading and handling to prevent damage to the pipe. Never roll pipe off the truck.

Trench depth of PVC pipe should be at least 48-inches to the top of pipe or several inches below the frost line, whichever is greater. The trench bottom should be smooth and regular, free of rocks and all hard objects to allow uniform support of the pipe.

Narrow trenches may be used if the trench width is sufficient to allow for adequate tamping of the soil around the pipe, where approved.

Inspect bell, gasket and spigot to insure that they are clean and free of dirt or foreign objects.

Lubricate spigot end of pipe with factory supplied lubricant. Align the spigot with the bell and push together by hand or with a block and bar, until assembly mark on spigot is aligned with the end of the bell.

PVC pipe can be installed with gradual curves by uniformly deflecting the pipe barrel. Minimum radii of curvature are in accordance with UNIBELL recommendations.

Joints are designed to permit 2° deflection without bell distortion. Fittings should be used to effect greater deflections.

Care should be taken to provide adequate thrust blocking at all bends, intersections, ends and reductions in accordance with Engineers' recommendations.

Backfilling should be done immediately after installing each length of pipe. Backfill that will lay adjacent to the pipe should contain no large rocks or hard clods. Tamp around and under the pipe to insure adequate soil support, as approved by the WPCA Engineer.

Pipe may be tested at any time after installation. Prior to testing make sure line is properly restrained. Do not exceed the maximum water pressure rating of the pipe.

Storage of pipe at the site shall be as specified for PVC gravity pipe.

S 4.05 COPPER TUBE

Copper tube shall conform to the requirements of ASTM Designation B88 Type.

For all other services, buried copper tube shall be type K annealed, and exposed pipe, type L hard-drawn.

Connections to the water main in the street shall be coordinated with the local water department, Aquarion.

S 4.06 SLEEVES, CASTINGS AND WALL FITTINGS

Ductile iron pipe passes through walls and floors the Contractor shall furnish and install duct. Iron wall castings or sleeves, as shown on the drawings.

Wall fittings for reinforced concrete pipe shall be bell wall fittings where shown on the drawings.

Where all other pipes pass through walls and floors, the Contractor shall furnish and install schedule 40 steel sleeves, except where otherwise shown.

All sleeves and castings below ground surface, or where watertightness is required, shall have a center water stop.

Sleeves shall be packed and caulked with an approved caulking compound.

S 4.07 FLEXIBLE COUPLINGS AND FLANGED COUPLING ADAPTERS

Flexible pipe couplings and flanged coupling adapters for making field joints between plain end pipes shall be of the elastic gasket type, meeting the requirements of the Code for Pressure Piping, ANSI Standard B31.1.

The couplings shall be designed and constructed to facilitate easy assembly in the field and to provide tight flexible joints when subject to expansion, contraction, irregularities and distortion due to normal settlement, and shall be as manufactured by the Dresser Manufacturing Division of Dresser Industries, Smith-Blair, Inc. or equal.

Flexible pipe couplings shall be Style 38 Dresser couplings. Flanged coupling adapters shall be style 127 for 8 inch pipe and smaller and style 128 for all others.

Unless otherwise noted, all flange coupling adapters and all flexible couplings shall be harnessed.

On ductile iron pipe the harnessing shall be done by tying adjacent flanges with tie bolts. Lock pin type harnessing may also be used.

On steel pipe, cast steel lugs shall be welded to the plain end section of pipe and the joint tied with steel bolts and nuts between the lugs and adjacent flange. Dimensions, sizes, spacing and material for tie bolts, washers and nuts shall conform to the standards of Dresser Industries, Smith-Blair, Inc. or approved equal for pipe size and test pressure indicated.

S 4.08 JOINT RESTRAINT

Pipe joints subjected to an unbalanced thrust shall be suitably harnessed to the satisfaction of the Engineer. All tees and bends deflecting 11 1/4 degrees or more and other locations where there will be an unbalanced thrust shall be harnessed in accordance with this item. The type of

joint restraint the Contractor proposes to use at points of unbalanced thrust shall be submitted to the Engineer for approval.

Socket pipe clamps and tie rods may be used for joint restraint on mechanical joints. Socket pipe clamp shall be Grinnell Figures 600 with socket clamp washers, Figure 599, or approved equal for all straight pipe harnessing and for fittings of 12 inch diameter and smaller. Clamps for fittings larger than 12 inch diameter shall be specially designed and fabricated to suit the fittings proposed for use. Tie rods shall extend from the back of the bell of one joint beyond next joint to provide positive restraint. The use of socket pipe clamps as restraint devices relying on friction between the clamp and pipe barrel will not be permitted.

Dimensions, sizes, spacing, and material for lugs, tie bolts, washers, and nuts shall conform to the standards of Dresser Industries, or approved equal, for pipe size, wall thickness, and test pressure indicated.

S 4.09 CONNECTIONS TO EXISTING PIPES

The connection to the existing forcemain shall be made via a 45-degree fitting. The existing forcemain located in between the new connection location and the existing vale pit shall be removed.

The connection to the existing 12-inch diameter Class 52 DIP water main in the Route 133 shall be coordinated with the local water department, Aquarion.

S 4.10 JOINTS BETWEEN DIFFERENT PIPE MATERIALS

Where joints are required between pipes of different materials, the Contractor shall use an approved transition fitting or furnish details of his proposed method. The method used shall provide an adequate seal to prevent leakage at the junction.

S 4.11 EXPANSION JOINTS

Ample provisions shall be made for flexibility in all pipe lines, to compensate for expansion. Unless other forms of expansion joints are specified, all runs of pipe subject to change in length shall be fabricated shorter than their theoretical length to the extent of one-half of the expansion and shall be so erected that there may be freedom to expand without increasing the stresses imposed when cold. When the foregoing method of compensation for expansion is not adequate, the Contractor shall furnish, and install in the pipe lines, expansion devices that will be adequate to all the lines to expand and contract freely without injury to any part of the piping system. The devices may be in the form of expansion joints, swivel or swing joints, or pipe bends, and shall include such anchors as may be shown, specified or required to make the devices effective.

Where harnessing of rubber expansion joints are shown, adjacent flanges shall be tied with tie bolts. Expansion joints shall be adequate for the maximum estimated expansion movement. Unless otherwise specified, the expansion joints on all pipe lines 2 inches (2") in diameter or smaller, shall be all brass with screwed ends; on all lines 2 1/2 inches and larger in diameter,

they shall be of the iron body pattern with flanged ends and covered brass expansion element. Expansion joints shall be Flexonic, Adesco, Zellea, or approved equal.

Rubber expansion joints shall be Standard Single Arch Type, as manufactured by the Mercer Rubber Company, Metraflex Co. or approved equal.

S 4.12 COATING

Not Applicable.

S 4.13 PIPE LAYING AND INSTALLATION

All pipe and fittings shall be installed to the lines, elevations and grades shown or ordered, and in accordance with the manufacturer's recommendations.

Suitable tools and equipment shall be used for proper handling, storing, and laying of pipe and fittings. In order to avoid damage to interior coatings, lifting hooks or bars shall not be inserted therein.

Each pipe and fitting shall be checked for defects and injuries as installation proceeds. Imperfect pipe materials shall be rejected and removed from the work. Pipe found to be defective after installation shall be removed and replaced by undamaged material.

The interior of all pipe shall be cleaned of dirt, and other deleterious materials, and kept clean, as the next section of pipe is laid. During the progress of the work, the exposed ends of the pipe shall be provided with approved temporary covers fitted to the pipe, in order to prevent material from entering the pipe. All pipes shall be left clean.

Where pipe must be cut to fit as closing pieces, such cuts shall be evenly and squarely made in a workmanlike manner with approved equipment. Injury to linings or coatings shall be satisfactorily repaired. Ductile iron joints must be thoroughly brushed with a wire brush to remove all loose rust or foreign material, and soapy water brushed over the joint surfaces and over the gasket. Bolts for mechanical or flanged joints shall be tightened uniformly, using only torque-limiting wrenches to avoid overstressing the bolts. Bolt heads, nuts and all unpainted surfaces of the flanges shall be coated with two heavy applications of black asphaltum varnish.

Where pipe joints are to be welded, all welding shall be done by duly qualified welders in conformity with the Code for Pressure Piping, ANSI B31. Certificates of qualification of current issue for the work involved executed by an approved inspection agency or corporation, shall be given to the Engineer.

I.P.S. threads for screwed joints shall be cut clean and true in conformance with ANSI Standard B2-1 for taper threads. Care shall be taken not to damage or mar pipe and fitting surfaces. Fittings shall be screwed up close to the shoulders of the male threads. No lampwick, cord, wool, or shall be used in making up screwed joints. Pipe joint compounds shall be applied to male threads only; all joints shall be made with Permatex compound.

Unless otherwise specified, handling and laying of ductile iron pipe shall comply with the methods described in Section 3 of the "Handbook of Cast Iron Pipe" of the Cast Iron Pipe Research Association. Pipe shall be laid in conformance with Laying Condition Type 4.

In general, all buried non-ferrous pipes shall be laid in accordance with the requirements of ASTM Designation on C-12.1 except where otherwise shown, specified, or approved. Joints shall be made in accordance with the recommendations of the manufacturer.

The Contractor shall excavate and dewater the trench below the pipe invert, to limits shown or ordered, and place the pipe on foundation material, as shown, specified or ordered.

Inside piping, fittings and valves shall be supported as shown, specified, or required. Where temporary supports are used, they shall be sufficiently rigid to prevent shifting or distortion of the pipe. Where expansion couplings are used, they shall be properly adjusted so that the pipe lines are liquid or gas tight during expansion or contraction.

S 4.14 MATERIAL TESTING

Ductile iron pipe shall be hydrostatically tested at the point of manufacture to 500 psi for duration of one minute. Testing may be performed prior to machining bell and spigot. Failure of ductile iron pipe shall be defined as any rupture of pipe wall. Certified test certificates shall be furnished in duplicate prior to time of shipment. All ductile iron pipe and ductile iron fittings shall be inspected and tested at the foundry as required by the standard specifications to which the material is manufactured. Furnish in duplicate sworn certificates that all tests and inspections required by the Specifications under which the pipe is manufactured have been satisfied.

For plastic pipe, sand box tests shall be run on the same number of lengths as specified above. Test loads shall be equal to twice the maximum trench load.

S 4.15 GRAVITY PIPE LINE TESTING - NOT USED

S 4.16 PRESSURE PIPE LINE TESTING

Pressure pipe for force mains shall be tested for leakage by the Contractor. The duration of each test shall be not less than 4 hours. The Contractor shall provide all necessary facilities, water, bulkheads, apparatus and all required labor therefore.

Force mains shall be tested under a constant hydrostatic pressure of 75 psi. Leakage in force mains shall not exceed 2-1/2 gph per inch of internal diameter per mile of pipe.

All visual leaks shall be made tight. Tests shall be repeated until the results are satisfactory.

The Contractor shall notify the Engineer five (5) days in advance of the time the test is to be made. No test shall be accepted unless witnessed by the Engineer or his authorized representative.

S 4.17 HANGERS AND SUPPORTS - GENERAL REQUIREMENTS

"Hangers and Supports" shall include all hanging and supporting devices of metallic construction shown, specified or required for pipe lines, apparatus and equipment. Included in this classification are saddle stands, steel and cast iron stanchions, hangers, pipe pole supports, supports of structural steel, and all necessary pipe saddles, pipe rolls, fastenings, anchors and appurtenances.

Hangers and supports shall be adequate to maintain the pipe lines, apparatus and equipment in proper position and alignment under all operating conditions, and have springs where necessary; they shall be adequate to prevent creeping, sagging, buckling or vibration and shall allow for expansion and contraction. Hangers and supports shall be of standard design where possible and be best suited for the service required, as approved by the Engineer, all supporting devices shall be designed in accordance with the best practice and shall not be unnecessarily heavy.

Pipe hangers and supports, where shown or required, shall be carefully located and adjusted so as to maintain the pipe in proper alignment without causing any undue strain in the pipe or in any equipment. Sufficient hangers and supports shall be installed to provide a working safety factor of not less than twelve for each hanger, assuming the pipe filled with water. Pipe shall be supported at all changes in direction and on straight runs at intervals of not more than 10 feet for pipe 1 1/2" (inch) or larger and 8 feet from pipes 1" (inch) or smaller. No pipe shall be supported from pipe of other trades. Each length of flexible joint pipe shall be supported by a minimum of two (2) supports, whether or not specifically shown.

The Contractor shall furnish, fabricate, erect or install pipe supports as detailed, including structural steel shapes and plates, grout which shall be a non-shrink grout, drill anchors, anchor bolts, Schedule 40 steel pipe which shall be threaded where required, and concrete supports.

All hangers and supports shall be screw adjustable after installation. Galvanized materials shall be finished and painted as specified in Section S9.

Where temporary supports are used, they shall be sufficiently rigid to prevent shifting or distortion of the pipe.

Except when otherwise show, specified or required, hangers, supports, anchors and concrete inserts, shall be the standard types as manufactured by the Crane Co., Grinnel Co., Inc., Fee and Mason Mfg. Co., or approved equal, and shall be constructed as follows:

Pipe Rings- Malleable iron fitted with an adjusting nut of the locking type, threaded to take a rod.

Pipe Rolls - Provided with threaded nuts or with sockets to take threaded rods.

Pipe Clamps - Heavy steel, each equipped with a hooked nut to take a rod.

The Contractor's working drawings, as required by the General Provisions hereof, shall show the quality, type, design and location of all hangers and supports required under the contract.

Hangers and Supports shall conform to the requirements specified herein and to the following standards:

STRUCTURAL STEEL	-ASTM Designation A-7 Rivets - ASTM Designation A-141
STEEL BARS	-ASTM Designation A-107
STEEL CASTINGS	-ASTM Designation A-27 (Grade 65-35, full annealed)
WROUGHT IRON	-ASTM Designation a_189 and A-42
WROUGHT STEEL PIPE	-ASTM Designation A-53 (Schedule 40)
IRON CASTINGS	-ASTM Designation A-48 (Class No. 35)
CAST IRON PIPE	
STANCHIONS	-ANSI Class 125
MALLEABLE IRON	
CASTINGS	-ASTM Designation A-47
BOLTING MATERIALS	-Bolts, stud bolts, and nuts - ASTM Designation a-307
CHAINS	-ASTM Designation A-56
SPRING HANGERS	-ANSI Standard B-31.1

S 4.18 OVERHEAD HANGERS Overhead hangers shall be supported by vertical threaded rods, fastened to the various types of construction in the following manner:

Steel

- (a) By side I-Beam clamps or channel iron clamps of forged steel fastened directly to the steel beams or channels.
- (b) By welded steel brackets fastened to steel columns.

Concrete

By malleable iron concrete inserts or by expansion cases placed in the concrete.

Irrespective of the type of hanger-rod, sizes shall be determined by the size of pipe supported in accordance with the following schedule:

<u>Size of Pipe</u>	<u>Diameter of Rod</u>
3/4" to 2" inclusive	3/8 inch
2 1/2" to 3 1/2", inclusive	1/2 inch
4" to 5", inclusive	5/8 inch
6"	3/4 inch
8" to 12', inclusive	7/8 inch
14" O.D. and 16" O.D.	1 inch

The foregoing schedule is based on Schedule 80 - Wrought Iron and Wrought Steel Pipe ANSI Standard B 36.10, filled with water. Then heavier pipe is to be supported, the distance between rods shall be lessened or rods of greater diameter shall be used. For multiple pipes on trapeze type hangers, use appropriate hanger rods based on the table above and the number and sizes of pipes. Trapeze angers shall be constructed from 2 structural steel angles back to back with space in between for the hanger rods.

S 4.19 WALL AND FLOOR SUPPORTS

Supports for piping from walls, columns and floors of the various structures shall be as follows except where otherwise indicated, specified or approved:

From Walls or Columns- Welded steel brackets and adjustable stands, of the roll type or approved equal.

- (a) Pipe rolls or chairs with bases.
- (b) Saddle stands or stanchions.

Brackets shall be made of welded wrought steel and shall be designed for three maximum loads classified as follows:

Light	750 pounds
Medium	1,500 pounds
Heavy	3,000 pounds

Where medium or heavy brackets are bolted to walls, back plates of adequate size and thickness shall be furnished and installed to distribute the load against the wall. Where the use of back plates is not practicable, the brackets shall be fastened to the wall in an approved manner. Pipe rolls or chairs shall be of the cast iron type. When specified, shown or required, they shall be furnished adjustable.

Saddle stands shall be of the adjustable type. Each stand shall consist of a length of wrought steel pipe fitted at the base with a standard screw threaded cast iron flange and at the top with an adjustable saddle or roll. The base flange shall be bolted to floor or foundation.

Column supports of the cast iron pipe type or of the built-up structural steel type, of approved design, shall be installed when specified, shown or required.

Where, in the opinion of the Engineer, adjustable supporting devices are not required, pipe lines three inches in diameter and smaller may be supported on approved cast iron, malleable iron or wrought steel hooks, hook plates, ring or ring plates, offset clamps, or wall brackets with U-bolts.

Pipe supports for non-insulated copper tubes shall be copper plated.

S 4.20 ANCHORS

Anchors shall be furnished and installed when specified, shown or required for holding the pipe lines and equipment in position or alignment. All anchors shall be designed for rigid fastening to the structures either directly or through brackets. The design of all anchors shall be subject to approval.

Anchors for piping shall be of the cast iron chair type with wrought steel straps, except where

anchors form an integral part of pipe fittings or where an anchor of special design is required.

S 4.21 CONCRETE INSERTS

All concrete inserts shall be galvanized steel and shall be installed in the concrete structures where required for fastening supporting devices. They shall be designed to permit the rods to be adjusted horizontally in one plane and to automatically lock the rod nut or head. Inserts shall be recessed near the upper flange to receive reinforcing rods. To facilitate installation, nail slots shall be provided in the exposed flanges of the insert. Inserts shall be designed to safely carry the maximum load that can be imposed by the rod which they engage.

S 4.22 FLEXIBLE JOINT

The Contractor shall furnish and install as shown on the plans, flanged spool-type rubber expansion joints, equal to General Rubber Corporation Style 1075.

The body of the expansion joints is to have a single arch, to compensate for pipe motion due to thermal expansion and contraction.

The expansion joint shall be constructed with a rubber tube, suitable plies of fabric and steel wire reinforcement, a protective Ethylene-Propylene Diene Monomer cover, and to be complete with integral flanges on each end.

Rubber expansion joints are to be supplied complete with 3/8" thick split steel retaining rings having matching 125 lb. standard drilling. Proper anchoring of the metal piping on both side of the Expansion Joint is required.

S 4.23 SUBMITTALS

Certifications. Tests and Inspections required under this Section shall be certified in accordance with the Contract Documents and shall be submitted for review by ENGINEER.

Shop Drawings. Electronic shop drawings are required for the following:

- (1) Pipe and Fittings
- (2) Bedding Material Sieve Analysis
- (3) Imported Backfill Material Sieve Analysis
- (4) Pipe to Manhole Wall Connectors

Other Submittals. Other submittals required are as follows:

- (1) Pipe Testing Procedure and Instruments

END OF SECTION S-4

SECTION S-5 CONCRETE VALVE PIT

S 5.01 PRECAST CONCRETE VALVE PIT

The valve pit shall be constructed of precast reinforced concrete with a flat slab top section, as manufactured by International Pipe and Ceramics Corp. or Armco Steel Corp. or equal. The minimum compressive strength of the concrete for all sections shall be 4,000 lbs. per sq. inch. The maximum allowable absorption of the concrete shall not exceed 8% of the dry weight. Tests shall be similar to those described in ASTM C76. The circumferential reinforcement in the walls of all sections shall be a minimum of 0.12 sq. in. per linear ft. for inside diameters up to and including 54 in., and 0.17 sq. in. per linear ft. for the larger sizes. Reinforcement in flat slab top section shall be designed to support H-20 Loading.

Joints of the valve pit shall be formed entirely of concrete in accordance with ASTM Designated C361 and shall be made with a rubber gasket installed in accordance with the manufacturer's recommendations. Joints shall be self-centered and watertight against internal and external hydrostatic pressure with only the gasket utilized as the sealing element. Ship lap joints with rubber butyl sealant may also be utilized, as approved by the Authority or its Engineer. Each joint shall be mortared on the outside before backfilling.

There shall be two (2) flexible joints on each pipe and within 24" outside the valve pit wall, one of which may be embedded in the valve pit wall.

A concrete fill shall be poured in the base to form a slope to sump. Slope shall be entirely of monolithically poured concrete and shall be sloped to drain to the sump. Concrete used shall be a stiff, rich mix, and shall be given a steel trowel finish.

The valve pit access hatch shall be a Bilco JD-1AL 30"X48" Aluminum access door with ladder up assembly or approved equal. Ladder rungs shall be extruded aluminum alloy of the step drop front design, equal to Aluminum Co. of America or Washington Aluminum Co. Type 6061-T6. Rungs shall be cast in the side of the structure on 12 inch centers. Rungs of fiberglass coated steel may be approved by the Authority's Engineer upon submission of satisfactory technical information.

The flow meter located inside the valve pit shall be a 6" Tigermag as manufactured by Sparling, or approved equal. See Section S-6, Valves, for additional information on other components located within the valve pit.

S 5.02 SUBMITTALS

Shop Drawings. Shop Drawings are required for the following:

- (1) Precast Concrete Valve Pit with Associated Components
- (2) Internal Piping and Valves
- (3) Flow Meter
- (4) Valve Pit Access Hatch
- (5) Bedding Material
- (6) Pipe supports

END OF SECTION S-5

SECTION S-6 VALVES

S 6.01 VALVE SCHEDULE

The following schedule denotes the various types of valves that shall be furnished and installed by Contractor for the various piping systems, unless otherwise shown, noted, or specified.

<u>Name of Pipe</u>	<u>Valves</u>
Force Main	Gate Valves
Force Main	Check Valves
Valve Pit Drain	Check Valve

Valves shall be operated turning counter clockwise to open the valve and they shall be so marked with an arrow and the word "OPEN".

S 6.02 GATE VALVES

Gate valves shall be iron body, bronze mounted, double disc, parallel seat, non-rising stem, with O-ring stuffing box conforming to the requirements of AWWA Specifications C500. All valves shall be opened left (counter clockwise). All valves shall be Mueller Corporation AWWA gate valves or approved equal, with full diameter openings.

Valves 2 1/2 inches and less shall have threaded ends for screwed joints, except those for installation on copper tubing, which shall have recessed ends for soldered joints.

Valves for buried installation underground shall be furnished complete with extension stem, tee wrench, valve box and cover. All exposed valves shall be furnished with hand-wheels.

S 6.03 PLUG VALVES – NOT USED

S 6.04 CHECK VALVES

Valves 3" (inch) and larger shall be iron-body, bronze mounted, spring loaded and weighted lever, swing check valves designed for a working pressure of not less than 150 pounds, W.O.G. non-shock, and shall be as manufactured by Darling Valve and Manufacturing Co., A.P. Smith Manufacturing Co., Mueller Corp., or approved equal.

The valve pit drain line shall be fitted with a Check Valve, as manufactured by Tideflex or approved equal.

S 6.05 VALVE STEMS AND EXTENSION STEMS

Unless otherwise specified valve stems and extension stems shall be of bronze conforming to the requirements of ASTM Designation B147, Alloy 8A or B132, Alloy A. Stems shall be of a suitable size to provide for the operation of the valve under all conditions. Threads shall be of the square or Amce type, unless otherwise required or permitted. Approved stem guides shall be provided where required; guides shall be spaced not more than 8 feet on centers.

Extension stems for buried valves shall be of sufficient length to permit setting the operating nuts 3 inches below the top of the valve box cover.

S 6.06 TESTS FOR VALVES AND GATES

All valves shall be shop tested at hydrostatic pressures equal to twice the working pressures. The manufacturer shall furnish the Engineer with certified copies of the test reports.

S 6.07 MARKING VALVES AND GATES

All valves and gates shall have the size of the opening, the name of the maker, and the working water pressure for which they are designed, cast in raised letters upon the body of yoke. All operating floor stands and bench stands for valves and gates shall have the name of the maker cast upon a prominent part.

S 6.08 VALVE TAGS AND CHARTS

Each valve shall be identified with a permanent tag bearing distinguishing numbers and letters corresponding to those on required valve charts. The tags shall be 1 1/2 inches diameter, brass, Style P- 250, as manufactured by Seton Nameplate Co., with depressed black-filled numbers 1/2 inches high and letters 1/4 inches high, as determined by the Engineer. The tags shall be securely fastened to the valves with 4 ply smooth copper wire, brass "S" hooks, or brass jack chain.

S 6.09 PAINTING

The ferrous surfaces of all valve interiors shall be given 2 shop coats of an approved asphaltum varnish or other approved coating.

The exterior ferrous surfaces of all valves shall be given a shop primer.

Valve boxes and curb boxes shall be painted inside and outside with two coats of asphaltum varnish.

END OF SECTION S-6

SECTION S-8 EROSION AND SEDIMENT CONTROL

S 8.01 GENERAL

1.01 GENERAL REQUIREMENTS

- A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.02 WORK INCLUDED

- A. Work of this Section includes all labor, materials, equipment and services necessary to complete the temporary erosion control measures as shown on the drawings or as ordered by the Engineer or Owner's Field Representative. The Contractor is responsible for maintaining all required and supplemental erosion and sediment control measures and water pollution control devices for the duration of this project. The required measures shall include but not be limited to the following:

1. Silt Fence
2. Inlet Protection
3. Tree Protection
4. Filter Bag
5. Construction Access Area
6. Temporary Soil Stockpile
7. Concrete Washout
8. Construction Fence
9. Temporary and Permanent Seeding
10. Dust Control

1.03 RELATED WORK

- A. S-1 Earthwork and Backfill
- B. S-4 Pipes
- C. S-7 Restoration of Surfaces

1.04 QUALITY ASSURANCE

- A. The Contractor shall perform all his operations in accordance with the rules, regulations and ordinances of those governing bodies having jurisdiction.
- B. Compliance with Other Regulations
 1. Unless otherwise provided, the Owner will obtain all permits and the Contractor shall comply with applicable regulations of fish, wildlife and other agencies and all applicable, Federal, State and Local statutes relating the prevention and abatement of soil erosion

and water pollution. The Contractor shall request assurance of these permits prior to beginning construction operations.

2. In the event of conflict between the requirements of these Project Specifications and the pollution control laws, rules or regulations of Federal, State or Local agencies, the more restrictive laws, rules or regulations shall govern.

C. Satisfactory Performance

1. Soil erosion and water pollution control measures are of the utmost importance on this site. Soil erosion and water pollution control measures shall at all times be satisfactory to the Owner's Field Representative. When it becomes necessary, the Owner's Field Representative will inform the Contractor of unsatisfactory construction procedures and operations. If the unsatisfactory construction procedures and operations are not corrected promptly, the Owner's Field Representative may suspend the performance of any or all other construction until the unsatisfactory condition has been corrected, and such suspension shall not be the basis of any claim by the Contractor for additional compensation from the Owner nor for an extension of time to complete the Work. The Contractor is responsible for installing and maintaining adequate erosion and sediment control measures regardless of what is shown on the plans to insure there are no adverse offsite erosion and sediment control impacts.

1.05 SUBMITTALS

- A. Prior to the Start of the construction, the Contractor shall submit to the Engineer and Owner's Field Representative his program and schedule for accomplishment of temporary and permanent erosion control work applicable during all phases of construction, and his plan for disposal of waste materials. Where erosion is likely to be a problem, clearing and grubbing operations shall be scheduled so that grading operations and permanent erosion control features can follow immediately thereafter, if the Project conditions permit; otherwise temporary erosion control measures may be required between successive construction stages. No Work shall be started until the erosion control schedule and methods of operations have been accepted by the Engineer and Owner's Field Representative.
- B. The Contractor shall submit the following material designs for the type specified prior to materials being delivered to the site:
 1. Silt Fence
 2. Inlet Protection
 3. Tree Protection
 4. Filter Bag
 2. Dust Control Materials, including application rates
 3. Temporary Seeding, including application rates

4. Filter Bags

1.06 DELIVERY, STORAGE & HANDLING (NOT USED)

1.07 JOB CONDITIONS

- A. Protection of existing conditions as indicated in Section S-17 of these Project Specifications shall apply to this Section.
- B. The Contractor shall provide all necessary safeguards as may be required to prevent damage to property beyond the Work area or adjacent property.
- C. Area of Work
 - 1. The Owner's Field Representative shall have the authority to increase or decrease the surface area of erodible earth material exposed by clearing and grubbing, and/or excavation and fill operations, and to direct the Contractor to provide immediate permanent or temporary pollution control measures to prevent contamination of adjacent streams or other watercourses, lakes, ponds or other areas of water impoundment. Other than the specific authority of the Owner as outlined above, the Contractor shall not disturb more than 5 acres at anyone time.
 - 2. The Contractor is responsible for maintaining all necessary erosion and sediment control measures for the life of the contract. The Contractor is responsible for making weekly site assessments or after each significant rainfall (significant for purposes of this section shall mean and rainfall in excess of 0.5") and make any and all necessary adjustments or repairs to the in place measures.
 - 3. In general, the limit of the area of clearing and grubbing and/or excavation and fill operations in progress, shall be commensurate with the Contractor's capability and progress in keeping the finished grade, mulching, seeding and other such permanent control measures current and in accordance with the accepted schedule. Should seasonal limitations make such coordination unrealistic, as determined by the Owner's Field Representative, temporary erosion control measures shall immediately be provided by the Contractor.
- D. Temporary Erosion Control Measures
 - 1. Temporary erosion control measures shall be used to correct conditions which develop during construction that are needed prior to installation of permanent control features, or that are temporarily needed to control erosion that develops during normal construction practices, but which are not associated with permanent control features on the Project. All slopes and stockpile areas which will remain undisturbed and/or not topsoiled and seeded for a period of fifteen (15) days shall be temporarily seeded as specified on Drawings.
- E. Permanent Erosion Control Measures

1. The Contractor shall incorporate all permanent erosion control features into the Project at the earliest practical time as outlined in his accepted schedule. Slopes shall be seeded as each ten (10) foot incremental height is satisfactorily completed.

1.08 WARRANTY (NOT USED)

S 8.02 PRODUCTS

2.01 MATERIALS

- A. All materials shall be in accordance with the items specified on the Drawings and/or contained in the United States Department of Agriculture-Soil Conservation Service "Standards and Specifications for Soil Erosion and Sediment Control in Developing Areas".

S 8.03 EXECUTION

3.01 INSPECTION

- A. Examine the areas and conditions Erosion Control Measures are to be installed and notify the Engineer of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected by the Contractor in a manner acceptable to the Engineer.

3.02 INSTALLATION

- A. General Requirements
 1. The Contractor shall conduct his operations to minimize erosion of soils and to prevent silting and muddying of streams, rivers, irrigation systems, impoundments (lakes, reservoirs, etc.) and lands adjacent to or affected by the Work, in accordance with the approved Sequence of Construction, Drawings and these Project Specifications.
 2. Construction of drainage facilities and performance of other Work which will contribute to the control of erosion and sedimentation shall be carried out in conjunction with earthwork operations or as soon thereafter as practical.
 3. Where erosion is likely to be a problem, clearing and grubbing operations shall be scheduled so that grading operations and permanent erosion control features can follow immediately thereafter, if the Project conditions permit; otherwise, temporary erosion control measures may be required between successive construction stages. The area of bare soil exposed at any one time by construction operations shall be kept to a minimum.
 4. Throughout all operations covered by this Section, the Contractor

shall provide all necessary measures to control dust through the use of water, calcium chloride or other material in accordance with the approval of the Owner's Field Representative, at such locations and during such periods as he may direct, or as may be required by Local Ordinance or Authorities.

B. Waterways

1. All waterways shall be cleared as soon as practical of formwork, sheeting, debris or other obstructions placed during construction operations and which are not a part of the finished Work.
2. Ditches which are filled or partly inoperative shall be cleaned and made operative before the Contractor stops work for any day, and for the duration of the Contract shall be maintained in a condition satisfactory to the Owner's Field Representative.

C. Temporary Erosion Control Measures

1. Temporary erosion control measures shall be used to correct conditions which develop during construction that are needed prior to installation of permanent control features, or that are temporarily needed to control erosion that develops during normal construction practices, but which are not associated with permanent control features on the Project.
2. All slopes and stockpile areas which will remain undisturbed and/or not topsoiled and seeded for a period of fifteen (15) days shall be temporarily seeded as specified on Drawings.

D. Sediments and Pollutants

1. Water from operations containing sediment shall be treated by filtration, settling basins or other approved means sufficient to reduce the sediment content to no more than that of the stream into which it is discharged.
2. Pollutants such as fuels, lubricants, bitumens, raw sewage and other harmful materials shall not be discharged into or near rivers, streams, and impoundments or into natural or manmade channels leading thereto. Wash water or waste from concrete mixing operations shall not be allowed to enter live streams.

E. Permanent Erosion Control Measures

1. The Contractor may be required to incorporate permanent erosion control features into the Project at the earliest practical time as outlined in his accepted schedule. Slopes shall be seeded as each ten (10) foot incremental height is satisfactorily completed.
2. No area shall receive permanent seeding prior to approval by the Owner's Field Representative.

F. Dust Control

1. Watering equipment shall consist of pipelines, tanks, tank trucks or

other approved devices capable of applying a uniform spread of water over the surface. A suitable device for regulating the flow and positive shut-off of the water shall be provided for positive control by the operator.

2. The Owner's Field Representative will advise the Contractor of any unsatisfactory procedures for dust control. If the unsatisfactory procedures are not corrected promptly, the Owner's Field Representative may suspend the performance of any or all construction until the condition has been corrected.

END OF SECTION S-8

SECTION S-9 SITE PREPARATION

S 9.01 GENERAL

1.01 GENERAL REQUIREMENTS

- A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.02 WORK INCLUDED

- A. Work of this Section includes all labor, materials, equipment and services necessary to complete the Site Preparation as shown on the drawings and specified herein, including, but not limited to, the following:
 1. Installation of erosion control devices as shown on drawings.
 2. Clearing and grubbing.
 3. Removal of structures, obstructions and utilities.
 4. Protection of existing structures and utilities to remain.
 5. Protection of existing trees, landscaping and natural features to remain.

1.03 EXISTING UTILITY

- A. The contractor shall have all existing utilities on the project site located by a qualified Utility Locator Company.

1.04 QUALITY ASSURANCE

- A. The Contractor shall perform all his operations in accordance with the rules, regulations and ordinances of those governing bodies having jurisdiction.

1.05 SUBMITTALS

- A. The Contractor shall submit a schedule of his proposed methods and operations of Site Preparation for review and approval prior to start of Work.

1.06 DELIVERY, STORAGE & HANDLING (NOT USED)

1.07 JOB CONDITIONS

- A. Locations shown on Drawings not Guaranteed
 1. The structures, obstructions, utilities, trees and shrubs shown on the Drawings are those known to exist, but their location is not guaranteed to be exact, nor is it guaranteed that all structures, obstructions, utilities, trees and shrubs are shown. The Contractor shall, however, be responsible for the protection of all structures, obstructions, utilities, trees and shrubs, whether shown on the

Drawings or not.

2. Should any discrepancy be found between points, lines or grades shown on Drawings and actual field conditions, the Contractor shall immediately inform the Contract and Design Engineer of such discrepancy and shall not proceed with the work affected thereby until necessary instructions are received from the Contract and Design Engineer.

B. Safeguards and Protection

1. The Contractor shall provide all necessary safeguards including the installation of shoring, structural supports, protective fencing and barriers, etc., as may be required to prevent damage to adjacent property or injury to persons. All Work shall be performed in accordance with the requirements of the local building codes and the rules, regulations and ordinances of all other governing bodies having jurisdiction. The Contractor will be held responsible for any claim arising from his failure to provide proper safeguards or for his failure to conduct his operation in a manner consistent with the rules, regulations and ordinances of these governing bodies having jurisdiction.

C. Replacement of Disturbed Ground Surfaces

1. The Contractor shall at his own expense, repair or replace all ground surfaces, pavements, sidewalks, curbs, etc., which are to remain and which may become disturbed or damaged due to his operations. Said repair or replacement shall be satisfactory to the Contract and Design Engineer and in accordance with the requirements of the governing bodies having jurisdiction.

D. Damage

1. The Contractor, at his own expense, shall make good, repair and/or replace all damage occurring as a direct or indirect result of his operations.

E. Notification of Utility Owners

1. The Contractor shall notify all utility owners at least seventy-two (72) hours prior to the start of any operation that will affect utilities, whether to remain or to be discontinued, removed, relocated and/or reconstructed and at all other times as may be specified by law. The Contractor will be held responsible for any claims arising from his failure to make such notification, or for his failure to do the work in accordance with the rules and regulations of the governing authorities.

F. Demolition

1. All structures and buildings designated for disposal shall be demolished onsite. Unless otherwise specified, the salvage value of all materials in these structures and buildings shall accrue to the

Contractor and shall be reflected in the Proposal.

G. Cleaning

1. Upon completion of site preparation and prior to commencing site construction, clean areas within contract limits, remove tools and equipment. Provide site clear, clean, and free of materials and debris, and suitable for earthwork operations.

1.08 WARRANTY NOT USED

S 9.02 PRODUCTS

2.01 MATERIALS DEFINITIONS

- A. Construction signs, lights, flares, barricades and protective devices shall conform to the "Manual of Uniform Traffic Control Devices".
- B. Materials for construction access and staging areas shall conform to the appropriate sections of the specifications.

S 9.03 EXECUTION

3.01 INSPECTION

- A. Examine the areas and conditions where Site Preparation is to be performed and notify the WPCA of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until satisfactory conditions have been corrected by the Contractor in a manner acceptable to the Contract and Design Engineer.

3.02 INSTALLATION

- A. Stakeout of Site Layout and Grading:
 1. General Requirements
 - (a) The Contractor shall stakeout the proposed work. On completion of stakeouts, prior to start of clearing, the Owner's Field Representative shall make a field inspection.
 - (b) Maintain all benchmarks, monuments, and any other existing or newly established reference points. Replace them if they are disturbed or destroyed.
 - (c) Locate, protect and maintain active utilities and site improvements to remain.
- B. Clearing and Grubbing
 1. General Requirements:

Clear and grub within Contract limits or limit of disturbance as required for utilities installation and execution of the work. Clearing

and grubbing work includes, but is not limited to: the removal of trees, brush, stumps, wooded growth, grass, shrubs, poles, posts, signs, fences, culverts and other vegetation and minor structures; the protection of designated wooded growth; the storage and protection of minor structures and materials which are to be replaced; the disposal of non-salvageable structures and materials; necessary preliminary grading; and the removal of rubbish and other perishable or objectionable materials, as directed by the Contract and Design Engineer.

- (a) Limit clearing and grubbing for utility corridors and access ways to area widths determined by the Contract and Design Engineer as necessary for proper installation and reasonable access.
- (b) Restore materials and structures to be replaced to their original condition and location as closely as possible.
- (c) Repair any damage to structures using the same materials contained in the structures, to the complete satisfaction of the Contract and Design Engineer.

2. Preparation:

- (a) Carefully preserve and protect from injury all trees and/or shrubs marked to be saved.
- (b) Right-of-Way:
 - 1. Where excavation is required on public or private rights-of-way containing trees, shrubs, other growth, or any structure or construction, obtain the Contract and Design Engineer direction concerning the extent to which such obstacles can be cleared or stripped prior to performing work.
 - 2. In all rights-of-way, remove only those particular growths or structures which are, in the opinion of the Contract and Design Engineer, essential for construction operations.
 - 3. All other removals or damage shall be replaced or restored at the Contractor's expense.
 - 4. No work within public right-of ways shall be performed until municipal or State approvals are obtained.

3. Disposal

- (a) All material obtained from clearing and grubbing shall become the property of the Contractor and, unless otherwise specified, shall be disposed of offsite in an approved disposal site, in accordance with all applicable local and state laws, ordinances, and code requirements.

- (b) Accumulation is not permitted. Dispose of material to be removed daily as it accumulates. Maintain disposal routes clear, clean and free of debris.
 - (c) Remove and dispose offsite all tree protection materials at end of construction period as determined by the Contract and Design Engineer.
4. Replacement of Materials: Properly store and preserve all material to be replaced in a location approved by the Contract and Design Engineer.
- (a) Shrubs and Bushes: Remove, store and replace ornamental shrubs and bushes to be preserved in accordance with accepted horticultural practices.
 - (b) Topsoil: Carefully remove, store, and protect topsoil.
 - (c) Responsibility: Replace, at no additional cost to the WPCA, materials lost or damaged because of careless removal or neglectful or wasteful storage, disposal or use of these materials.

C. Removal of Structures, Utilities and Obstructions

1. General Requirements

- (a) The Contractor shall remove and dispose of those existing structures, utilities and obstructions which interfere with the proposed construction as shown on the Drawings, and as determined in the field by the Contract and Engineer. This shall include, but not necessarily be limited to, buildings and building foundations, fences, guide rails, walls, poles, pole bases, catch basins, inlets, manholes, vaults, tanks, conduit, pipes and appurtenances, floor slabs, pavements, sidewalks, curbs, signs and sign supporting structures.
- (b) The Contractor shall remove only those items and structures that he has been authorized to remove, either by specific directions given on the Drawings or by written instructions given before or during the progress of the Work by the Engineer or the WPCA.
- (c) The Contractor will be held responsible for any claim arising from his removal of any existing item or structure without the required authorization specified herein.

2. Portions of Pavements, Curbs, etc., to Remain

- (a) In removing portions of pavements, curbs, sidewalks, driveways and similar items where other portions of such items are to remain, removal shall be to an existing joint. Where this is not practical, as determined by the WPCA,

removal shall be to a reasonably true line with vertical face, which shall be cut with a power driven concrete saw or by other approved mechanical line cutting methods.

3. Disposal of Material

- (a) All waste material obtained from the removal of structures and obstructions, including, but not limited to, concrete matted together by reinforcing, plaster, wood, paper, asphalt shingles, tanks, metal and miscellaneous debris, shall be disposed of offsite.

D. Protection of Existing Structures and Utilities

1. General Requirements

- (a) The Contractor shall be responsible throughout the course of the Work for protection from injury or damage of all existing structures and utilities, which are to remain.
- (b) All existing gas and water lines, telegraph, telephone and electric poles, wires, conduits, sewers, drains, culverts, fire hydrants and other utilities which are to remain shall be carefully supported, maintained in operation and protected from injury or damage by the Contractor.
- (c) The Contractor shall sling, support, shore up and secure in place all pipe or conduits, without damage thereto. The Contractor shall provide for and maintain, by means of suitable temporary channels or pipe, the flow of drainage and watercourses, whether on the surface or underground, which may be interrupted during the progress of the Work. All Works of drainage intercepted or disconnected, shall be restored and/or rebuilt to the extent made necessary by the new Work, and all temporary material required for such construction shall immediately be removed therefrom when no longer required.

2. Dead-End Pipe and/or Conduit to be sealed

- (a) When pipe, conduits or sewers are removed from trenches, leaving dead ends in the ground, the Contractor shall carefully plug or bulkhead such ends with brick and mortar or in such other manner as may be satisfactory to the Owner's Field Representative or representatives of the utility owner.

E. Protection of Existing Landscaping and Natural Features

1. General Requirements

- (a) The Contractor shall protect, throughout the course of construction, all such trees as are shown on the Drawings

or marked by the Contract and Design Engineer as to be protected, from damage and harmful occurrences including:

- (1) Compaction of root area by moving trucks or heavy equipment.
 - (2) Storage of heavy equipment, supplies, gravel, and earth fill within the drip-line of trees and shrubs.
 - (3) Trunk damage by leaning supplies and equipment against trees.
 - (4) Nailing, screwing, or bolting objects to trees other than protective barriers.
 - (5) Strangulation by attaching ropes, guy wires, or power lines to trunks or branches.
 - (6) Poisoning by spilling or discarding noxious paint, cement, solvents, oil, and gasoline around trees and roots; or by runoff of such material from other areas.
 - (7) Avoid cutting of roots in the process of excavation for trenching.
 - (8) Damage to branches by temporary overhead lines.
 - (9) Damage by moving vehicles and equipment.
 - (10) Improper pruning to allow for construction.
 - (11) Damage to root system by flooding and ponding caused by grade changes.
 - (12) Damage to root system from mud or silt buildup from construction area drainage.
- (b) The Contractor shall also protect throughout the course of construction all landscaping, vegetation and natural features on public and private property. The Contractor shall use every precaution to prevent injury, damage, pollution, erosion or destruction of existing landscaping, vegetation and natural features, including, but not limited to drainage-ways, ponds, lakes, swamps, woods and fields.

2. Protective Fencing

- (a) The Contractor shall protect trees, shrubs and areas to be left undisturbed with armoring and fencing. Place the protective barriers before any excavation or grading has begun and maintained and repaired throughout the construction period.
- (b) Fencing shall be located at the drip-line of trees to be protected unless otherwise approved by Contract and Design Engineer. If it is necessary to reduce the distance between fencing and tree trunk as determined by Contract and Design Engineer, the minimum distance between fence and tree trunk shall be determined by the caliper of

the tree to be protected. For each inch of tree caliper, the fence shall be 12" distant with a minimum of 18".

F. Maintenance and Protection of Traffic

1. General Requirements

- (a) The Contractor shall maintain traffic as required during the course of construction in such a manner satisfactory to the WPCA and authorities having jurisdiction. The Contractor shall comply with all rules and regulations of those governing bodies having jurisdiction on the adjacent roadways, and shall obtain required permits and pay all fees, deposits and charges in connection with same.

2. Conduct of Work

- (a) The Contractor shall furnish, install and maintain construction signs, lights, flares, fences, barricades, steel plates, and/or all other protective devices necessary and required to adequately maintain both vehicular and pedestrian traffic during construction. He shall provide all personnel necessary for directing and controlling traffic. Traffic entering and exiting the site shall be regulated and maintained so as not to disrupt the normal flow of highway traffic. Emergency personnel and equipment shall have safe and adequate access at all times to the site.

END OF SECTION S-9

SECTION S-10 ADMINISTRATIVE REQUIREMENTS

PART 1 - GENERAL

S 10.01 SECTION INCLUDES

- A. Preconstruction meeting.
- B. Site mobilization meeting.
- C. Progress meetings.
- D. Construction progress schedule.
- E. Coordination drawings.
- F. Submittals for review, information, and project closeout.
- G. Number of copies of submittals.
- H. Submittal procedures.
- I. Scheduling meeting at condominium boards.

S 10.02 PROJECT COORDINATION

- J. Project Coordinator: Contractor
- K. Cooperate with the WPCA in allocation of mobilization areas of site; for material storage, vehicular access, traffic, and parking facilities.
- L. During construction, coordinate use of site and facilities through the WPCA.
- M. Comply with WPCA procedures for intra-project communications; submittals, reports and records, schedules, coordination drawings, and recommendations; and resolution of ambiguities and conflicts.
- N. Comply with instructions of the WPCA for use of temporary utilities and construction facilities.
- O. Coordinate field engineering and layout work under instructions of the WPCA.
- P. Make the following types of submittals to the Engineer:
 - 1. Requests for interpretation and/or information.
 - 2. Requests for substitution.
 - 3. Shop drawings, product data, and samples.

4. Test and inspection reports.
5. Manufacturer's instructions and field reports.
6. Applications for payment and change order requests.
7. Progress schedules.
8. Coordination drawings.
9. Closeout submittals.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

S 10.03 PRECONSTRUCTION MEETING

- A. WPCA will schedule a meeting after Notice of Award.
- B. Attendance Required:
 1. WPCA.
 2. Langan.
 3. Keystone.
 4. Integral Engineering Services.
 5. Professional Consultants (as required).
 6. General Contractor.
 7. Major Subcontractors.
- C. Agenda:
 1. Execution of Agreement.
 2. Submission of executed bonds and insurance certificates.
 3. Distribution of Contract Documents.
 4. Submission of list of Subcontractors, list of Products, schedule of values, submittal schedule and construction schedule.
 5. Designation of personnel representing the parties to Contract, Langan, and their consultants.
 6. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
 7. Scheduling.
- D. Record minutes and distribute copies within two days after meeting to participants, with one copy to Langan, WPCA, Keystone, participants, and those affected by decisions made.

S 10.04 SITE MOBILIZATION MEETING

- E. The WPCA will schedule a meeting at the Project site prior to commencement of construction.
- F. Attendance Required:

1. WPCA.
2. Langan.
3. Keystone, as necessary.
4. Integral Engineering Services, as necessary.
5. Professional Consultants (as required).
6. General Contractor.
7. Major Subcontractors.
8. Construction Manager.

G. Agenda:

1. Use of premises by relevant parties.
2. WPCA requirements.
3. Construction facilities and controls.
4. Temporary utilities.
5. Survey and layout.
6. Security and housekeeping procedures.
7. Schedules.
8. Application for payment procedures.
9. Procedures for testing.
10. Procedures for maintaining record documents.
11. Requirements for start-up of equipment.
12. Inspection and acceptance of equipment put into service during construction period.
13. Utility location.

- H. The Contractor will record minutes and distribute copies within two days after meeting to participants, with one copy to Langan, WPCA participants, and those affected by decisions made.

S 10.05 PROGRESS MEETINGS

- I. The contractor will schedule and administer meetings throughout progress of the Work at maximum intervals of one per month.
- J. The contractor will make arrangements for meetings, prepare agenda with copies for participants that preside at meetings.
- K. Attendance Required:
1. WPCA.
 2. Langan.
 3. Keystone, as necessary.
 4. Integral Engineering Services, as necessary.
 5. Professional Consultants (as required).
 6. General Contractor.
 7. Major Subcontractors.
 8. Construction Manager.

- L. Agenda:
 - 1. Review minutes of previous meetings.
 - 2. Review of Work progress.
 - 3. Field observations, problems, and decisions.
 - 4. Identification of problems or concerns, including those that impede, or will impede, planned progress.
 - 5. Review of submittals schedule and status of submittals.
 - 6. Review of off-site fabrication and delivery schedules.
 - 7. Maintenance of progress schedule.
 - 8. Corrective measures to regain projected schedules.
 - 9. Planned progress during succeeding work period.
 - 10. Coordination of projected progress.
 - 11. Maintenance of quality and work standards.
 - 12. Effect of proposed changes on progress schedule and coordination.
 - 13. Other business relating to Work.

- M. The contractor will record minutes and distribute copies within two days after meeting to participants with copies to all attendees, General Contractor and those affected by decisions made.

S 10.06 CONSTRUCTION PROGRESS SCHEDULE

- N. Within 10 days after date of the Agreement, submit preliminary schedule defining planned operations for the first 60 days of Work, with a general outline for remainder of Work.

- O. If preliminary schedule requires revision after review, submit revised schedule within 10 days.

- P. Within 20 days after review of preliminary schedule, submit draft of proposed complete schedule for review.
 - 1. Include written certification that major contractors have reviewed and accepted proposed schedule.

- Q. Within 10 days after joint review, submit complete schedule.

- R. Submit updated schedule with each Application for Payment.

S 10.07 SUBMITTALS FOR REVIEW

- S. All submittals to follow requirements set forth in the General Clauses of the Contract Documents.

END OF SECTION S-10

SECTION S-11 PHOTOGRAPHIC DOCUMENTATION

PART 1 - GENERAL

S 11.01 RELATED DOCUMENTS

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

S 11.02 SUMMARY

- B. This Section includes administrative and procedural requirements for the following:
 - 1. Pre-construction photographs.
 - 2. Pre-construction videotapes.

S 11.03 SUBMITTALS

- C. Qualification Data: For photographer.
- D. Key Plan: Submit key plan of Project site and building with notation of vantage points marked for location and direction of each photograph. Include same label information as corresponding set of photographs.
- E. Construction Photographs: Submit two prints of each photographic view within seven days of taking photographs.
 - 1. Format: 8-by-10-inch smooth-surface matte prints on single-weight commercial-grade photographic paper, enclosed back-to-back in clear plastic sleeves that are punched for standard 3-ring binder.
 - 2. Identification: On back of each print, provide an applied label or rubber-stamped impression with the following information:
 - a. Name of Project.
 - b. Name and address of photographer.
 - c. Name of Engineer.
 - d. Name of Contractor.
 - e. Date photograph was taken if not date stamped by camera.
 - f. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.
 - g. Unique sequential identifier.

- F. Videotapes: Submit two copies of each videotape with protective sleeve or case within seven days of recording. Remove safety tab to prevent accidental re-recording.
 - 1. Identification: On each copy, provide an applied label with the following information:
 - a. Name of Project.
 - b. Name and address of photographer.
 - c. Name of Engineer.
 - d. Name of Contractor.
 - e. Date videotape was recorded.
 - f. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.
 - g. Weather conditions at time of recording.

S 11.04 QUALITY ASSURANCE

- G. Photographer Qualifications: An individual who has been regularly engaged as a professional photographer of construction projects for not less than three years.

S 11.05 COORDINATION

- H. Auxiliary Services: Cooperate with photographer and provide auxiliary services requested, including access to Project site and use of temporary facilities, including temporary lighting required to produce clear, well-lit photographs without obscuring shadows.

S 11.06 USAGE RIGHTS

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

PART 2 - EXECUTION

S 11.07 CONSTRUCTION PHOTOGRAPHS

- A. Photographer: Engage a qualified commercial photographer to take construction photographs.
- B. General: Take photographs using the maximum range of depth of field, and that are in focus, to clearly show the Work. Photographs with blurry or out-of-focus areas will not be accepted.

1. Maintain key plan with each set of construction photographs that identifies each photographic location.
- C. Film Images:
1. Date Stamp: Unless otherwise indicated, date and time stamp each photograph as it is being taken so stamp is integral to photograph.
 2. Field Office Prints: Retain one set of prints of progress photographs in the field office at Project site, available at all times for reference. Identify photographs same as for those submitted to Engineer.
- D. Pre-Construction Photographs: Before starting construction, take color photographs of Project site and surrounding properties, from different vantage points, as directed by Engineer.

S 11.08 CONSTRUCTION VIDEOTAPES

- E. Videotape Photographer: Engage a qualified commercial videographer to record construction videotapes.
- F. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to show area of construction. Display continuous running time and date. At start of each videotape, record weather conditions from local newspaper or television and the actual temperature reading at Project site.
- G. Preconstruction Videotape: Before starting construction, record videotape of Project site and surrounding properties from different vantage points, as directed by Engineer.

PART 3 - PAYMENT

S 11.09 BASIS OF PAYMENT

- A. No separate payment will be made for Photographic Documentation. All work described in this section will be paid for in the prices bid for various items in the Schedule of Prices.

END OF SECTION S-11

SECTION S-13 AS-BUILT REQUIREMENTS

PART 1 - GENERAL

S 13.01 RELATED DOCUMENTS

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

S 13.02 SUMMARY

- A. This Section includes general procedural requirements governing execution of the as-built survey.

S 13.03 SUBMITTALS

- A. Certified Final As-Built: Submit two (2) paper copies, signed by professional land surveyor, and one electronic drawing in AutoCADD format, latest version, of the final as-built of the entire site after all construction operations are complete.

S 13.04 QUALITY ASSURANCE

- A. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

S 13.05 CONSTRUCTION AS-BUILTS

- A. All as-built submissions will be considered shop drawings and will be reviewed by the ENGINEER and returned to the CONTRACTOR. Each as-built must be approved by the ENGINEER before the CONTRACTOR can get paid for the as-built line item.
- B. The As-Built shall be prepared in a vertical datum acceptable to the WPCA.

- C. Final As-Builts shall be performed at a 25' x 25' grid across the entire site after all items of construction are complete. In addition to the grid throughout the grass and sod areas, all above ground flatwork shall be located and documented on the plan.

END OF SECTION S-13

**PUMP STATION ELECTRICAL AND
INSTRUMENTAL SPECIFICATIONS**

**SECTION 16010
ELECTRICAL DEMOLITION**

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Provide all labor, material and equipment to perform all electrical demolition as specified and as shown on the Drawings.
2. All equipment selected for demolition shall have power and communication cables de-energized and disconnected. All disconnected cables shall be removed.
3. All Power and Lighting panels circuit breakers shall be relabeled as spare where power was once fed to demolished equipment.
4. All conduit shall be disconnected and removed from demolished equipment.
5. Contractor is responsible for making equipment scheduled for demolition safe for removal.

PART 2 - PRODUCTS

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that field measurements and circuitry arrangements are as shown on the Drawings.
- B. Verify that abandoned wiring and equipment serve only abandoned facilities.
- C. Demolition work indicated on drawings are based on casual field observation and existing record documents. Report discrepancies to Engineer before disturbing any existing installation.
- D. The Contractor accepts existing conditions by starting demolition work.

3.2 PREPARATION

- A. Investigate the existing conditions of electrical system in walls, floors and ceilings scheduled for removal.
- B. Disconnect and deliver to the Owner those items requested to remain the Owner's property.
- C. Provide temporary wiring and connections to maintain existing systems in service where needed. When work must be performed on energized equipment or circuits, use personnel experienced in such operations.

3.3 DEMOLITION OF ELECTRICAL FACILITIES

- A. All items indicated to be removed shall become Contractor's property and removed from the site, except for items specified or requested in writing to remain the Owner's property.
- B. For demolition in buildings that are to remain in service after completion of demolition work:
 - 1. Remove exposed abandoned raceways, including abandoned raceways above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.
 - 2. Disconnect abandoned outlets and remove devices. Remove abandoned outlet boxes if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlet boxes which are not removed.
 - 3. Repair adjacent construction and finishes damaged during demolition and extension work.
 - 4. Maintain access to existing electrical installations which remain active. Modify installation or provide access panel as appropriate.
 - 5. Patch concrete pads to provide uniform surface.

3.4 DISPOSAL OF DEMOLISHED MATERIALS

- A. Except for items or materials indicated to be recycled, reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.
 - 1. Do not allow demolished materials to accumulate on-site.
 - 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
 - 3. Transport demolished materials off Owner's property and legally dispose of them.

3.5 CLEANING AND REPAIR (FOR FACILITIES TO REMAIN IN SERVICE)

- A. General
 - 1. Clean and repair existing materials and equipment which remain or are to be reused.
- B. Panelboards
 - 1. Clean exposed surfaces and check tightness of electrical connections. Replace damaged circuit breakers and provide closure plates for vacant positions. Provide typed circuit directory showing revised circuiting arrangement.
- C. Luminaires
 - 1. Remove existing luminaires for cleaning. Use mild detergent to clean all exterior and interior surfaces; rinse with clean water and wipe dry. Replace lamps, ballasts, and broken electrical parts.

END OF SECTION 16010

**SECTION 16050
BASIC ELECTRICAL MATERIALS AND METHODS**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Electrical equipment coordination and installation.
 - 2. Sleeves for raceways and cables.
 - 3. Sleeve seals.
 - 4. Common electrical installation requirements.

1.3 DEFINITIONS

- A. ATS: Acceptance Testing Specifications.
- B. EPDM: Ethylene-propylene-diene terpolymer rubber.
- C. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

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

1.5 QUALITY ASSURANCE

- A. Test Equipment Suitability and Calibration: Comply with NETA ATS, "Suitability of Test Equipment" and "Test Instrument Calibration."

1.6 COORDINATION

- A. Coordinate arrangement, mounting, and support of electrical equipment:
 - 1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
 - 2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
 - 3. To allow right of way for piping and conduit installed at required slope.

4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.
- B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.
- C. Coordinate electrical testing of electrical, mechanical, and architectural items, so equipment and systems that are functionally interdependent are tested to demonstrate successful interoperability.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

2.2 SLEEVES FOR RACEWAYS AND CABLES

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
- B. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.052- or 0.138-inch thickness as indicated and of length to suit application.

2.3 SLEEVE SEALS

- A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
 1. Available Manufacturers:
 - a. Advance Products & Systems, Inc.
 - b. Calpico, Inc.
 - c. Metraflex Co.
 - d. Pipeline Seal and Insulator, Inc.
 - e. Approved equal.
 2. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
 3. Pressure Plates: Plastic. Include two for each sealing element.

4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

- A. Comply with NECA 1.
- B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.
- C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.
- D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.
- E. Right of Way: Give to raceways and piping systems installed at a required slope.

3.2 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Electrical penetrations occur when raceways, cables, wireways, cable trays, or busways penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.
- B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
- C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
- D. Rectangular Sleeve Minimum Metal Thickness:
 1. For sleeve cross-section rectangle perimeter less than 50 inches and no side greater than 16 inches, thickness shall be 0.052 inch.
 2. For sleeve cross-section rectangle perimeter equal to, or greater than, 50 inches and 1 or more sides equal to, or greater than, 16 inches, thickness shall be 0.138 inch.
- E. Cut sleeves to length for mounting flush with both surfaces of walls.
- F. Extend sleeves installed in floors 2 inches above finished floor level.
- G. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed.
- H. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies.

- I. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint.
- J. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.
- K. Aboveground, Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- L. Underground, Exterior-Wall Penetrations: Install cast-iron "wall pipes" for sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing mechanical sleeve seals.

3.3 SLEEVE-SEAL INSTALLATION

- A. Install to seal underground, exterior wall penetrations.
- B. Use type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.4 FIELD QUALITY CONTROL

- A. Inspect installed sleeve and sleeve-seal installations and associated firestopping for damage and faulty work.

END OF SECTION 16050

**SECTION 16060
GROUNDING AND BONDING**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes methods and materials for grounding systems and equipment.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Plans showing dimensioned as-built locations of grounding features specified in Part 3 "Field Quality Control" Article, including the following:
 - 1. Bonding to water pipes.
 - 2. Bonding to foundation reinforcing steel.
- C. Field quality-control test reports.

1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70 by a qualified testing agency and marked for intended use.
- B. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 CONDUCTORS

- A. Insulated Conductors: Copper or tinned-copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
- B. Bare Copper Conductors:
 - 1. Solid Conductors: ASTM B 3.
 - 2. Stranded Conductors: ASTM B 8.
 - 3. Tinned Conductors: ASTM B 33.

2.2 CONNECTORS

- A. Listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used, and for specific types, sizes, and combinations of conductors and other items connected.
- B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, bolted pressure-type, with at least two bolts.
 - 1. Pipe Connectors: Clamp type, sized for pipe.
- C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

PART 3 - EXECUTION

3.1 APPLICATIONS

- A. Conductors: Install solid conductor for No. 12 AWG and smaller, and stranded conductors for No. 10 AWG and larger, unless otherwise indicated.
- B. Underground Grounding Conductors: Install bare copper conductor, No. 2/0 AWG minimum.
 - 1. Bury at least 24 inches below grade.
 - 2. Ground rings shall be buried a minimum of 30 inches below grade.
- C. Conductor Terminations and Connections:
 - 1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
 - 2. Underground Connections: Welded connectors.
 - 3. Connections to Structural Steel: Welded connectors.
 - 4. Connection to Foundation Reinforcing Steel: Welded connectors.

3.2 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with all feeders and branch circuits.

3.3 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. Bonding to Concrete Foundation Reinforcing Steel: Use exothermic-welded connectors to bond to 20 ft or more of 1/2 in. foundation and/or footing reinforcing steel at each buildings and structure. Where 20 ft of reinforcing steel is not available, imbed 20 ft or more of bare copper not smaller than 4 AWG.

- C. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.
 - 1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
 - 2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install so vibration is not transmitted to rigidly mounted equipment.
 - 3. Use exothermic-welded connectors for outdoor locations, but if a disconnect-type connection is required, use a bolted clamp.

- D. Grounding and Bonding for Piping:
 - 1. Install insulated copper grounding conductors, in conduit, from building's main service equipment or electrical grounding bus to metal piping entrances to building. Connect grounding conductors to metal water pipes using a bolted clamp connector or by bolting a lug-type connector to a pipe flange, using one of the lug bolts of the flange. Bond metal grounding conductor conduit or sleeve to conductor at each end.
 - 2. Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
 - 3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

3.4 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections and prepare test reports:
 - 1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
 - 2. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at individual ground rods. Make tests at ground rods before any conductors are connected.
 - a. Measure ground resistance not less than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
 - b. Perform tests by fall-of-potential method according to IEEE 81.

- B. Report measured ground resistances that exceed 10 ohms and include recommendations to reduce ground resistance.

END OF SECTION 16060

**SECTION 16073
HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Hangers and supports for electrical equipment and systems.
 - 2. Construction requirements for concrete bases.

1.3 DEFINITIONS

- A. RNC: Rigid non-metallic conduit.
- B. RMC: Rigid metal conduit.

1.4 PERFORMANCE REQUIREMENTS

- A. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.
- B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
- C. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

1.5 SUBMITTALS

- A. Product Data: For the following:
 - 1. Steel slotted support systems.
- B. Shop Drawings: Show fabrication and installation details and include calculations for the following:
 - 1. Steel slotted channel systems. Include Product Data for components.
 - 2. Equipment supports.

1.6 QUALITY ASSURANCE

- A. Comply with NFPA 70.

1.7 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 3.

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Cooper B-Line, Inc.; a division of Cooper Industries.
 - b. Thomas & Betts Corporation.
 - c. Unistrut; Tyco International, Ltd.
 - d. Approved equal.
 - 2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
 - 3. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
 - 4. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
 - 5. Channel Dimensions: Selected for applicable load criteria.
- B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.
- C. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.
- E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- F. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
 - 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) Hilti Inc.
 - 2) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
 - 3) MKT Fastening, LLC.
 - 4) Simpson Strong-Tie Co., Inc.; Masterset Fastening Systems Unit.
2. Mechanical-Expansion Anchors: Insert-wedge-type, stainless steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
 - 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) Cooper B-Line, Inc.; a division of Cooper Industries.
 - 2) Empire Tool and Manufacturing Co., Inc.
 - 3) Hilti Inc.
 - 4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
 - 5) MKT Fastening, LLC.
3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
6. Toggle Bolts: All-steel springhead type.
7. Hanger Rods: Threaded steel.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.
- B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for RNC and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.
- C. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

D. Locations:

1. Indoors: Install galvanized steel supports.
2. Outdoors, Wet Locations, Vaults: Install Stainless Steel 316 supports.

3.2 SUPPORT INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.
- B. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.
- C. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
1. To Wood: Fasten with lag screws or through bolts.
 2. To New Concrete: Bolt to concrete inserts.
 3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
 4. To Existing Concrete: Expansion anchor fasteners.
 5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.
 6. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69, Spring-tension clamps.
 7. To Light Steel: Sheet metal screws.
 8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.
- D. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 PAINTING

- A. Touchup: Comply with requirements in Division 9 painting Sections for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.
- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 16073

**SECTION 16075
ELECTRICAL IDENTIFICATION**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following
 1. Identification for raceway.
 2. Identification for conductors and communication and control cable.
 3. Underground-line warning tape.
 4. Warning labels and signs.
 5. Instruction signs.
 6. Equipment identification labels.
 7. Miscellaneous identification products.

1.3 SUBMITTALS

- A. Product Data: For each electrical identification product indicated.
- B. Wire and cable labeling scheme.
 1. Submit table detailing wire scheme for each control circuit installed under this Contract.
 2. Table shall include each terminating end point with terminal number, signal type, conduit number, and a unique wire identification number.

1.4 QUALITY ASSURANCE

- A. Comply with ANSI A13.1 and ANSI C2.
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.145.

1.5 COORDINATION

- A. Coordinate identification names, abbreviations, colors, and other features with requirements in the Contract Documents, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual, and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.

- B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- C. Coordinate installation of identifying devices with location of access panels and doors.

PART 2 - PRODUCTS

2.1 RACEWAY IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.
- B. Color for Printed Legend:
 - 1. Power Circuits: Black letters on an orange field.
 - 2. Legend: Indicate system or service and voltage, if applicable.
- C. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.
- D. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; 2 inches wide; compounded for outdoor use.

2.2 CONDUCTOR AND COMMUNICATION- AND CONTROL-CABLE IDENTIFICATION MATERIALS

- A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils (0.08 mm) thick by 1 to 2 inches (25 to 50 mm) wide.
- B. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.
- C. Write-On Tags: Polyester tag, 0.010 inch thick, with corrosion-resistant grommet and polyester or nylon tie for attachment to conductor or cable.
 - 1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.

2.3 UNDERGROUND-LINE WARNING TAPE

- A. Description: Permanent, bright-colored, continuous-printed, polyethylene tape.
 - 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 shall indicate type of underground line.

2.4 WARNING LABELS AND SIGNS

- A. Comply with NFPA 70 and 29 CFR 1910.145.
- B. Self-Adhesive Warning Labels: Factory printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment, unless otherwise indicated.
- C. Warning label and sign shall include, but are not limited to, the following legends:
 - 1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
 - 2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."

2.5 INSTRUCTION SIGNS

- A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch thick for signs up to 20 sq. in. and 1/8 inch thick for larger sizes.
 - 1. Engraved legend with black letters on white face.
 - 2. Punched or drilled for mechanical fasteners.
 - 3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.6 EQUIPMENT IDENTIFICATION LABELS

- A. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. White letters on a dark-gray background. Minimum letter height shall be 3/8 inch.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 30 A: Identify with orange self-adhesive vinyl label.
- B. Power-Circuit Conductor Identification: For conductors No. 1/0 AWG and larger in vaults, pull and junction boxes, manholes, and handholds use color-coding conductor tape and marker tape. Identify source and circuit number of each set of conductors. For single conductor cables, identify phase in addition to the above.
- C. Branch-Circuit Conductor Identification: Where there are conductors for more than three branch circuits in same junction or pull box, use marker tape. Identify each ungrounded conductor according to source and circuit number.

- D. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, signal, sound, intercommunications, voice, and data connections.
 - 1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
 - 2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
 - 3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and Operation and Maintenance Manual.

- E. Control Circuit Point to Point Identification and Labeling:
 - 1. Wire label to contain unique wire number and shall identifying each terminating end point.
 - 2. Wire Label shall be applied at each end of each circuit, and shall include:
 - a. Each terminating end point with terminal number.
 - b. Signal type (DI, DO, AI or AO)
 - c. Conduit number
 - d. A unique wire identification number.

- F. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable..
- G. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Comply with 29 CFR 1910.145 and apply self-adhesive warning labels. Identify system voltage with black letters on an orange background. Apply to exterior of door, cover, or other access.
 - 1. Equipment with Multiple Power or Control Sources: Apply to door or cover of equipment including, but not limited to, the following:
 - a. Power transfer switches.
 - b. Controls with external control power connections.
 - 2. Equipment Requiring Workspace Clearance According to NFPA 70: Unless otherwise indicated, apply to door or cover of equipment but not on flush panelboards and similar equipment in finished spaces.

- H. Instruction Signs:
 - 1. Operating Instructions: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.
 - 2. Emergency Operating Instructions: Install instruction signs with white legend on a red background with minimum 3/8-inch- high letters for emergency instructions at equipment used for power transfer.

- I. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control

panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.

1. Labeling Instructions:
 - a. Indoor Equipment: Engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch- high letters on 1-1/2-inch- high label; where 2 lines of text are required, use labels 2 inches high.
 - b. Outdoor Equipment: Engraved, laminated acrylic or melamine label.
 - c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.

2. Equipment to Be Labeled:
 - a. Panelboards, electrical cabinets, and enclosures.

 - b. Transformers.
 - c. Disconnect switches.
 - d. Enclosed circuit breakers.
 - e. Power transfer equipment.
 - f. Power-generating units.
 - g. Monitoring and control equipment.

3.2 INSTALLATION

- A. Verify identity of each item before installing identification products.
- B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
- C. Apply identification devices to surfaces that require finish after completing finish work.
- D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.
- E. System Identification Color Banding for Raceways and Cables: Each color band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands 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.
- F. Color-Coding for Phase Identification, 600 V and Less: Use the colors listed below for ungrounded service, feeder, and branch-circuit conductors.
 1. Color shall be factory applied or, for sizes larger than No. 10 AWG if authorities having jurisdiction permit, field applied.
 2. Colors for 208/240/120-V Circuits:
 - a. Phase A: Black.
 - b. Phase B: Red.
 - c. Phase C: Blue.

3. Colors for 480/277-V Circuits:
 - a. Phase A: Brown.
 - b. Phase B: Orange.
 - c. Phase C: Yellow.

4. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

- G. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench exceeds 16 inches overall.

END OF SECTION 16075

SECTION 16120
LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Copper building wire rated 600 V or less.
 - 2. Connectors, splices, and terminations rated 600 V or less.

1.3 DEFINITIONS

- A. RoHS: Restriction of Hazardous Substances.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Product Schedule: Indicate type, use, location, and termination locations.

1.5 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Member company of NETA.
 - 1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

PART 2 - PRODUCTS

2.1 COPPER BUILDING WIRE

- A. Description: Flexible, insulated, and uninsulated, drawn copper current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V or less.

- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Okonite Company (The).
 - 2. Service Wire Co.
 - 3. Southwire Company, LLC.
 - 4. WESCO.
 - 5. Approved Equal.
- C. Standards:
 - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
 - 2. RoHS compliant.
 - 3. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."
- D. Conductors: Copper, complying with ASTM B3 for bare annealed copper and with ASTM B8 for stranded conductors.
- E. Conductor Insulation:
 - 1. Type THHN and Type THWN-2: Comply with UL 83.
 - 2. Type XHHW-2: Comply with UL 44.

2.2 CONNECTORS AND SPLICES

- A. Description: Factory-fabricated connectors, splices, and lugs of size, ampacity rating, material, type, and class for application and service indicated; listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. 3M Electrical Products.
 - 2. ABB, Electrification Business.
 - 3. Hubbell Utility Solutions; Hubbell Incorporated.
 - 4. ILSCO.
 - 5. O-Z/Gedney; brand of Emerson Electric Co., Automation Solutions, Appleton Group.
 - 6. Service Wire Co.
 - 7. Approved Equal.
- C. Jacketed Cable Connectors: For steel and aluminum jacketed cables, zinc diecast with set screws, designed to connect conductors specified in this Section.
- D. Lugs: One piece, seamless, designed to terminate conductors specified in this Section.
 - 1. Material: Copper.
 - 2. Type: One hole with standard barrels.
 - 3. Termination: Compression.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders: Copper; solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Service Entrance: Type XHHW-2, single conductors in raceway.
- B. Exposed Feeders: Type XHHW-2, single conductors in raceway.
- C. Feeders Concealed, above grade: Type THHN/THWN-2, single conductors in raceway.
- D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type XHHW-2, single conductors in raceway.
- E. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type XXHW-2, single conductors in raceway.
- F. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.
- B. Complete raceway installation between conductor and cable termination points according to Section 16130 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.
- C. 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.
- D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members and follow surface contours where possible.
- F. Support cables according to Section 16073 "Hangers and Supports for Electrical Systems."

3.4 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-486B.
- B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 12 inches of slack.

3.5 IDENTIFICATION

- A. Identify and color-code conductors and cables according to Section 16075 "Identification for Electrical Systems."
- B. Identify each spare conductor at each end with identity number and location of other end of conductor and identify as spare conductor.

3.6 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
 - 1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors for compliance with requirements.
 - 2. Perform each of the following visual and electrical tests:
 - a. Inspect exposed sections of conductor and cable for physical damage and correct connection according to the single-line diagram.
 - b. Test bolted connections for high resistance using one of the following:
 - 1) A low-resistance ohmmeter.
 - 2) Calibrated torque wrench.
 - 3) Thermographic survey.
 - c. Inspect compression-applied connectors for correct cable match and indentation.
 - d. Inspect for correct identification.
 - e. Inspect cable jacket and condition.
 - f. Insulation-resistance test on each conductor for ground and adjacent conductors. Apply a potential of 500-V dc for 300-V rated cable and 1000-V dc for 600-V rated cable for a one-minute duration.
 - g. Continuity test on each conductor and cable.
 - h. Uniform resistance of parallel conductors.
- B. Cables will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports to record the following:
 - 1. Procedures used.

2. Results that comply with requirements.
3. Results that do not comply with requirements, and corrective action taken to achieve compliance with requirements.

END OF SECTION 16120

**SECTION 16123
CONTROL VOLTAGE ELECTRICAL POWER CABLES**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Low-voltage control cabling.
 - 2. Control-circuit conductors.
 - 3. Identification products.

1.3 DEFINITIONS

- A. EMI: Electromagnetic interference.
- B. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control and signaling power-limited circuits.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.5 INFORMATIONAL SUBMITTALS

- A. Source quality-control reports.
- B. Field quality-control reports.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. RoHS compliant.

2.2 BALANCED TWISTED PAIR CABLE HARDWARE

- A. Description: Hardware designed to connect, splice, and terminate balanced twisted pair copper communications cable.
- B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1. AMP NETCONNECT; a TE Connectivity Ltd. company.
 - 2. Belden CDT Networking Division/NORDX.
 - 3. Molex Premise Networks.
 - 4. Approved Equal.
- C. General Requirements for Balanced Twisted Pair Cable Hardware:
 - 1. Comply with the performance requirements of Category 6.
 - 2. Comply with TIA-568-C.2, IDC type, with modules designed for punch-down caps or tools.
 - 3. Cables shall be terminated with connecting hardware of same category or higher.
- D. Source Limitations: Obtain balanced twisted pair cable hardware from same manufacturer as balanced twisted pair cable, from single source.
- E. Patch Cords: Factory-made, four-pair cables in 48-inch lengths; terminated with an eight-position modular plug at each end.
 - 1. Patch cords shall have bend-relief-compliant boots and color-coded icons to ensure performance. Patch cords shall have latch guards to protect against snagging.

2.3 LOW-VOLTAGE CONTROL CABLE

- A. Description: Shielded Twisted Pair (STP) cables shall be used for all analog signal wiring installed under this contract.
- B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1. Belden Electronic Wire and Cable Company.
 - 2. General Cable; Prysmian Group North America.
 - 3. Okonite Company.
 - 4. Approved Equal.
- C. Paired Cable: NFPA 70, Type CMG.
 - 1. One pair, twisted, No. 16 AWG, stranded (19x29) tinned-copper conductors.
 - 2. PVC insulation, 600 V.
 - 3. Cable shield shall be aluminum-polyester tape overlapped to provide 100% coverage, and a 7-strand tinned copper drain wire, size 18 AWG.
 - 4. PVC jacket, 80 C temperature rating.
 - 5. Flame Resistance: Comply with UL 1685.

2.4 CONTROL-CIRCUIT CONDUCTORS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1. General Cable; Prysmian Group North America.
 - 2. Service Wire Co.
 - 3. Southwire Company.
 - 4. Approved Equal.
- B. Class 1 Control Circuits: Stranded copper, Type XHHW-2, complying with UL 83 in raceway.
- C. Class 2 Control Circuits: Stranded copper, Type XHHW-2, complying with UL 83 in raceway.
- D. Class 3 Remote-Control and Signal Circuits: Stranded copper, Type THHN/THWN-2, complying with UL 83 in raceway.

2.5 SOURCE QUALITY CONTROL

- A. Factory test twisted pair cables according to TIA-568-C.2.
- B. Cable will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Test cables on receipt at Project site.
 - 1. Test each pair of twisted pair cable for open and short circuits.
 - 2. Reject failed cables.

3.2 INSTALLATION OF RACEWAYS AND BOXES

- A. Comply with requirements in Section 16130 "Raceways and Boxes for Electrical Systems" for raceway selection and installation requirements for boxes, conduits, and wireways as supplemented or modified in this Section.
 - 1. Outlet boxes shall be no smaller than 2 inches wide, 3 inches high, and 2-1/2 inches deep.
 - 2. Flexible metal conduit shall not be used.
- B. Comply with TIA-569-D for pull-box sizing and length of conduit and number of bends between pull points.
- C. Install manufactured conduit sweeps and long-radius elbows if possible.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Comply with NECA 1.

B. General Requirements for Cabling:

1. Comply with TIA-568-C Series of standards.
2. Comply with BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems."
3. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, and cross-connect and patch panels.
4. Cables may not be spliced and shall be continuous from terminal to terminal. Do not splice cable between termination, tap, or junction points. Make taps, and terminations only at indicated outlets, terminals, and cross-connect and patch panels.
5. Cables serving a common system may be grouped in a common raceway. Install network cabling and control wiring and cable in separate raceway from power wiring. Do not group conductors from different systems or different voltages.
6. Furnish a separate raceway system for shielded signal cable. Do not run in the same conduit with power cable.
7. Where telemetry cables are run in the same duct bank with power cables, use galvanized steel conduit. Use junction boxes and "LB" fittings in manholes to maintain a continuous steel raceway system for signal cables.
8. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
9. Install exposed cables parallel and perpendicular to surfaces or exposed structural members and follow surface contours where possible.
10. Do not install bruised, kinked, scored, deformed, or abraded cable. Remove and discard cable if damaged during installation and replace it with new cable.
11. Cold-Weather Installation: Bring cable to room temperature before de-reeling. Do not use heat lamps for heating.
12. Pulling Cable: Comply with BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems." Monitor cable pull tensions.
13. Support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals. Do not allow cables to lie on removable ceiling tiles.
14. Secure: Fasten securely in place with hardware specifically designed and installed so as to not damage cables.
15. Provide strain relief.
16. Keep runs short. Allow extra length for connecting to terminals. Do not bend cables in a radius less than 10 times the cable OD. Use sleeves or grommets to protect cables from vibration at points where they pass around sharp corners and through penetrations.
17. Ground wire shall be copper, and grounding methods shall comply with IEEE C2. Demonstrate ground resistance.

C. Balanced Twisted Pair Cable Installation:

1. Comply with TIA-568-C.2.
2. Install UTP cables using techniques, practices, and methods that are consistent with the Category rating of components and that ensure required Category performance of completed and linked signal paths, end to end.
3. Do not untwist balanced twisted pair cables more than 1/2 inch at the point of termination to maintain cable geometry.

D. Installation of Control-Circuit Conductors:

1. Install wiring in raceways.
2. Use insulated spade lugs for wire and cable connection to screw terminals.
3. Comply with requirements specified in Section 16130 "Raceways and Boxes for Electrical Systems."
4. Control wiring may be pulled in the power conduits and wireways providing the highest voltage of the adjacent wires is not more than 120 volts.

E. Power Control Systems

1. The wiring of this category (single conductor, or multiple conductor) is to be installed in accordance with the NEC.

F. Telemetry and Instrumentation Signal Systems

1. Separate conduit and wireway runs are required for this category. All wiring is to be isolated from all power systems.

G. Separation from EMI Sources:

1. Comply with BICSI TDMM and TIA-569-D recommendations for separating unshielded copper voice and data communications cable from potential EMI sources including electrical power lines and equipment.
2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:
 - a. Electrical Equipment or Circuit Rating Less Than 2 kVA: A minimum of 5 inches.
 - b. Electrical Equipment or Circuit Rating between 2 and 5 kVA: A minimum of 12 inches.
 - c. Electrical Equipment or Circuit Rating More Than 5 kVA: A minimum of 24 inches.
3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
 - a. Electrical Equipment or Circuit Rating Less Than 2 kVA: A minimum of 2-1/2 inches.
 - b. Electrical Equipment or Circuit Rating between 2 and 5 kVA: A minimum of 6 inches.
 - c. Electrical Equipment or Circuit Rating More Than 5 kVA: A minimum of 12 inches.
4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
 - a. Electrical Equipment or Circuit Rating Less Than 2 kVA: No requirement.
 - b. Electrical Equipment or Circuit Rating between 2 and 5 kVA: A minimum of 3 inches.
 - c. Electrical Equipment or Circuit Rating More Than 5 kVA: A minimum of 6 inches.

5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or 5 HP and Larger: A minimum of 48 inches.
6. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches.

3.4 REMOVAL OF CONDUCTORS AND CABLES

- A. Remove abandoned conductors and cables. Abandoned conductors and cables are those installed that are not terminated at equipment and are not identified with a tag for future use.

3.5 CONTROL-CIRCUIT CONDUCTORS

- A. Minimum Conductor Sizes:
 1. Class 1 remote-control and signal circuits; No 14 AWG.
 2. Class 2 low-energy, remote-control, and signal circuits; No. 16 AWG.
 3. Class 3 low-energy, remote-control, alarm, and signal circuits; No 12 AWG.

3.6 GROUNDING

- A. For low-voltage control wiring and cabling, comply with requirements in Section 16060 "Grounding and Bonding for Electrical Systems."

3.7 IDENTIFICATION

- A. Comply with requirements for identification specified in Section 16075 "Identification for Electrical Systems."
- B. Identify data and communications system components, wiring, and cabling according to TIA-606-B; label printers shall use label stocks, laminating adhesives, and inks complying with UL 969.
- C. Identify each wire on each end and at each terminal with a number-coded identification tag. Each wire shall have a unique tag.

3.8 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. General Tests and Inspections:
 1. Visually inspect cable jacket materials for UL or third-party certification markings. Inspect cabling terminations to confirm color-coding for pin assignments and inspect cabling connections to confirm compliance with TIA-568-C.1.
 2. Visually inspect cable placement, cable termination, grounding and bonding, equipment, and patch cords, and labeling of all components.

3. Test cabling for direct-current loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination, but not after cross-connection.
 - a. Test instruments shall meet or exceed applicable requirements in TIA-568-C.2. Perform tests with a tester that complies with performance requirements in its "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in its "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
- C. Balanced Twisted Pair Cable Testing
 1. Wire-map test that reports open circuits, short circuits, crossed pairs, reversed pairs, split pairs, and improper terminations.
 2. Channel and permanent link tests for cable length, insertion loss, near-end crosstalk loss, power sum near-end crosstalk loss, equal-level far-end crosstalk loss, power sum equal-level far-end crosstalk, return loss, propagation delay, and delay skew. Performance shall comply with minimum criteria in TIA/EIA-568-B.2.
- D. Retest and inspect cabling to determine compliance of replaced or additional work with specified requirements.
- E. Document data for each measurement. Print data for submittals in a summary report that is formatted using Table 10.1 in BICSI TDMM as a guide or transfer the data from the instrument to the computer, save as text files, print, and submit.
- F. End-to-end cabling will be considered defective if it does not pass tests and inspections.
 1. Remove and replace cabling where test results indicate that they do not comply with specified requirements. Retest until satisfactory.
- G. Prepare test and inspection reports.

END OF SECTION 16123

**SECTION 16130
RACEWAYS AND BOXES**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

1.3 DEFINITIONS

- A. EPDM: Ethylene-propylene-diene terpolymer rubber.
- B. FMC: Flexible metal conduit.
- C. LFMC: Liquidtight flexible metal conduit.
- D. NBR: Acrylonitrile-butadiene rubber.
- E. RNC: Rigid nonmetallic conduit.

1.4 SUBMITTALS

- A. Product Data: For surface raceways, wireways and fittings, hinged-cover enclosures, and cabinets.
- B. Shop Drawings: For the following raceway components. Include plans, elevations, sections, details, and attachments to other work.
 - 1. For handholes and boxes for underground wiring, including the following:
 - a. Duct entry provisions, including locations and duct sizes.
 - b. Frame and cover design.
 - c. Grounding details.
 - d. Dimensioned locations of cable rack inserts, and pulling-in and lifting irons.
 - e. Joint details.
- C. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
 - 1. Structural members in the paths of conduit groups with common supports.

2. HVAC and plumbing items and architectural features in the paths of conduit groups with common supports.

D. Source quality-control test reports.

1.5 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.

PART 2 - PRODUCTS

2.1 METAL CONDUIT AND TUBING

- 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. Allied Tube & Conduit; a Tyco International Ltd. Co.
 2. Anamet Electrical, Inc.; Anaconda Metal Hose.
 3. O-Z Gedney; a unit of General Signal.
 4. Wheatland Tube Company.
 5. Approved equal.
- B. Rigid Steel Conduit: ANSI C80.1.
- C. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.
 1. Comply with NEMA RN 1.
 2. Coating Thickness: 0.040 inch, minimum.
- D. LFMC: Flexible steel conduit with PVC jacket.
- E. EMT: ANSI C80.3.
- F. Fittings for Conduit (Including all Types and Flexible and Liquidtight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.
 1. Coating for Fittings for PVC-Coated Steel Conduit: Minimum thickness, 0.040 inch, with overlapping sleeves protecting threaded joints.
 2. Fittings for EMT: Steel, compression type
- G. Joint Compound for Rigid Steel Conduit or IMC: Listed for use in cable connector assemblies, and compounded for use to lubricate and protect threaded raceway joints from corrosion and enhance their conductivity.

2.2 NONMETALLIC CONDUIT

- 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. AFC Cable Systems, Inc.
 2. Anamet Electrical, Inc.; Anaconda Metal Hose.
 3. Arnco Corporation.
 4. CANTEX Inc.
 5. CertainTeed Corp.; Pipe & Plastics Group.
 6. Condux International, Inc.
 7. ElecSYS, Inc.
 8. Electri-Flex Co.
 9. Lamson & Sessions; Carlon Electrical Products.
 10. Manhattan/CDT/Cole-Flex.
 11. RACO; a Hubbell Company.
 12. Thomas & Betts Corporation.
- B. RNC: NEMA TC 2, Type EPC-40-PVC, unless otherwise indicated.
- C. LFNC: UL 1660.
- D. Fittings for RNC: NEMA TC 3; match to conduit type and material.
- E. Fittings for LFNC: UL 514B.

2.3 BOXES, ENCLOSURES, AND CABINETS

- 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. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
 2. EGS/Appleton Electric.
 3. Hoffman.
 4. Hubbell Incorporated; Killark Electric Manufacturing Co. Division.
 5. O-Z/Gedney; a unit of General Signal.
 6. RACO; a Hubbell Company.
 7. Robroy Industries, Inc.; Enclosure Division.
 8. Thomas & Betts Corporation..
 9. Approved equal.
- B. Sheet Metal Outlet and Device Boxes: NEMA OS 1.
- C. Cast-Metal Outlet and Device Boxes: NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.
- D. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- E. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1, cast aluminum with gasketed cover.

F. Cabinets:

1. NEMA 250, Type 1, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below, unless otherwise indicated:

1. Exposed Conduit: Rigid steel conduit.
2. Underground Conduit, Direct Buried: PVC-Coated Steel Conduit.
3. Underground, Concrete Encased: Rigid Nonmetallic Conduit
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
5. Boxes and Enclosures, Aboveground: NEMA 250, Type 4X 316 stainless steel.

B. Indoors: Apply raceway products as specified below, unless otherwise indicated:

1. Exposed, Dry Location: Rigid Steel Conduit. Painted white to match existing conduits.
2. Embedded in concrete floors and walls, and below concrete floors and slabs: RNC
 - a. Use PVC-Coated Steel Conduit where conduits pass through, stub-up or leave concrete floors and walls.
 - b. Use PVC-Coated Steel Conduit where conduits stub-up or leave outdoor grade level.
3. Boxes and Enclosures: NEMA 250, Type 12.

C. Minimum Raceway Size:

1. Direct buried: 1 inch trade size.
2. All other applications: 3/4-inch trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.
2. PVC-Coated Steel Conduit: Use only fittings listed for use with that material. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer.

3.2 INSTALLATION

- A. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.
- B. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- C. Complete raceway installation before starting conductor installation.
- D. Support raceways as specified in Division 16 Section "Hangers and Supports for Electrical Systems."
- E. Arrange stub-ups so curved portions of bends are not visible above the finished slab.
- F. Conceal conduit within finished walls, ceilings, and floors, unless otherwise indicated.
- G. Raceways Embedded in Slabs:
 - 1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
 - 2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
- H. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire.
- I. Flexible Conduit Connections: Use maximum of 72 inches of flexible conduit for equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
- J. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall.
- K. Set metal floor boxes level and flush with finished floor surface.
- L. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.3 INSTALLATION OF UNDERGROUND CONDUIT

- A. Direct-Buried Conduit:
 - 1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Division 2 Section "Earthwork" for pipe less than 6 inches in nominal diameter.
 - 2. Install backfill as specified in Division 2 Section "Earthwork."
 - 3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12

- inches of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Division 2 Section "Earthwork."
4. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.
 - a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete.
 - b. For stub-ups at equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches from edge of equipment pad or foundation. Install insulated grounding bushings on terminations at equipment.
 5. Warning Planks: Bury warning planks approximately 12 inches above direct-buried conduits, placing them 24 inches o.c. Align planks along the width and along the centerline of conduit.

3.4 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
- B. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
- C. Rectangular Sleeve Minimum Metal Thickness:
 1. For sleeve cross-section rectangle perimeter less than 50 inches and no side greater than 16 inches, thickness shall be 0.052 inch.
 2. For sleeve cross-section rectangle perimeter equal to, or greater than, 50 inches and 1 or more sides equal to, or greater than, 16 inches, thickness shall be 0.138 inch.
- D. Cut sleeves to length for mounting flush with both surfaces of walls.
- E. Extend sleeves installed in floors 2 inches above finished floor level.
- F. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway unless sleeve seal is to be installed.
- G. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway, using joint sealant appropriate for size, depth, and location of joint. Refer to Division 7 Section "Joint Sealants" for materials and installation.
- H. Roof-Penetration Sleeves: Seal penetration of individual raceways with flexible, boot-type flashing units applied in coordination with roofing work.
- I. Aboveground, Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- J. Underground, Exterior-Wall Penetrations: Install cast-iron "wall pipes" for sleeves. Size sleeves to allow for 1-inch annular clear space between raceway and sleeve for installing mechanical sleeve seals.

3.5 SLEEVE-SEAL INSTALLATION

- A. Install to seal underground, exterior wall penetrations.
- B. Use type and number of sealing elements recommended by manufacturer for raceway material and size. Position raceway in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.6 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.

END OF SECTION 16130

SECTION 16431
SURGE PROTECTION FOR LOW-VOLTAGE ELECTRICAL POWER CIRCUITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes:
 - 1. Type 2 surge protective devices.
 - 2. Enclosures.
 - 3. Conductors and cables.

1.3 DEFINITIONS

- A. Inominal: Nominal discharge current.
- B. MCOV: Maximum continuous operating voltage.
- C. Mode(s), also Modes of Protection: air of electrical connections where the VPR applies.
- D. MOV: Metal-oxide varistor; an electronic component with a significant non-ohmic current-voltage characteristic.
- E. NRTL: Nationally recognized testing laboratory.
- F. OCPD: Overcurrent protective device.
- G. SCCR: Short-circuit current rating.
- H. SPD: Surge protective device.
- I. Type 2 SPDs: Permanently connected SPDs intended for installation on the load side of the service disconnect overcurrent device, including SPDs located at the branch panel.
- J. VPR: Voltage protection rating.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include electrical characteristics, specialties, and accessories for SPDs.

2. NRTL certification of compliance with UL 1449.
 - a. Tested values for VPRs.
 - b. Inominal ratings.
 - c. MCOV, type designations.
 - d. OCPD requirements.
 - e. Manufacturer's model number.
 - f. System voltage.
 - g. Modes of protection.

1.5 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.
- B. Sample Warranty: For manufacturer's special warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For SPDs to include in maintenance manuals.

1.7 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace SPDs that fail in materials or workmanship within five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 TYPE 2 SURGE PROTECTIVE DEVICES (SPDs)

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 1. ABB, Electrification Products Division.
 2. Eaton.
 3. Schneider Electric USA, Inc.
 4. Siemens Industry, Inc., Energy Management Division.
 5. Approved Equal.
- B. Source Limitations: Obtain devices from single source from single manufacturer.
- C. Standards:
 1. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 1449, Type 2.
 2. Comply with UL 1283.
- D. Product Options:

1. Include LED indicator lights for power and protection status.
2. Include internal thermal protection that disconnects the SPD before damaging internal suppressor components.
3. Include NEMA ICS 5, dry Form C contacts rated at 2 A and 24 V ac for remote monitoring of protection status.
4. Include surge counter.

E. Performance Criteria:

1. MCOV: Not less than 125 percent of nominal system voltage for 208Y/120 V and 120/240 V power systems.
2. Peak Surge Current Rating: Minimum single-pulse surge current withstand rating per phase must not be less than 100 kA. Peak surge current rating must be arithmetic sum of the ratings of individual MOVs in a given mode.
3. The SPD surge current ratings shall be based on the electrical system ampacity listed in the table below:

Electrical System Ampacity @ SPD Install Point	Surge Protection (kA)	
	Per Mode	Per Phase
2500-6000A	300	600
1200-2000A	250	500
600-1000A	200	400
225-400A	150	300
125-225A	100	200

4. The SPD shall be rated as shown on Drawings.
5. Modes of Protection: The SPD system shall provide surge protection in all possible modes (L-N, L-G, L-L, and N-G). Each replaceable module shall provide the uncompromising ability to deliver full surge current rating per mode.
6. SPD modules shall be configured to isolate individual suppression component failures without causing total loss of surge protection in that mode.
7. Protection modes and UL 1449 VPR for grounded wye circuits with 208Y/120 V, three-phase, four-wire circuits must not exceed the following:
 - a. Line to Neutral: 700 V for 208Y/120 V.
 - b. Line to Ground: 700 V for 208Y/120 V.
 - c. Neutral to Ground: 700 V for 208Y/120 V.
 - d. Line to Line: 1200 V for 208Y/120 V.
8. Protection modes and UL 1449 VPR for 240/120 V, single-phase, three-wire circuits must not exceed the following:
 - a. Line to Neutral: 700 V.
 - b. Line to Ground: 700 V.
 - c. Neutral to Ground: 700 V.
 - d. Line to Line: 1200 V.
9. SCCR: Equal or exceed 100 kA.
10. Inominal Rating: 20 kA.

2.2 ENCLOSURES

- A. Indoor Enclosures: NEMA 250, Type 1.

2.3 CONDUCTORS AND CABLES

- A. Power Wiring: Same size as SPD leads, complying with Section 16120 "Low-Voltage Electrical Power Conductors and Cables."

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with NECA 1.
- B. Provide OCPD and disconnect for installation of SPD in accordance with UL 1449 and manufacturer's written instructions.
- C. Install leads between disconnects and SPDs short, straight, twisted, and in accordance with manufacturer's written instructions. Comply with wiring methods in Section 16120 "Low-Voltage Electrical Power Conductors and Cables."
 - 1. Do not splice and extend SPD leads unless specifically permitted by manufacturer.
 - 2. Do not exceed manufacturer's recommended lead length.
 - 3. Do not bond neutral and ground.
- D. Use crimped connectors and splices only. Wire nuts are unacceptable.

3.2 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Compare equipment nameplate data for compliance with Drawings and the Specifications.
 - 2. Inspect anchorage, alignment, grounding, and clearances.
 - 3. Verify that electrical wiring installation complies with manufacturer's written installation requirements.
- B. SPDs that do not pass tests and inspections will be considered defective. Replace and retest.
- C. Prepare test and inspection reports.

3.3 STARTUP SERVICE

- A. Complete startup checks in accordance with manufacturer's written instructions.

- B. Do not perform insulation-resistance tests of the distribution wiring equipment with SPDs installed. Disconnect SPDs before conducting insulation-resistance tests; reconnect them immediately after the testing is over.
- C. Energize SPDs after power system has been energized, stabilized, and tested.

3.4 DEMONSTRATION

- A. Train Owner's maintenance personnel to operate and maintain SPDs.

END OF SECTION 16431

**SECTION 16442
PANELBOARDS**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

- 1. Lighting panelboards.

1.3 DEFINITIONS

- A. AFCI: Arc-fault circuit interrupter.
- B. ATS: Acceptance testing specification.
- C. HID: High-intensity discharge.
- D. MCCB: Molded-case circuit breaker.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of panelboard.

- 1. Include materials overcurrent protective devices, accessories, and components indicated.
- 2. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

- B. Shop Drawings: For each panelboard and related equipment.

- 1. Include dimensioned plans, elevations, sections, and details.
- 2. Show tabulations of installed devices with nameplates, conductor termination sizes, equipment features, and ratings.
- 3. Detail enclosure types including mounting and anchorage, environmental protection, knockouts, corner treatments, covers and doors, gaskets, hinges, and locks.
- 4. Detail bus configuration, current, and voltage ratings.
- 5. Short-circuit current rating of panelboards and overcurrent protective devices.

1.5 INFORMATIONAL SUBMITTALS

- A. Panelboard Schedules: For installation in panelboards.

1.6 CLOSEOUT SUBMITTALS

- A. Field Quality-Control Reports:
 - 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.
- B. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 01782 "Operation and Maintenance Data," 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 that allows adjustments.

1.7 QUALITY ASSURANCE

- A. Manufacturer Qualifications: ISO 9001 or ISO 9002 certified.
- B. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories from single-source from single manufacturer.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Remove loose packing and flammable materials from inside panelboards; install temporary electric heating (250 W per panelboard) to prevent condensation.
- B. Handle and prepare panelboards for installation according to NEMA PB 1.

1.9 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace panelboards that fail in materials or workmanship within specified warranty period.
 - 1. Panelboard Warranty Period: 18 months from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PANELBOARDS AND LOAD CENTERS COMMON REQUIREMENTS

- A. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.
- B. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:
 - 1. Eaton Corporation, Inc. (Eaton)
 - 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution. (GE)
 - 3. Siemens Energy & Automation, Inc. (Siemens)
 - 4. Square D; a brand of Schneider Electric. (Square D)
 - 5. Approved equal.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- D. Comply with NEMA PB 1.
- E. Comply with NFPA 70.
- F. Enclosures: Surface-mounted, dead-front cabinets.
 - 1. Rated for environmental conditions at installed location.
 - a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
 - b. Outdoor Locations, Wash-Down, and Process Areas and other Wet or Damp Indoor Locations: NEMA 250, Type 4X, stainless steel.
 - 2. Height: 84 inches maximum.
 - 3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover. Trims shall cover all live parts and shall have no exposed hardware.
 - 4. Finishes:
 - a. Panels and Trim: Steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
 - b. Back Boxes: Galvanized steel.
- G. Incoming Mains:
 - 1. Location: Bottom.
 - 2. Main Breaker: Main lug interiors up to 200 amperes shall be field convertible to main breaker.
- H. Phase, Neutral, and Ground Buses:
 - 1. Material: Tin-plated aluminum.

- a. Plating shall run entire length of bus.
 - b. Bus shall be fully rated the entire length.
2. Interiors shall be factory assembled into a unit. Replacing switching and protective devices shall not disturb adjacent units or require removing the main bus connectors.
 3. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
 4. Full-Sized Neutral: Equipped with full-capacity bonding strap for service entrance applications. Mount electrically isolated from enclosure. Do not mount neutral bus in gutter.
- I. Future Devices: Panelboards or load centers shall have mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.
1. Percentage of Future Space Capacity: 10 percent.
- J. Panelboard Short-Circuit Current Rating: Rated for series-connected system with integral or remote upstream overcurrent protective devices and labeled by an NRTL. Include label or manual with size and type of allowable upstream and branch devices listed and labeled by an NRTL for series-connected short-circuit rating.
1. Panelboards rated 240 V or less shall have short-circuit ratings as shown on Drawings, but not less than 10,000 A rms symmetrical.
- K. High- Lag Panelboard Identification.

2.2 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

- A. Single Source: Obtain protective devices from same manufacturer of panelboards.
- B. MCCB: Comply with UL 489, with interrupting capacity to meet available fault currents.
1. Thermal-Magnetic Circuit Breakers:
 - a. Inverse time-current element for low-level overloads.
 - b. Instantaneous magnetic trip element for short circuits.
 - c. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
 2. MCCB Features and Accessories:
 - a. Standard frame sizes, trip ratings, and number of poles.
 - b. Breaker handle indicates a tripped status.
 - c. UL listed for reverse connection without restrictive line or load ratings.
 - d. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
 - e. Rating Plugs: Three-pole breakers with ampere ratings greater than 150 amperes shall have interchangeable rating plugs or electronic adjustable trip units.
 - f. Multipole units enclosed in a single housing with a single handle.
 - g. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in off position.

2.3 IDENTIFICATION

- A. Panelboard Label: Manufacturer's name and trademark, voltage, amperage, number of phases, and number of poles shall be located on the interior of the panelboard door.
- B. Breaker Labels: Faceplate shall list current rating, UL and IEC certification standards, and AIC rating.
- C. Circuit Directory: Computer-generated circuit directory mounted inside panelboard door with transparent plastic protective cover.
 - 1. Circuit directory shall identify specific purpose with detail sufficient to distinguish it from all other circuits.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify actual conditions with field measurements prior to ordering panelboards to verify that equipment fits in allocated space in, and comply with, minimum required clearances specified in NFPA 70.
- B. Receive, inspect, handle, and store panelboards according to NEMA PB 1.1.
- C. Examine panelboards before installation. Reject panelboards that are damaged, rusted, or have been subjected to water saturation.
- D. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- 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, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Comply with NECA 1.
- C. Install panelboards and accessories according to NEMA PB 1.1.
- D. Equipment Mounting:
 - 1. Mount surface-mounted panelboards to steel slotted supports 1-1/4 inch in depth. Orient steel slotted supports vertically.
- E. Mount top of trim 90 inches above finished floor unless otherwise indicated.

- F. Mount panelboard cabinet plumb and rigid without distortion of box.
- G. Install overcurrent protective devices and controllers not already factory installed.
 - 1. Set field-adjustable, circuit-breaker trip ranges.
 - 2. Tighten bolted connections and circuit breaker connections using calibrated torque wrench or torque screwdriver per manufacturer's written instructions.
- H. Install filler plates in unused spaces.
- I. Arrange conductors in gutters into groups and bundle and wrap with wire ties.

3.3 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; install warning signs complying with requirements in Section 16075 "Identification for Electrical Systems."
- B. Create a directory to indicate installed circuit loads; incorporate Owner's final room designations. Submit for approval before installing. Handwritten directories are not acceptable. Install approved directory inside panelboard door.
- C. Panelboard Nameplates: Label each panelboard with a nameplate complying with NEC Article 408.4 and requirements for identification specified in Section 16075 "Identification for Electrical Systems."
 - 1. Include the following information:
 - a. Equipment name or identifier
 - b. System voltage and phase
 - c. Source of supply
- D. Install warning signs complying with requirements in Section 16075 "Identification for Electrical Systems" identifying source of remote circuit.

3.4 FIELD QUALITY CONTROL

- A. Tests and Inspections:
 - 1. Perform each visual and mechanical inspection and electrical test for low-voltage air circuit breakers stated in NETA ATS, Paragraph 7.6 Circuit Breakers. Do not perform optional tests. 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.
- B. Panelboards will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results, with comparisons of the two scans. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

- A. Adjust moving parts and operable components to function smoothly and lubricate as recommended by manufacturer.
- B. Set field-adjustable circuit-breaker trip ranges as indicated.

3.6 PROTECTION

- A. Temporary Heating: Prior to energizing panelboards, apply temporary heat to maintain temperature according to manufacturer's written instructions.

END OF SECTION 16442

**SECTION 16511
LED EXTERIOR LIGHTING**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

- 1. Exterior solid-state luminaires that are designed for and exclusively use LED lamp technology.
 - 2. Luminaire supports.
 - 3. Luminaire-mounted photoelectric relays.
- B. CCT: Correlated color temperature.
 - C. CRI: Color rendering index.
 - D. Fixture: See "Luminaire."
 - E. IP: International Protection or Ingress Protection Rating.
 - F. Lumen: Measured output of lamp and luminaire, or both.
 - G. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.3 SUBMITTALS

A. Product Data: For each type of luminaire.

- 1. Arrange in order of luminaire designation.
- 2. Include data on features, accessories, and finishes.
- 3. Include physical description and dimensions of luminaire.

4. Lamps, include life, output (lumens, CCT, and CRI), and energy-efficiency data.
 5. Photometric data and adjustment factors based on laboratory tests, complying with IES Lighting Measurements Testing and Calculation Guides, of each luminaire type. The adjustment factors shall be for lamps and accessories identical to those indicated for the luminaire as applied in this Project IES LM-79.
 - a. Manufacturer's Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the NVLAP for Energy Efficient Lighting Products.
 - b. Testing Agency Certified Data: For indicated luminaires, photometric data certified by a qualified independent testing agency. Photometric data for remaining luminaires shall be certified by manufacturer.
 6. Wiring diagrams for power, control, and signal wiring.
 7. Photoelectric relays.
 8. Means of attaching luminaires to supports and indication that the attachment is suitable for components involved.
- B. Product Schedule: For luminaires and lamps. Use same designations indicated on Drawings.
- C. Product Certificates: For each type of the following:
1. Luminaire.
 2. Photoelectric relay.
- D. Source quality-control reports.
- E. Operation and Maintenance Data: For luminaires and photoelectric relays to include in operation and maintenance manuals.
1. Provide a list of all lamp types used on Project. Use ANSI and manufacturers' codes.
 2. Provide a list of all photoelectric relay types used on Project; use manufacturers' codes.
- F. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Lamps: Furnish at least one of each type.
2. Glass, Acrylic, and Plastic Lenses, Covers, and Other Optical Parts: Furnish at least one of each type.
3. Diffusers and Lenses: Furnish at least one of each type.
4. Globes and Guards: Furnish at least one of each type.

1.4 QUALITY ASSURANCE

- A. Luminaire Photometric Data Testing Laboratory Qualifications: Luminaire manufacturers' laboratory that is accredited under the NVLAP for Energy Efficient Lighting Products.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering prior to shipping.

1.6 FIELD CONDITIONS

- A. Verify existing and proposed utility structures prior to the start of work associated with luminaire installation.
- B. Mark locations of exterior luminaires for approval by Architect prior to the start of luminaire installation.

1.7 WARRANTY

- A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.
 1. Failures include, but are not limited to, the following:
 - a. Structural failures, including luminaire support components.
 - b. Faulty operation of luminaires and accessories.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 2. Warranty Period: 2 year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 LUMINAIRE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Provide fixtures as specified on the contract drawings.
- C. FM Global Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.
- D. UL Compliance: Comply with UL 1598.
- E. Lamp base complying with ANSI C81.61.
- F. Bulb shape complying with ANSI C79.1.
- G. CRI of 80. CCT in K as indicated on drawings.
- H. L70 lamp life of 35,000 hours.
- I. Internal driver.
- J. Nominal Operating Voltage: 120 V ac.
- K. In-line Fusing: Separate in-line fuse for each luminaire.
- L. Lamp Rating: Lamp marked for outdoor use.
- M. Source Limitations: Obtain luminaires from single source from a single manufacturer.
- N. Source Limitations: For luminaires, obtain each color, grade, finish, type, and variety of luminaire from single source with resources to provide products of consistent quality in appearance and physical properties.

2.2 LUMINAIRE TYPES

- A. Area and Site:
 - 1. Manufacturers: Subject to compliance with requirements, provide products as indicated on the Contract Drawings.
 - 2. Luminaire-Mounting Height: See drawings.

- B. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.

2.3 FINISHES

- A. Luminaire Finish: Manufacturer's standard paint applied to factory-assembled and -tested luminaire before shipping. Where indicated, match finish process and color of pole or support materials.
- B. Factory-Applied Finish for Aluminum Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 - 1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
 - 2. Natural Satin Finish: Provide fine, directional, medium satin polish (AA-M32); buff complying with AA-M20 requirements; and seal aluminum surfaces with clear, hard-coat wax.
 - 3. Class I, Clear-Anodic Finish: AA-M32C22A41 (Mechanical Finish: Medium satin; Chemical Finish: Etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.
 - 4. Class I, Color-Anodic Finish: AA-M32C22A42/A44 (Mechanical Finish: Medium satin; Chemical Finish: Etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker), complying with AAMA 611.
 - a. Color: See Drawings for Schedule information.

2.4 LUMINAIRE SUPPORT COMPONENTS

- A. Comply with requirements in Section 16073 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for luminaire electrical conduit to verify actual locations of conduit connections before luminaire installation.
- C. Examine walls, roofs for suitable conditions where luminaires will be installed.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 GENERAL INSTALLATION REQUIREMENTS

- A. Comply with NECA 1.
- B. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.
- C. Install lamps in each luminaire.
- D. Fasten luminaire to structural support.
- E. Supports:
 - 1. Sized and rated for luminaire weight.
 - 2. Able to maintain luminaire position after cleaning and re-lamping.
 - 3. Support luminaires without causing deflection of finished surface.
 - 4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and a vertical force of 400 percent of luminaire weight.
- F. Wiring Method: Install cables in raceways. Conceal raceways and cables.
- G. Install luminaires level, plumb, and square with finished grade unless otherwise indicated. Install luminaires at height and aiming angle as indicated on Drawings.
- H. Coordinate layout and installation of luminaires with other construction.

- I. Adjust luminaires that require field adjustment or aiming. Include adjustment of photoelectric device to prevent false operation of relay by artificial light sources, favoring a north orientation.
- J. Comply with requirements in Section 16120 "Low-Voltage Electrical Power Conductors and Cables" and Section 16130 "Raceways and Boxes for Electrical Systems" for wiring connections and wiring methods.

3.3 CORROSION PREVENTION

- A. Steel Conduits: Comply with Section 16130 "Raceways and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch-thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

3.4 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 16075 "Identification for Electrical Systems."

3.5 FIELD QUALITY CONTROL

- A. Inspect each installed luminaire for damage. Replace damaged luminaires and components.
- B. Perform the following tests and inspections:
 - 1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
 - 2. Verify operation of photoelectric controls.
 - 3. Verify operation of photoelectric bypass controls.
- C. Luminaire will be considered defective if it does not pass tests and inspections.
- D. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

3.6 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain luminaires and photocell relays.

END OF SECTION 16511

SECTION 01 33 23

SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES

PART 1 – GENERAL

1.1 DESCRIPTION

- A. This specification defines the general requirements and procedures for submittals. A submittal is information submitted for Town of Brookfield, Connecticut to review to establish compliance with the contract documents.
- B. Detailed submittal requirements are found in the technical sections of the contract specifications. The Contracting Officer may request submittals in addition to those specified when deemed necessary to adequately describe the work covered in the respective technical specifications at no additional cost to the government.
- C. Town of Brookfield, Connecticut approval of a submittal does not relieve the Contractor of the responsibility for any error which may exist. The Contractor is responsible for fully complying with all contract requirements and the satisfactory construction of all work, including the need to check, confirm, and coordinate the work of all subcontractors for the project. Non-compliant material incorporated in the work will be removed and replaced at the Contractor's expense.

1.2 DEFINITIONS

- A. Preconstruction Submittals: Submittals which are required prior to issuing contract notice to proceed or starting construction. For example, Certificates of insurance; Surety bonds; Site-specific safety plan; Construction progress schedule; Schedule of values; Submittal register; List of proposed subcontractors.
- B. Shop Drawings: Drawings, diagrams, and schedules specifically prepared to illustrate some portion of the work. Drawings prepared by or for the Contractor to show how multiple systems and interdisciplinary work will be integrated and coordinated.
- C. Product Data: Catalog cuts, illustrations, schedules, diagrams, performance charts, instructions, and brochures, which describe and illustrate size, physical appearance, and other characteristics of materials, systems, or equipment for some portion of the work. Samples of warranty language when the contract requires extended product warranties.
- D. Samples: Physical examples of materials, equipment, or workmanship that illustrate functional and aesthetic characteristics of a material or product and establish standards by which the work can be judged. Color samples from the manufacturer's standard line (or custom color samples if specified) to be used in selecting or approving colors for the project. Field samples and mock-ups constructed to establish standards by which the ensuing work can be judged.
- E. Design Data: Calculations, mix designs, analyses, or other data pertaining to a part of work.
- F. Test Reports: Report which includes findings of a test required to be performed by the Contractor on an actual portion of the work. Report which includes finding of a test made at the job site or on sample taken from the job site, on portion of work during or after installation.

- G. Certificates: Document required of Contractor, or of a manufacturer, supplier, installer, or subcontractor through Contractor. The purpose is to document procedures, acceptability of methods, or personnel qualifications for a portion of the work.
- H. Manufacturer's Instructions: Pre-printed material describing installation of a product, system, or material, including special notices and MSDS concerning impedances, hazards, and safety precautions.
- I. Manufacturer's Field Reports: Documentation of the testing and verification actions taken by manufacturer's representative at the job site on a portion of the work, during or after installation, to confirm compliance with manufacturer's standards or instructions. The documentation must indicate whether the material, product, or system has passed or failed the test.
- J. Operation and Maintenance Data: Manufacturer data that is required to operate, maintain, troubleshoot, and repair equipment, including manufacturer's help, parts list, and product line documentation. This data shall be incorporated in an operations and maintenance manual.
- K. Closeout Submittals: Documentation necessary to properly close out a construction contract. For example, Record Drawings and as-built drawings. Also, submittal requirements necessary to properly close out a phase of construction on a multi-phase contract.

1.3 SUBMITTAL SCHEDULING

- A. Submittals are to be scheduled, submitted, reviewed, and approved prior to the acquisition of the material or equipment.
- B. Coordinate scheduling, sequencing, preparing, and processing of submittals with performance of work so that work will not be delayed by submittal processing. Allow time for potential resubmittal.
- C. No delay costs or time extensions will be allowed for time lost in late submittals or resubmittals.
- D. All submittals are required to be approved prior to the start of the specified work activity.

1.4 SUBMITTAL PREPARATION

- A. Each submittal is to be complete and in sufficient detail to allow ready determination of compliance with contract requirements.
- B. Collect required data for each specific material, product, unit of work, or system into a single submittal. Prominently mark choices, options, and portions applicable to the submittal. Partial submittals will not be accepted for expedition of construction effort. Submittal will be returned without review if incomplete.
- C. If available product data is incomplete, provide Contractor-prepared documentation to supplement product data and satisfy submittal requirements.
- D. All irrelevant or unnecessary data shall be removed from the submittal to facilitate accuracy and timely processing. Submittals that contain the excessive amount of irrelevant or unnecessary data will be returned without review.
- E. Provide a transmittal form for each submittal with the following information:
 - 1. Project title, location and number.
 - 2. Construction contract number.

3. Date of the drawings and revisions.
 4. Name, address, and telephone number of subcontractor, supplier, manufacturer, and any other subcontractor associated with the submittal.
 5. List paragraph number of the specification section and sheet number of the contract drawings by which the submittal is required.
 6. When a resubmission, add alphabetic suffix on submittal description. For example, submittal 18 would become 18A, to indicate resubmission.
 7. Product identification and location in project.
- F. The Contractor is responsible for reviewing and certifying that all submittals are in compliance with contract requirements before submitting for Town of Brookfield, Connecticut review. Proposed deviations from the contract requirements are to be clearly identified. All deviations submitted must include a side by side comparison of item being proposed against item specified. Failure to point out deviations will result in the Town of Brookfield, Connecticut requiring removal and replacement of such work at the Contractor's expense.
- G. Stamp, sign, and date each submittal transmittal form indicating action taken.
- H. Stamp used by the Contractor on the submittal transmittal form to certify that the submittal meets contract requirements is to be similar to the following:

1.5 SUBMITTAL FORMAT AND TRANSMISSION

- A. Provide submittals in electronic format, with the exception of material samples. Use PDF as the electronic format, unless otherwise specified or directed by the Contracting Officer.
- B. Compile the electronic submittal file as a single, complete document. Name the electronic submittal file specifically according to its contents.
- C. Electronic files must be of sufficient quality that all information is legible. Generate PDF files from original documents so that the text included in the PDF file is both searchable and can be copied.
- D. E-mail electronic submittal documents smaller than 5MB in size to e-mail addresses as directed by the Contracting Officer.
- E. Provide electronic documents over 5MB through an electronic FTP file sharing system. Confirm that the electronic FTP file sharing system can be accessed from the Town of Brookfield, Connecticut computer network. The Contractor is responsible for setting up, providing, and maintaining the electronic FTP file sharing system for the construction contract period of performance.
- F. Provide hard copies of submittals when requested by the Contracting Officer. Up to 3 additional hard copies of any submittal may be requested at the discretion of the Contracting Officer, at no additional cost to the Town of Brookfield, Connecticut.

1.6 TOWN OF BROOKFIELD, CONNECTICUT REVIEW OF SUBMITTALS AND RFIS

- A. The Town of Brookfield, Connecticut will review all submittals for compliance with the technical requirements of the contract documents. The Architect-Engineer for this project will assist the Town

of Brookfield, Connecticut in reviewing all submittals and determining contractual compliance. Review will be only for conformance with the applicable codes, standards and contract requirements.

- B. Period of review for submittals begins when the Town of Brookfield, Connecticut COR receives submittal from the Contractor.
- C. Period of review for each resubmittal is the same as for initial submittal.
- D. Town of Brookfield, Connecticut review period is 15 business days for submittals.
- E. Town of Brookfield, Connecticut review period is 10 business days for RFIs.
- F. The Town of Brookfield, Connecticut will return submittals to the Contractor with the following notations:
 - 1. "Approved": authorizes the Contractor to proceed with the work covered.
 - 2. "Approved as noted": authorizes the Contractor to proceed with the work covered provided the Contractor incorporates the noted comments and makes the noted corrections.
 - 3. "Disapproved, revise and resubmit": indicates noncompliance with the contract requirements or that submittal is incomplete. Resubmit with appropriate changes and corrections. No work shall proceed for this item until resubmittal is approved.
 - 4. "Not reviewed": indicates submittal does not have evidence of being reviewed and approved by Contractor or is not complete. A submittal marked "not reviewed" will be returned with an explanation of the reason it is not reviewed. Resubmit submittals after taking appropriate action.

1.11 APPROVED SUBMITTALS

- A. The Town of Brookfield, Connecticut approval of submittals is not to be construed as a complete check, and indicates only that the general method of construction, materials, detailing, and other information are satisfactory.
- B. Town of Brookfield, Connecticut approval of a submittal does not relieve the Contractor of the responsibility for any error which may exist. The Contractor is responsible for fully complying with all contract requirements and the satisfactory construction of all work, including the need to check, confirm, and coordinate the work of all subcontractors for the project. Non-compliant material incorporated in the work will be removed and replaced at the Contractor's expense.
- C. After submittals have been approved, no resubmittal for the purpose of substituting materials or equipment will be considered unless accompanied by an explanation of why a substitution is necessary.
- D. Retain a copy of all approved submittals at project site, including approved samples.

1.12 WITHHOLDING OF PAYMENT

Payment for materials incorporated in the work will not be made if required approvals have not been obtained.

- END OF SECTION -

**SECTION 03 30 00
CAST-IN-PLACE CONCRETE**

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies cast-in-place structural concrete and materials and mixes for other concrete.

1.2 RELATED WORK

- A. Section 01 45 29, TESTING LABORATORY SERVICES: Materials testing and inspection during construction.

1.3 TESTING AGENCY FOR CONCRETE MIX DESIGN

- A. Testing agency for the trial concrete mix design retained and reimbursed by the Contractor and approved by Town of Brookfield, Connecticut. For all other testing, refer to Section 01 45 29 Testing Laboratory Services.
- B. Testing agency shall furnish equipment and qualified technicians to establish proportions of ingredients for concrete mixes.

1.4 TOLERANCES

- A. Formwork: ACI 117, except the elevation tolerance of formed surfaces before removal of shores is 3/4 inch.
- B. Reinforcement Fabricating and Placing: Per ACI 117
- C. Cross-Sectional Dimension: Per ACI 117
- D. Slab Finishes: Per ACI 117

1.5 REGULATORY REQUIREMENTS

- A. ACI SP-66 – ACI Detailing Manual.
- B. ACI 318 - Building Code Requirements for Reinforced Concrete.
- C. ACI 301 – Standard Specifications for Structural Concrete.

1.6 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES. All items indicated below are required submittals requiring Contracting Officer's Representative (Town of Brookfield, Connecticut) review and approval.
- B. Shop Drawings: Reinforcing steel: Complete shop drawings
- C. Mill Test Reports:
 - 1. Reinforcing Steel.
 - 2. Cement.

- D. Manufacturer's Certificates:
 - 1. Abrasive aggregate.
 - 2. Lightweight aggregate for structural concrete.
 - 3. Air-entraining admixture.
 - 4. Chemical admixtures, including chloride ion content.
 - 5. Non-shrinking grout.
 - 6. Liquid hardener.
 - 7. Waterstops.
 - 8. Adhesive binder.
- E. Testing Agency for Concrete Mix Design: Approval request including qualifications of principals and technicians and evidence of active participation in program of Cement and Concrete Reference Laboratory (CCRL) of National Institute of Standards and Technology.
- F. Test Report for Concrete Mix Designs: Trial mixes including water-cement ratio curves, concrete mix ingredients, and admixtures.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Conform to ACI 304. Store aggregate separately for each kind or grade, to prevent segregation of sizes and avoid inclusion of dirt and other materials.
- B. Deliver cement in original sealed containers bearing name of brand and manufacturer, and marked with net weight of contents. Store in suitable watertight building in which floor is raised at least 1 foot above ground. Store bulk cement in separate suitable bins.
- C. Deliver other packaged materials for use in concrete in original sealed containers, plainly marked with manufacturer's name and brand, and protect from damage until used.

1.8 PRE-CONCRETE CONFERENCE

- A. General: At least 15 days prior to submittal of design mixes, conduct a meeting to review proposed methods of concrete construction to achieve the required results.
- B. Agenda: Includes but is not limited to:
 - 1. Submittals.
 - 2. Coordination of work.
 - 3. Availability of material.
 - 4. Concrete mix design including admixtures.
 - 5. Methods of placing, finishing, and curing.
 - 6. Finish criteria required to obtain required flatness and levelness.
 - 7. Material inspection and testing.
- C. Attendees: Include but not limited to representatives of Contractor; subcontractors involved in supplying, conveying, placing, finishing, and curing concrete; lightweight aggregate manufacturer; admixture manufacturers; Town of Brookfield, Connecticut EOR.

- D. Minutes of the meeting: Contractor shall take minutes and type and distribute the minutes to attendees within five days of the meeting.

1.9 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.

- B. American Concrete Institute (ACI):

318-19.....	Building Code Requirements for Structural Concrete and Commentary
347R-14.....	Guide to Formwork for Concrete
SP-66-04.....	ACI Detailing Manual

- C. ASTM International (ASTM):

A615-20.....	Standard Specification for Deformed and Plain Carbon Steel Bars for Concrete Reinforcement
A775-19.....	Standard Specification for Epoxy Coated Steel Reinforcing Bars
C3-19a.....	Standard Practice for Making and Curing Concrete Test Specimens in the field
C33-18.....	Standard Specification for Concrete Aggregates
C39-20.....	Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
C94-19a.....	Standard Specification for Ready Mixed Concrete
C143-20.....	Standard Test Method for Slump of Hydraulic Cement Concrete
C150-20.....	Standard Specification for Portland Cement
C173-16.....	Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method
C260 2016.....	Standard Specification for Air Entraining Admixtures for Concrete
C494-19.....	Standard Specification for Chemical Admixtures for Concrete

PART 2 – PRODUCTS

2.1 FORMS

- A. Wood: PS 20 free from loose knots and suitable to facilitate finishing concrete surface specified; tongue and grooved.
- B. Plywood: PS-1 Exterior Grade B-B (concrete-form) 16 mm (5/8 inch), or 20 mm (3/4 inch) thick for unlined contact form. B-B High Density Concrete Form Overlay optional.
- C. Form Lining:
 - 1. 1. Hardboard: ANSI/AHA A135.4, Class 2 with one (S1S) smooth side)
 - 2. 2. Plywood: Grade B-B Exterior (concrete-form) not less than 6 mm (1/4 inch) thick.
- D. Form Ties: Develop a minimum working strength of 3000 pounds when fully assembled. Ties shall be adjustable in length to permit tightening of forms and not have any lugs, cones, washers to act as spreader within form, nor leave a hole larger than 3/4 inch diameter, or a depression in exposed concrete surface, or leave metal closer than 1 1/2 inches to concrete surface. Wire ties not permitted. Cutting ties back from concrete face not permitted.

2.2 MATERIALS

- A. Portland Cement: ASTM C150 Type I or II.
- B. Coarse Aggregate: ASTM C33.
 - 1. Size 67 or Size 467 may be used for footings and walls over 12 inches thick.
 - 2. Coarse aggregate for interior slabs on grade shall conform to the following:
 - a. Dense or well graded aggregate.
 - 1) Percent retained on each sieve below the top size and above the No. 100 sieve:
 - a) 8 to 18 percent for 1-1/2 inches top size.
 - b) 8 to 22 percent for 3/4 or 1 inch (19 or 25 mm) top size.
 - 3. Maximum size of coarse aggregates not more than one-fifth of narrowest dimension between sides of forms, one-third of depth of slabs, nor three-fourth of minimum clear spacing between reinforcing bars.
- C. Fine Aggregate: ASTM C33. Fine aggregate for applied concrete floor topping shall pass a 4.75 mm (No. 4) sieve, 10 percent maximum shall pass a 150 µm (No. 100) sieve.
- D. Mixing Water: Fresh, clean, and potable.
- E. Admixtures:
 - 1. Water Reducing Admixture: ASTM C494, Type A and not contain more chloride ions than are present in municipal drinking water.

2. Water Reducing, Retarding Admixture: ASTM C494, Type D and not contain more chloride ions than are present in municipal drinking water.
 3. High-Range Water-Reducing Admixture (Superplasticizer): ASTM C494, Type F or G, and not contain more chloride ions than are present in municipal drinking water. Use of superplasticizer requires Town of Brookfield, Connecticut approval.
 4. Non-Corrosive, Non-Chloride Accelerator: ASTM C494, Type C or E, and not contain more chloride ions than are present in municipal drinking water. Admixture manufacturer must have long-term non-corrosive test data from an independent testing laboratory of at least one year duration using an acceptable accelerated corrosion test method such as that using electrical potential measures.
 5. Air Entraining Admixture: ASTM C260.
 6. Use only in conjunction with high range water reducer.
 7. Calcium Nitrite corrosion inhibitor: ASTM C494 Type C.
 8. Prohibited Admixtures: Calcium chloride, thiocyanate or admixtures containing more than 0.05 percent chloride ions are not permitted.
 9. Certification: Written conformance to the requirements above and the chloride ion content of the admixture prior to mix design review.
- F. Reinforcing Steel: ASTM A615, or ASTM A996, deformed, grade as shown.
- G. Welded Wire Fabric: ASTM A185.
- H. Reinforcing Bars to be Welded: ASTM A706.
- I. Galvanized Reinforcing Bars: ASTM A767.
- J. Epoxy Coated Reinforcing Bars: ASTM A775.
- K. Supports, Spacers, and Chairs: Types which will hold reinforcement in position shown in accordance with requirements of ACI 318 except as specified.
- L. Expansion Joint Filler: ASTM D1751.
- M. Sheet Materials for Curing Concrete: ASTM C171.
- N. Liquid Membrane-forming Compounds for Curing Concrete: ASTM C309, Type I, with fugitive dye, and shall meet the requirements of ASTM C1315. Compound shall be compatible with scheduled surface treatment, such as paint and resilient tile, and shall not discolor concrete surface.
- O. Non-Shrink Grout:
1. ASTM C1107, pre-mixed, produce a compressive strength of at least 18 MPa at three days and 35 MPa (5000 psi) at 28 days. Furnish test data from an independent laboratory indicating that the grout when placed at a fluid consistency shall achieve 95 percent bearing under a 1200 mm x 1200 mm (4 foot by 4 foot) base plate.

2. Where high fluidity or increased placing time is required, furnish test data from an independent laboratory indicating that the grout when placed at a fluid consistency shall achieve 95 percent under an 450 mm x 900 mm (18 inch by 36 inch) base plate.

P. Adhesive Binder: ASTM C881.

Q. Porous Backfill: Crushed stone or gravel graded from 1 inch to 3/4 inch.

R. Bonding Admixture: Non-rewettable, polymer modified, bonding compound.

2.3 CONCRETE MIXES

A. Mix Designs: Proportioned in accordance with Section 5.3, "Proportioning on the Basis of Field Experience and/or Trial Mixtures" of ACI 318.

1. If trial mixes are used, make a set of at least 6 cylinders in accordance with ASTM C192 for test purposes from each trial mix; test three for compressive strength at 7 days and three at 28 days.
2. Submit a report of results of each test series, include a detailed listing of the proportions of trial mix or mixes, including cement, admixtures, weight of fine and coarse aggregate per cubic yard measured dry rodded and damp loose, specific gravity, fineness modulus, percentage of moisture, air content, water-cement ratio, and consistency of each cylinder in terms of slump.
3. Prepare a curve showing relationship between water-cement ratio at 7-day and 28-day compressive strengths. Plot each curve using at least three specimens.
4. If the field experience method is used, submit complete standard deviation analysis.

B. After approval of mixes no substitution in material or change in proportions of approval mixes may be made without additional tests and approval of the Town of Brookfield, Connecticut or as specified.

C. Maximum Slump: Maximum slump, as determined by ASTM C143 with tolerances as established by ASTM C94, for concrete to be vibrated shall be as shown in Table II.

TABLE II - MAXIMUM SLUMP, INCHES

Type of Construction	Normal Weight Concrete	Lightweight Structural Concrete
Reinforced Footings and Substructure Walls	3 inches	3 inches
Slabs, Beams, Reinforced Walls, and Building Columns	4 inches	4 inches

- D. Slump may be increased by the use of the approved high-range water-reducing admixture (superplasticizer). Tolerances as established by ASTM C94. Concrete containing the high-range-water-reducing admixture may have a maximum slump of 9 inches. The concrete shall arrive at the job site at a slump of 2 inches to 3 inches, and 3 inches to 4 inches for lightweight concrete. This should be verified, and then the high-range-water-reducing admixture added to increase the slump to the approved level.
- E. Air-Entrainment: Air-entrainment of normal weight concrete shall conform with Table III. Air-entrainment of lightweight structural concrete shall conform with Table IV. Determine air content by either ASTM C173 or ASTM C231.

**TABLE III - TOTAL AIR CONTENT
FOR VARIOUS SIZES OF COARSE AGGREGATES (NORMAL CONCRETE)**

Nominal Maximum Size of Total Air Content	Coarse Aggregate, Inches/ Percentage by Volume
3/8 in .6 to 10	1/2 in) .5 to 9
3/4 in .4 to 8	1 in .3-1/2 to 6-1/2

- F. High early strength concrete, made with Type III cement or Type I cement plus non-corrosive accelerator, shall have a 7-day compressive strength equal to specified minimum 28-day compressive strength for concrete type specified made with standard Portland cement.
- G. Lightweight structural concrete shall not weigh more than air-dry unit weight shown. Air-dry unit weight determined on 6 inch by 12 inch test cylinders after seven days standard moist curing followed by 21 days drying at 73.4 ± 3 degrees Fahrenheit, and plus or minus 7 percent relative humidity. Use wet unit weight of fresh concrete as basis of control in field.
- H. Concrete slabs placed at air temperatures below 50 degrees Fahrenheit use non-corrosive, non-chloride accelerator. Concrete required to be air entrained use approved air entraining admixture. Pumped concrete, synthetic fiber concrete, architectural concrete, concrete required to be watertight, and concrete with a water/cement ratio below 0.50 use high-range water-reducing admixture (superplasticizer).
- I. Durability: Use air entrainment for exterior exposed concrete subjected to freezing and thawing and other concrete shown or specified. For air content requirements see Table III or Table IV.
- J. Enforcing Strength Requirements: Test during the progress of the work. Seven-day tests may be used as indicators of 28-day strength. Average of any three 28-day consecutive strength tests of laboratory-cured specimens representing each type of concrete shall be equal to or greater than specified strength. No single test shall be more than 500 psi below specified strength. Interpret field test results in accordance with ACI 214. Should strengths shown by test specimens fall below required values, the Town of Brookfield, Connecticut may require any one or any combination of the following corrective actions, at no additional cost to the Government:

1. Require changes in mix proportions by selecting one of the other appropriate trial mixes or changing proportions, including cement content, of approved trial mix.
2. Require additional curing and protection.
3. If five consecutive tests fall below 95 percent of minimum values given in Table I or if test results are so low as to raise a question as to the safety of the structure, the Town of Brookfield, Connecticut may direct Contractor to take cores from portions of the structure. Use results from cores tested by the Contractor retained testing agency to analyze structure.
4. If strength of core drilled specimens falls below 85 percent of minimum value given in Table I, the Town of Brookfield, Connecticut may order load tests, made by Contractor retained testing agency, on portions of building so affected. Load tests in accordance with ACI 318 and criteria of acceptability of concrete under test as given therein.
5. Concrete work, judged inadequate by structural analysis, by results of load test, or for any reason, shall be reinforced with additional construction or replaced, if directed by the Town of Brookfield, Connecticut.

2.4 BATCHING AND MIXING

- A. General: Concrete shall be "Ready-Mixed" and comply with ACI 318 and ASTM C94, except as specified. Batch mixing at the site is permitted. Mixing process and equipment must be approved by the Town of Brookfield, Connecticut. With each batch of concrete, furnish certified delivery tickets listing information in Paragraph 16.1 and 16.2 of ASTM C94. Maximum delivery temperature of concrete is 100 degrees Fahrenheit. Minimum delivery temperature as follows:

Atmospheric Temperature	Minimum Concrete Temperature
30 degrees to 40 degrees F	60 degrees F.
-0 degrees to 30 degrees F.	70 degrees F.

1. Services of aggregate manufacturer's representative shall be furnished during the design of trial mixes and as requested by the Town of Brookfield, Connecticut for consultation during batching, mixing, and placing operations of lightweight structural concrete. Services will be required until field controls indicate that concrete of required quality is being furnished. Representative shall be thoroughly familiar with the structural lightweight aggregate, adjustment and control of mixes to produce concrete of required quality. Representative shall assist and advise the Town of Brookfield, Connecticut.

PART 3 – EXECUTION

3.1 FORMWORK

- A. General: Design in accordance with ACI 347 is the responsibility of the Contractor. The Contractor shall retain a registered Professional Engineer to design the formwork, shores, and reshores.
 - 1. Form boards and plywood forms may be reused for contact surfaces of exposed concrete only if thoroughly cleaned, patched, and repaired and the Town of Brookfield, Connecticut approves their reuse.
 - 2. Provide forms for concrete footings unless the Town of Brookfield, Connecticut determines forms are not necessary.
- B. Treating and Wetting: Treat or wet contact forms as follows:
 - 1. Coat plywood and board forms with non-staining form sealer. In hot weather, cool forms by wetting with cool water just before concrete is placed.
 - 2. Clean and coat removable metal forms with light form oil before reinforcement is placed. In hot weather, cool metal forms by thoroughly wetting with water just before placing concrete.
 - 3. Use sealer on reused plywood forms as specified for new material.
- C. Size and Spacing of Studs: Size and space studs, wales and other framing members for wall forms so as not to exceed safe working stress of kind of lumber used nor to develop deflection greater than $1/270$ of free span of member.
- D. Unlined Forms: Use plywood forms to obtain a smooth finish for concrete surfaces. Tightly butt edges of sheets to prevent leakage. Back up all vertical joints solidly and nail edges of adjacent sheets to same stud with 6d box nails spaced not over 150 mm (6 inches) apart.
- E. Lined Forms: May be used in lieu of unlined plywood forms. Back up form lining solidly with square edge board lumber securely nailed to studs with all edges in close contact to prevent bulging of lining. No joints in lining and backing may coincide. Nail abutted edges of sheets to same backing board. Nail lining at not over 200 mm (8 inches) on center along edges and with at least one nail to each square foot of surface area; nails to be 3d blued shingle or similar nails with thin flatheads.
- F. Wall Form Ties: Locate wall form ties in symmetrically level horizontal rows at each line of wales and in plumb vertical tiers. Space ties to maintain true, plumb surfaces. Provide one row of ties within 6 inches above each construction joint. Space through-ties adjacent to horizontal and vertical construction joints not over 18 inches on center.
 - 1. Tighten row of ties at bottom of form just before placing concrete and, if necessary, during placing of concrete to prevent seepage of concrete and to obtain a clean line. Ties to be entirely removed shall be loosened 24 hours after concrete is placed and shall be pulled from least important face when removed.
 - 2. Coat surfaces of all metal that is to be removed with paraffin, cup grease or a suitable compound to facilitate removal.

G. Inserts, Sleeves, and Similar Items: Flashing reglets, steel strips, masonry ties, anchors, wood blocks, nailing strips, grounds, inserts, wire hangers, sleeves, drains, guard angles, forms for floor hinge boxes, inserts or bond blocks for elevator guide rails and supports, and other items specified as furnished under this and other sections of specifications and required to be in their final position at time concrete is placed shall be properly located, accurately positioned, and built into construction, and maintained securely in place.

1. Locate inserts or hanger wires for furred and suspended ceilings only in bottom of concrete joists, or similar concrete member of overhead concrete joist construction.
2. Install sleeves, inserts and similar items for mechanical services in accordance with drawings prepared specially for mechanical services. Contractor is responsible for accuracy and completeness of drawings and shall coordinate requirements for mechanical services and equipment.
3. Do not install sleeves in beams, joists or columns except where shown or permitted by the Town of Brookfield, Connecticut. Install sleeves in beams, joists, or columns that are not shown, but are permitted by the Town of Brookfield, Connecticut, and require no structural changes, at no additional cost to the Government.
4. Minimum clear distance of embedded items such as conduit and pipe is at least three times diameter of conduit or pipe, except at stub-ups and other similar locations.
5. Provide recesses and blockouts in floor slabs for door closers and other hardware as necessary in accordance with manufacturer's instructions.

H. Construction Tolerances:

1. Set and maintain concrete formwork to assure erection of completed work within tolerances specified and to accommodate installation of other rough and finish materials. Accomplish remedial work necessary for correcting excessive tolerances. Erected work that exceeds specified tolerance limits shall be remedied or removed and replaced, at no additional cost to the Government.
2. Permissible surface irregularities for various classes of materials are defined as "finishes" in specification sections covering individual materials. They are to be distinguished from tolerances specified which are applicable to surface irregularities of structural elements.

3.2 PLACING REINFORCEMENT

A. General: Details of concrete reinforcement in accordance with ACI 318 unless otherwise shown.

B. Placing: Place reinforcement conforming to CRSI DA4, unless otherwise shown.

1. Place reinforcing bars accurately and tie securely at intersections and splices with 16 gauge epoxy-coated tie wire with epoxy-coated reinforcing. Secure reinforcing bars against displacement during the placing of concrete by spacers, chairs, or other similar supports. Portions of supports, spacers, and chairs in contact with formwork shall be made of plastic in areas that will be exposed when building is occupied. Type, number, and spacing of supports conform to ACI 318. Where concrete slabs are placed on ground, use concrete blocks or

other non-corrodible material of proper height, for support of reinforcement. Use of brick or stone supports will not be permitted.

2. Lap welded wire fabric at least 1 1/2 mesh panels plus end extension of wires not less than 12 inches in structural slabs. Lap welded wire fabric at least 1/2 mesh panels plus end extension of wires not less than 6 inches in slabs on grade.
 3. Splice column steel at no points other than at footings and floor levels unless otherwise shown.
- C. Spacing: Minimum clear distances between parallel bars, except in columns and multiple layers of bars in beams shall be equal to nominal diameter of bars. Minimum clear spacing is 1 inch or 1-1/3 times maximum size of coarse aggregate.
- D. Splicing: Splices of reinforcement made only as required or shown or specified. Accomplish splicing as follows:
1. Lap splices: Do not use lap splices for bars larger than Number 10
- E. Bending: Bend bars cold, unless otherwise approved. Do not field bend bars partially embedded in concrete, except when approved by the Town of Brookfield, Connecticut.
- F. Cleaning: Metal reinforcement, at time concrete is placed, shall be free from loose flaky rust, mud, oil, or similar coatings that will reduce bond.
- G. Future Bonding: Protect exposed reinforcement bars intended for bonding with future work by wrapping with felt and coating felt with a bituminous compound unless otherwise shown.

3.5 CONSTRUCTION JOINTS

- A. Unless otherwise shown, location of construction joints to limit individual placement shall not exceed 50 feet in any horizontal direction, except slabs on grade which shall have construction joints shown. Allow 48 hours to elapse between pouring adjacent sections unless this requirement is waived by the Town of Brookfield, Connecticut.
- B. Locate construction joints in suspended floors near the quarter-point of spans for slabs, beams or girders, unless a beam intersects a girder at center, in which case joint in girder shall be offset a distance equal to twice width of beam. Provide keys and inclined dowels as shown. Provide longitudinal keys as shown.
- C. Place concrete for columns slowly and in one operation between joints. Install joints in concrete columns at underside of deepest beam or girder framing into column.
- D. Allow 2 hours to elapse after column is cast before concrete of supported beam, girder or slab is placed. Place girders, beams, grade beams, column capitals, brackets, and haunches at the same time as slab unless otherwise shown.

3.6 EXPANSION JOINTS AND CONTRACTION JOINTS

- A. Clean expansion joint surfaces before installing premolded filler and placing adjacent concrete.

- B. Provide contraction (control) joints in floor slabs as indicated on the contract drawings. Joints shall be either formed or saw cut, to the indicated depth after the surface has been finished. Complete saw joints within 4 to 12 hours after concrete placement. Protect joints from intrusion of foreign matter.

3.7 PLACING CONCRETE

- C. Preparation:
1. Remove hardened concrete, wood chips, shavings and other debris from forms.
 2. Remove hardened concrete and foreign materials from interior surfaces of mixing and conveying equipment.
 3. Have forms and reinforcement inspected and approved by the Town of Brookfield, Connecticut before depositing concrete.
 4. Provide runways for wheeling equipment to convey concrete to point of deposit. Keep equipment on runways which are not supported by or bear on reinforcement. Provide similar runways for protection of vapor barrier on coarse fill.
- D. Bonding: Before depositing new concrete on or against concrete which has been set, thoroughly roughen and clean existing surfaces of laitance, foreign matter, and loose particles.
1. Preparing surface for applied topping:
 - a. Remove laitance, mortar, oil, grease, paint, or other foreign material by sand blasting. Clean with vacuum type equipment to remove sand and other loose material.
 - b. Broom clean and keep base slab wet for at least four hours before topping is applied.
 - c. Use a thin coat of one part Portland cement, 1.5 parts fine sand, bonding admixture; and water at a 50: 50 ratio and mix to achieve the consistency of thick paint. Apply to a damp base slab by scrubbing with a stiff fiber brush. New concrete shall be placed while the bonding grout is still tacky.
- E. Conveying Concrete: Convey concrete from mixer to final place of deposit by a method which will prevent segregation. Method of conveying concrete is subject to approval of the Town of Brookfield, Connecticut.
- F. Placing: For special requirements see Paragraphs, HOT WEATHER and COLD WEATHER.
1. Do not place concrete when weather conditions prevent proper placement and consolidation, or when concrete has attained its initial set, or has contained its water or cement content more than 1 1/2 hours.
 2. Deposit concrete in forms as near as practicable in its final position. Prevent splashing of forms or reinforcement with concrete in advance of placing concrete.
 3. Do not drop concrete freely more than 10 feet for concrete containing the high-range water-reducing admixture (superplasticizer) or 5 feet for conventional concrete. Where greater drops are required, use a tremie or flexible spout (canvas elephant trunk), attached to a suitable hopper.

4. Discharge contents of tremies or flexible spouts in horizontal layers not exceeding 20 inches in thickness, and space tremies such as to provide a minimum of lateral movement of concrete.
5. Continuously place concrete until an entire unit between construction joints is placed. Rate and method of placing concrete shall be such that no concrete between construction joints will be deposited upon or against partly set concrete, after its initial set has taken place, or after 45 minutes of elapsed time during concrete placement.
6. On bottom of members with severe congestion of reinforcement, deposit 25 mm (1 inch) layer of flowing concrete containing the specified high-range water-reducing admixture (superplasticizer). Successive concrete lifts may be a continuation of this concrete or concrete with a conventional slump.
7. Concrete on metal deck:
 - a. Concrete on metal deck shall be minimum thickness shown. Allow for deflection of steel beams and metal deck under the weight of wet concrete in calculating concrete quantities for slab.
 - 1) The Contractor shall become familiar with deflection characteristics of structural frame to include proper amount of additional concrete due to beam/deck deflection.
- G. Consolidation: Conform to ACI 309. Immediately after depositing, spade concrete next to forms, work around reinforcement and into angles of forms, tamp lightly by hand, and compact with mechanical vibrator applied directly into concrete at approximately 450 mm (18 inch) intervals. Mechanical vibrator shall be power driven, hand operated type with minimum frequency of 5000 cycles per minute having an intensity sufficient to cause flow or settlement of concrete into place. Vibrate concrete to produce thorough compaction, complete embedment of reinforcement and concrete of uniform and maximum density without segregation of mix. Do not transport concrete in forms by vibration.
 1. Use of form vibration shall be approved only when concrete sections are too thin or too inaccessible for use of internal vibration.
 2. Carry on vibration continuously with placing of concrete. Do not insert vibrator into concrete that has begun to set.

3.8 HOT WEATHER

- A. Follow the recommendations of ACI 305 or as specified to prevent problems in the manufacturing, placing, and curing of concrete that can adversely affect the properties and serviceability of the hardened concrete. Methods proposed for cooling materials and arrangements for protecting concrete shall be made in advance of concrete placement and approved by the Town of Brookfield, Connecticut.

3.9 COLD WEATHER

- A. Follow the recommendations of ACI 306 or as specified to prevent freezing of concrete and to permit concrete to gain strength properly. Use only the specified non-corrosive, non-chloride

accelerator. Do not use calcium chloride, thiocyanates or admixtures containing more than 0.05 percent chloride ions. Methods proposed for heating materials and arrangements for protecting concrete shall be made in advance of concrete placement and approved by the Town of Brookfield, Connecticut.

3.10 PROTECTION AND CURING

- A. Conform to ACI 308: Initial curing shall immediately follow the finishing operation. Protect exposed surfaces of concrete from premature drying, wash by rain and running water, wind, mechanical injury, and excessively hot or cold temperatures. Keep concrete not covered with membrane or other curing material continuously wet for at least 7 days after placing, except wet curing period for high-early-strength concrete shall be not less than 3 days. Keep wood forms continuously wet to prevent moisture loss until forms are removed. Cure exposed concrete surfaces as described below. Other curing methods may be used if approved by the Town of Brookfield, Connecticut.
 - 1. Plastic sheets: Apply as soon as concrete has hardened sufficiently to prevent surface damage. Utilize widest practical width sheet and overlap adjacent sheets 2 inches. Tightly seal joints with tape.
 - 2. Paper: Utilize widest practical width paper and overlap adjacent sheets 2 inches. Tightly seal joints with sand, wood planks, pressure-sensitive tape, mastic or glue.

3.11 REMOVAL OF FORMS

- A. Remove in a manner to assure complete safety of structure after the following conditions have been met.
 - 1. Where structure as a whole is supported on shores, forms for beams and girder sides, columns, and similar vertical structural members may be removed after 24 hours, provided concrete has hardened sufficiently to prevent surface damage and curing is continued without any lapse in time as specified for exposed surfaces.
 - 2. Take particular care in removing forms of architectural exposed concrete to insure surfaces are not marred or gouged, and that corners and arises are true, sharp and unbroken.
- B. Control Test: Use to determine if the concrete has attained sufficient strength and curing to permit removal of supporting forms. Cylinders required for control tests taken in accordance with ASTM C172, molded in accordance with ASTM C31, and tested in accordance with ASTM C39. Control cylinders cured and protected in the same manner as the structure they represent. Supporting forms or shoring not removed until strength of control test cylinders have attained at least 70 percent of minimum 28-day compressive strength specified. Exercise care to assure that newly unsupported portions of structure are not subjected to heavy construction or material loading.

3.13 CONCRETE FINISHES

- A. Vertical and Overhead Surface Finishes:

1. Unfinished areas: Vertical and overhead concrete surfaces exposed in pipe basements, elevator and dumbwaiter shafts, pipe spaces, pipe trenches, above suspended ceilings, manholes, and other unfinished areas will not require additional finishing.
2. Interior and exterior exposed areas to be painted: Remove fins, burrs and similar projections on surfaces flush, and smooth by mechanical means approved by the Town of Brookfield, Connecticut, and by rubbing lightly with a fine abrasive stone or hone. Use ample water during rubbing without working up a lather of mortar or changing texture of concrete.
3. Interior and exterior exposed areas finished: Give a grout finish of uniform color and smooth finish treated as follows:
 - a. After concrete has hardened and laitance, fins and burrs removed, scrub concrete with wire brushes. Clean stained concrete surfaces by use of a hone stone.
 - b. Apply grout composed of one part of Portland cement, one part fine sand, smaller than a 600 μm (No. 30) sieve. Work grout into surface of concrete with cork floats or fiber brushes until all pits, and honeycombs are filled.
 - c. After grout has hardened slightly, but while still plastic, scrape grout off with a sponge rubber float and, about 1 hour later, rub concrete vigorously with burlap to remove any excess grout remaining on surfaces.
 - d. In hot, dry weather use a fog spray to keep grout wet during setting period. Complete finish of area in same day. Make limits of finished areas at natural breaks in wall surface. Leave no grout on concrete surface overnight.
4. Textured: Finish as specified. Maximum quantity of patched area 0.2 m^2 (2 square feet) in each 93 m^2 (1000 square feet) of textured surface.

SPEC WRITER NOTE: Be sure that slab finish requirements are shown on the drawings.

B. Slab Finishes:

1. Place slabs monolithically. Once slab placement commences, complete finishing operations within same day. Slope finished slab to floor drains where they occur, whether shown or not.
2. Use straightedges specifically made for screeding, such as hollow magnesium straightedges or power strike-offs. Do not use pieces of dimensioned lumber. Strike off and screed slab to a true surface at required elevations. Use optical or laser instruments to check concrete finished surface grade after strike-off. Repeat strike-off as necessary. Complete screeding before any excess moisture or bleeding water is present on surface. Do not sprinkle dry cement on the surface.
3. Immediately following screeding, and before any bleed water appears, use a 3000 mm (10 foot) wide highway straightedge in a cutting and filling operation to achieve surface flatness. Do not use bull floats or darbys, except that darbying may be allowed for narrow slabs and restricted spaces.

4. Wait until water sheen disappears and surface stiffens before proceeding further. Do not perform subsequent operations until concrete will sustain foot pressure with maximum of 6 mm (1/4 inch) indentation.
5. Scratch Finish: Finish base slab to receive a bonded applied cementitious application as indicated above, except that bull floats and darbys may be used. Thoroughly coarse wire broom within two hours after placing to roughen slab surface to insure a permanent bond between base slab and applied materials.
6. Float Finish: Slabs to receive unbonded toppings, steel trowel finish, fill, mortar setting beds, or a built-up roof, and ramps, stair treads, platforms (interior and exterior), and equipment pads shall be floated to a smooth, dense uniform, sandy textured finish. During floating, while surface is still soft, check surface for flatness using 10 foot highway straightedge. Correct high spots by cutting down and correct low spots by filling in with material of same composition as floor finish. Remove any surface projections and re-float to a uniform texture.
7. Steel Trowel Finish: Concrete surfaces to receive resilient floor covering or carpet, monolithic floor slabs to be exposed to view in finished work, future floor roof slabs, applied toppings, and other interior surfaces for which no other finish is indicated. Steel trowel immediately following floating. During final troweling, tilt steel trowel at a slight angle and exert heavy pressure to compact cement paste and form a dense, smooth surface. Finished surface shall be smooth, free of trowel marks, and uniform in texture and appearance.
8. Broom Finish: Finish exterior slabs, ramps, and stair treads with a bristle brush moistened with clear water after surfaces have been floated. Brush in a direction transverse to main traffic. Match texture approved by the Town of Brookfield, Connecticut from sample panel.

- END OF SECTION -

**SECTION 05 12 00
STRUCTURAL STEEL FRAMING**

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Structural steel shapes, plates, and bars.
 - 2. Bolts, nuts, and washers.

1.2 RELATED REQUIREMENTS

- A. Materials Testing And Inspection During Construction: Section 01 45 29, TESTING LABORATORY SERVICES.
- B. Roof Decks Framing: Section 03 51 16, GYPSUM CONCRETE ROOF DECKS.
- C. Steel Finishes: Section 09 06 00, SCHEDULE FOR FINISHES.
- D. Painting: Section 09 91 00, PAINTING.

1.3 APPLICABLE PUBLICATIONS

- A. Comply with references to extent specified in this section.
- B. American Institute of Steel Construction (AISC):
 - 1. AISC Manual - Steel Construction Manual, 14th Edition
- C. American Welding Society (AWS):
 - 1. D1.1/D1.1M-15 - Structural Welding Code - Steel.
- D. ASTM International (ASTM):
 - 1. A36 - Carbon Structural Steel
 - 2. A123 - Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - 3. A307 - Carbon Steel Bolts, Studs, and Threaded Rod 60,000 PSI Tensile Strength.
 - 4. A500 - Cold-Formed Welded and Seamless Carbon Steel Structural Tubing and Rounds and Shapes.
 - 5. A572 - Structural Steel.
 - 6. A992 - Structural Shapes.
 - 7. F2329/ - Zinc Coating, Hot-Dip, Requirements for Application to Carbon and Alloy steel Bolts, Screws, washers, Nuts, and Special Threaded Fasteners.
 - 8. F3125 - Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi and 150 ksi Minimum Tensile Strength, Inch and Metric Dimensions
- E. Master Painters Institute (MPI):
 - 1. No. 18 - Primer, Zinc Rich, Organic.

- F. Occupational Safety and Health Administration (OSHA):
 - 1. 29 CFR 1926.752(e) - Guidelines For Establishing The Components Of A Site-Specific Erection Plan.
 - 2. 29 CFR 1926 2001 - Safety Standards for Steel Erection.

1.4 SUBMITTALS

- A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Submittal Drawings:
 - 1. Show size, configuration, and fabrication and installation details.
- C. Test Reports: Certify products comply with specifications.
 - 1. Welders' qualifying tests.
- D. Certificates: Certify each product complies with specifications.
 - 1. Structural steel.
 - 2. Steel connections.
 - 3. Welding materials.
 - 4. Shop coat primer paint.
- E. Qualifications: Substantiate qualifications comply with specifications.
 - 1. Fabricator with project experience list.
 - 2. Installer with project experience list.
 - 3. Welders and welding procedures.

1.5 QUALITY ASSURANCE

- A. Fabricator Qualifications: AISC Quality Certification participant designated as AISC Certified Plant, Category STD.
 - 1. Regularly fabricates specified products.
 - 2. Fabricated specified products with satisfactory service on five similar installations for minimum five years.
- B. Installer Qualifications: AISC Quality Certification Program participant designated as AISC Certified Erector, Category ACSE.
 - 1. Regularly installs specified products.
 - 2. Installed specified products with satisfactory service on five similar installations for minimum five years.
- C. Before commencement of Work, ensure steel erector provides written notification required by OSHA 29 CFR 1926.752(e). Submit a copy of the notification to Contracting Officer's Representative.
- D. Welders and Welding Procedures Qualifications: AWS D1.1/D1.1M.

PART 2 - PRODUCTS

2.1 SYSTEM PERFORMANCE

- A. Delegated Design: Prepare submitter documents including design calculations and drawings signed and sealed by registered design professional, licensed in state where project is located.

- B. Design structural steel framing connections complying with specified performance:
 - 1. Load Capacity: Resist full capacity of supported framing member.
 - a. Request additional design criteria when necessary to complete connection design.

2.2 MATERIALS

- A. W-Shapes:
 - 1. ASTM A992
 - 2. ASTM A572 Grade 50
- B. Channel and Angles:
 - 1. ASTM A36
 - 2. ASTM A572/A572M; Grade 50
 - 3. ASTM A529; Grade 50
- C. Plates and Bars:
 - 1. ASTM A36
 - 2. ASTM A572 Grade 50
- D. Bolts, Nuts and Washers: Galvanized for galvanized framing and a plain finish for other framing.
 - 1. High-strength bolts, including nuts and washers: ASTM F3125.
 - 2. Bolts and nuts, other than high-strength: ASTM A307, Grade A.
 - 3. Plain washers, other than those in contact with high-strength bolt heads and nuts: ASME B18.22.1.
- E. Welding Materials: AWS D1.1, type to suit application.

2.3 FABRICATION

- A. Fabricate structural steel according to Chapter M, AISC 360.
- B. Shop and Field Connections:
 - 1. Weld connections according to AWS D1.1/D1.1M. Welds shall be made only by welders and welding operators who have been previously qualified by tests as prescribed in AWS D1.1 to perform type of work required.
 - 2. High-Strength Bolts: High-strength bolts tightened to a bolt tension minimum 70 percent of their minimum tensile strength. Tightening done with properly calibrated wrenches, by turn-of-nut method or by use of direct tension indicators (bolts or washers). Tighten bolts in

connections identified as slip-critical using Direct Tension Indicators. Twist-off torque bolts are not an acceptable alternate fastener for slip critical connections.

2.4 FINISHES

- A. Shop Priming:
 - 1. Prime paint structural steel according to AISC 303, Section 6.
- B. Do not paint:
 - 1. Surfaces within 2 inches of field welded joints.
 - 2. Surfaces indicated to be encased in concrete.
 - 3. Surfaces receiving sprayed on fireproofing.
 - 4. Beam top flanges receiving shear connector studs applied.
- C. Structural Steel Galvanizing: ASTM A123, hot dipped, after fabrication. Touch-up after erection: Clean and wire brush any abraded and other spots worn through zinc coating, including threaded portions of bolts and welds and touch-up with galvanizing repair paint.
 - 1. Galvanize structural steel framing installed at exterior locations.
- D. Bolts, Nuts, and Washers Galvanizing: ASTM F2329, hot-dipped.

2.5 ACCESSORIES

- A. General: Shop paint steel according to AISC 303, Section 6.
- B. Finish Paint System: Primer and finish as specified in Section 09 91 00, PAINTING.
- C. Galvanizing Repair Paint: MPI No. 18.

PART 3 - EXECUTION

3.1 ERECTION

- A. Erect structural steel according to AISC 303 and AISC 360.
- B. Set structural steel accurately at locations and elevations indicated on drawings.
- C. Weld and bolt connections as specified for shop connections.

3.2 FIELD PAINTING

- A. After welding, clean and prime weld areas to match adjacent finish.
- B. Touch-up primer damaged by construction operations.
- C. Apply galvanizing repair paint to galvanized coatings damaged by construction operations.
- D. Finish Painting: As specified in Section 09 91 00, PAINTING.

- END OF SECTION -

**SECTION 09 91 00
PAINTING**

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work of this Section includes all labor, materials, equipment, and services necessary to complete the painting and finishing as shown on the construction documents and/or specified herein, including, but not limited to, the following:
 - 1. Painting galvanized ferrous metals exposed to view.

1.2 RELATED WORK

- A. Division 05 METALS: Shop prime painting of steel and ferrous metals.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
 - 1. Before work is started, or sample panels are prepared, submit manufacturer's literature and technical data, the current Master Painters Institute (MPI) "Approved Product List" indicating brand label, product name and product code as of the date of contract award, will be used to determine compliance with the submittal requirements of this specification. The Contractor may choose to use subsequent MPI "Approved Product List", however, only one (1) list may be used for the entire contract and each coating system is to be from a single manufacturer. All coats on a particular substrate must be from a single manufacturer. No variation from the MPI "Approved Product List" where applicable is acceptable.
- C. Sample of identity markers if used.

1.4 DELIVERY AND STORAGE

- A. Deliver materials to site in manufacturer's sealed container marked to show following:
 - 1. Name of manufacturer.
 - 2. Product type.
 - 3. Batch number.
 - 4. Instructions for use.
 - 5. Safety precautions.
- B. In addition to manufacturer's label, provide a label legibly printed as following:
 - 1. Federal Specification Number, where applicable, and name of material.
 - 2. Surface upon which material is to be applied.
 - 3. Specify Coat Types: Prime; body; finish; etc.

- C. Maintain space for storage, and handling of painting materials and equipment in a ventilated, neat and orderly condition to prevent spontaneous combustion from occurring or igniting adjacent items.
- D. Store materials at site at least 24 hours before using, at a temperature between 45 and 85 degrees F.

1.5 QUALITY ASSURANCE

- A. Qualification of Painters: Use only qualified journeyman painters for the mixing and application of paint on exposed surfaces. Submit evidence that key personnel have successfully performed surface preparation and application of coating on a minimum of three (3) similar projects within the past three (3) years.
- B. Paint Coordination: Provide finish coats which are compatible with the prime paints used. Review other Sections of these specifications in which prime paints are to be provided to ensure compatibility of the total coatings system for the various substrates. Upon request from other subcontractors, furnish information on the characteristics of the finish materials proposed to be used, to ensure that compatible prime coats are used. Provide barrier coats over incompatible primers or remove and re-prime as required. Notify the Contracting Officer Representative (Town of Brookfield , Connecticut) in writing of any anticipated problems using the coating systems as specified with substrates primed by others.
- C. In addition to the samples specified herein to be submitted for approval, apply in the field, at their final location, each type and color of approved paint materials, applied 3.05 m (10 feet) wide, floor to ceiling of wall surfaces, before proceeding with the remainder of the work, for approval by the Town of Brookfield , Connecticut. Paint mock-ups to include one (1) door and frame assembly.
- D. Finish and texture approved by Town of Brookfield , Connecticut will be used as a standard of quality and workmanship for remainder of work.
- E. Repaint individual areas which are not approved, as determined by the Town of Brookfield , Connecticut, until approval is received.

1.6 REGULATORY REQUIREMENTS

- A. Paint materials are to conform to the restrictions of the local Environmental and Toxic Control jurisdiction.
 - 1. Volatile Organic Compounds (VOC) Emissions Requirements: Field-applied paints and coatings that are inside the waterproofing system to not exceed limits of authorities having jurisdiction.
 - 2. Lead-Base Paint:
 - a. Comply with Section 410 of the Lead-Based Paint Poisoning Prevention Act, as amended, and with implementing regulations promulgated by Secretary of Housing and Urban Development.
 - b. Regulations concerning prohibition against use of lead-based paint in federal and federally assisted construction, or rehabilitation of residential structures are set forth in Subpart F, Title 24, Code of Federal Regulations, Department of Housing and Urban Development.
 - c. Do not use coatings having a lead content over 0.06 percent by weight of non-volatile content.

3. Asbestos: Provide materials that do not contain asbestos.
4. Chromate, Cadmium, Mercury, and Silica: Provide materials that do not contain zinc-chromate, strontium-chromate, Cadmium, mercury or mercury compounds or free crystalline silica.
5. Human Carcinogens: Provide materials that do not contain any of the ACGIH-BKLT and ACGHI-DOC confirmed or suspected human carcinogens.
6. Use high performance acrylic paints in place of alkyd paints.

1.7 SAFETY AND HEALTH

- A. Apply paint materials using safety methods and equipment in accordance with the following:
 1. Comply with applicable Federal, State, and local laws and regulations.
- B. Safety Methods Used During Paint Application: Comply with the requirements of SSPC PA Guide 10.
- C. Toxic Materials: To protect personnel from overexposure to toxic materials, conform to the most stringent guidance of:
 1. The applicable manufacturer's Material Safety Data Sheets (MSDS) or local regulation.
 2. 29 CFR 1910.1000.
 3. ACHIH-BKLT and ACGHI-DOC, threshold limit values.

1.8

- A. Society for Protective Coatings (SSPC):
 - SSPC SP 1-82(R2004).....Solvent Cleaning
 - SSPC SP 2-82(R2004).....Hand Tool Cleaning
 - SSPC SP 3-28(R2004).....Power Tool Cleaning
 - SSPC PA Guide 10.....Guide to Safety and Health Requirements
- B. Underwriter's Laboratory (UL)

PART 2 - PRODUCTS

2.1 MATERIALS:

- A. Conform to the coating specifications and standards referenced in PART 3. Submit manufacturer's technical data sheets for specified coatings and solvents.

2.2 PAINT PROPERTIES:

- A. Use ready-mixed (including colors), except two component epoxies, polyurethanes, polyesters, paints having metallic powders packaged separately and paints requiring specified additives.

PART 3 - EXECUTION

3.1 JOB CONDITIONS:

- A. Safety: Observe required safety regulations and manufacturer's warning and instructions for storage, handling and application of painting materials.
 1. Take necessary precautions to protect personnel and property from hazards due to falls, injuries, toxic fumes, fire, explosion, or other harm.

2. Deposit soiled cleaning rags and waste materials in metal containers approved for that purpose. Dispose of such items off the site at end of each day's work.

B. Atmospheric and Surface Conditions:

1. Do not apply coating when air or substrate conditions do not meet manufacturer requirements.
2. Do no exterior painting when it is windy and dusty.
3. Do not paint in direct sunlight or on surfaces that the sun will warm.
4. Apply only on clean, dry and frost-free surfaces except as follows:
 - a. Apply water thinned acrylic and cementitious paints to damp (not wet) surfaces only when allowed by manufacturer's printed instructions.
 - b. Concrete and masonry when permitted by manufacturer's recommendations, dampen surfaces to which water thinned acrylic and cementitious paints are applied with a fine mist of water on hot dry days to prevent excessive suction and to cool surface.
5. Varnishing:
 - a. Apply in clean areas and in still air.
 - b. Before varnishing vacuum and dust area.
 - c. Immediately before varnishing wipe down surfaces with a tack rag.

3.2 INSPECTION:

- A. Examine the areas and conditions where painting and finishing are to be applied and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

3.3 GENERAL WORKMANSHIP REQUIREMENTS:

- A. Application may be by brush or roller. Spray application only upon acceptance from the Town of Brookfield , Connecticut in writing.
- B. Furnish to the Town of Brookfield , Connecticut a painting schedule indicating when the respective coats of paint for the various areas and surfaces will be completed. This schedule is to be kept current as the job progresses.
- C. Protect work at all times. Protect all adjacent work and materials by suitable covering or other method during progress of work. Upon completion of the work, remove all paint and varnish spots from floors, glass and other surfaces. Remove from the premises all rubbish and accumulated materials of whatever nature not caused by others and leave work in a clean condition.
- D. Remove and protect hardware, accessories, device plates, lighting fixtures, and factory finished work, and similar items, or provide in place protection. Upon completion of each space, carefully replace all removed items by workmen skilled in the trades involved.
- E. When indicated to be painted, remove electrical panel box covers and doors before painting walls. Paint separately and re-install after all paint is dry.
- F. Materials are to be applied under adequate illumination, evenly spread and flowed on smoothly to avoid runs, sags, holidays, brush marks, air bubbles and excessive roller stipple.

- G. Apply materials with a coverage to hide substrate completely. When color, stain, dirt or undercoats show through final coat of paint, the surface is to be covered by additional coats until the paint film is of uniform finish, color, appearance and coverage, at no additional cost to the Government.
- H. All coats are to be dry to manufacturer's recommendations before applying succeeding coats.
- I. All suction spots or "hot spots" in plaster after the application of the first coat are to be touched up before applying the second coat.

3.4 SURFACE PREPARATION:

A. General:

1. The Contractor shall be held wholly responsible for the finished appearance and satisfactory completion of painting work. Properly prepare all surfaces to receive paint, which includes cleaning, sanding, and touching-up of all prime coats applied under other Sections of the work. Broom clean all spaces before painting is started. All surfaces to be painted or finished are to be completely dry, clean and smooth.
2. See other sections of specifications for specified surface conditions and prime coat.
3. Perform preparation and cleaning procedures in strict accordance with the paint manufacturer's instructions and as herein specified, for each particular substrate condition.
4. Clean surfaces before applying paint or surface treatments with materials and methods compatible with substrate and specified finish. Remove any residue remaining from cleaning agents used. Do not use solvents, acid, or steam on concrete and masonry. Schedule the cleaning and painting so that dust and other contaminants from the cleaning process will not fall in wet, newly painted surfaces.

B. Ferrous Metals:

1. Remove oil, grease, soil, drawing and cutting compounds, flux and other detrimental foreign matter in accordance with SSPC-SP 1 (Solvent Cleaning).
2. Remove loose mill scale, rust, and paint, by hand or power tool cleaning, as defined in SSPC-SP 2 (Hand Tool Cleaning) and SSPC-SP 3 (Power Tool Cleaning).
3. Fill dents, holes and similar voids and depressions in flat exposed surfaces of hollow steel doors and frames, access panels, roll-up steel doors and similar items specified to have semi-gloss or gloss finish with TT-F-322D (Filler, Two-Component Type, For Dents, Small Holes and Blow-Holes). Finish flush with adjacent surfaces.
 - a. Fill flat head countersunk screws used for permanent anchors.
 - b. Do not fill screws of item intended for removal such as glazing beads.
4. Spot prime abraded and damaged areas in shop prime coat which expose bare metal with same type of paint used for prime coat. Feather edge of spot prime to produce smooth finish coat.
5. Spot prime abraded and damaged areas which expose bare metal of factory finished items with paint as recommended by manufacturer of item.

C. /Zinc-Coated (Galvanized) Metal Surfaces Specified Painted:

1. Clean surfaces to remove grease, oil and other deterrents to paint adhesion in accordance with SSPC-SP 1 (Solvent Cleaning).
2. Spot coat abraded and damaged areas of zinc-coating which expose base metal on hot-dip zinc-coated items with MPI 18 (Organic Zinc Rich Coating). Prime or spot prime with MPI 134 (Waterborne Galvanized Primer) or MPI 135 (Non-Cementitious Galvanized Primer) depending on finish coat compatibility.

3.5 PAINT PREPARATION:

- A. Thoroughly mix painting materials to ensure uniformity of color, complete dispersion of pigment and uniform composition.
- B. Do not thin unless necessary for application and when finish paint is used for body and prime coats. Use materials and quantities for thinning as specified in manufacturer's printed instructions.
- C. Remove paint skins, then strain paint through commercial paint strainer to remove lumps and other particles.
- D. Mix two (2) component and two (2) part paint and those requiring additives in such a manner as to uniformly blend as specified in manufacturer's printed instructions unless specified otherwise.
- E. For tinting required to produce exact shades specified, use color pigment recommended by the paint manufacturer.

3.6 APPLICATION:

- A. Start of surface preparation or painting will be construed as acceptance of the surface as satisfactory for the application of materials.
- B. Unless otherwise specified, apply paint in three (3) coats; prime, body, and finish. When two (2) coats applied to prime coat are the same, first coat applied over primer is body coat and second coat is finish coat.
- C. Apply each coat evenly and cover substrate completely.
- D. Allow not less than 48 hours between application of succeeding coats, except as allowed by manufacturer's printed instructions, and approved by Town of Brookfield , Connecticut.
- E. Apply by brush or roller. Spray application for new or existing occupied spaces only upon approval by acceptance from Town of Brookfield , Connecticut in writing.
 1. Apply painting materials specifically required by manufacturer to be applied by spraying.
 2. In new construction and in existing occupied spaces, where paint is applied by spray, mask or enclose with polyethylene, or similar air tight material with edges and seams continuously sealed including items specified in "Building and Structural Work Field Painting"; "Work not Painted"; motors, controls, telephone, and electrical equipment, fronts of sterilizes and other recessed equipment and similar prefinished items.

- F. Do not paint in closed position operable items such as access doors and panels, window sashes, overhead doors, and similar items except overhead roll-up doors and shutters.

3.7 PRIME PAINTING:

- A. After surface preparation, prime surfaces before application of body and finish coats, except as otherwise specified.
- B. Spot prime and apply body coat to damaged and abraded painted surfaces before applying succeeding coats.
- C. Additional field applied prime coats over shop or factory applied prime coats are not required except for exterior exposed steel apply an additional prime coat.
- D. Prime rabbets for stop and face glazing of wood, and for face glazing of steel.
- E. Metals except boilers, incinerator stacks, and engine exhaust pipes:
 - 1. Steel and iron: Alkyd Metal Primer
 - a. Sherwin Williams Pro Industrial Alkyd Enamel
 - b. Benjamin Moore Corotech Alkyd Enamel V201
 - c. Tnemec Series 135 Chembuild

3.8 EXTERIOR FINISHES:

- A. Apply following finish coats where specified in Section 09 06 00, SCHEDULE FOR FINISHES.
- B. Steel and Ferrous Metal:Alkyd Metal Primer
 - a. Sherwin Williams Pro Industrial Alkyd Enamel
 - b. Benjamin Moore Corotech Alkyd Enamel V201
 - c. Tnemec Series 135 Chembuild

3.9 PAINT COLOR:

- A. Color shall be black and semi-gloss.

3.10 PROTECTION CLEAN UP, AND TOUCH-UP:

- A. Protect work from paint droppings and spattering by use of masking, drop cloths, removal of items or by other approved methods.
- B. Upon completion, clean paint from hardware, glass and other surfaces and items not required to be painted of paint drops or smears.
- C. Before final inspection, touch-up or refinished in a manner to produce solid even color and finish texture, free from defects in work which was damaged or discolored.

- END OF SECTION -

CONTRACT ITEMS

**CONTRACT ITEM 1
MOBILIZATION AND DEMOBILIZATION**

Sect. 1.01 WORK INCLUDED AND PAYMENT

Mobilization and Demobilization shall consist of the cost of initiating the contract. Payment for Mobilization and Demobilization will be made at the lump sum price bid for this item in the proposal, which price shall include the cost of initiating the contract. The provisions for payment for the Item Mobilization and Demobilization supersede any provisions elsewhere in the specifications for including the cost of these initial services and facilities in the prices bid for the various items scheduled in the proposal. Fifty percent (50%) of the lump sum price bid for Mobilization and Demobilization shall be payable to the Contractor whenever he/she shall have completed 10 percent of the work of the contract. For the purposes of this Item, 10 percent of the work shall be considered complete when the total of payments earned, exclusive of the amount bid for this Item, shown on the monthly certificate of the approximate quantities of work done, shall exceed 10 percent of the total price bid for the contract. The remaining 50% shall be payable upon substantial completion of the project.

The lump sum price bid for Mobilization and Demobilization should not exceed 3% of the total contract value.

CONTRACT ITEM 2 GENERAL STRUCTURAL WORK

Sect. 2.01 WORK INCLUDED

Under this item, the Contractor shall furnish, deliver, install the shed roof and jib crane as shown on the Contract drawings and as described in the Structural Specifications. The work shall also include the foundation installation, framing, bracing, and underpinning of existing concrete slabs as required. Electrical work necessary to connect to the jib crane shall be included in this line item.

Sect. 2.02 WORK NOT INCLUDED

This item does not include work described in or payable under other items of the contract.

All work shall conform to the requirements of the Specifications and all other Contract Documents.

Sect. 2.03 GENERAL REQUIREMENTS

Work under this item shall conform to the Structural Specifications and Structural Drawings.

Sect. 2.04 METHOD OF MEASUREMENT

Item 2 – General Structural Work

The shed roof and jib crane installation shall be considered one lump sum. The cost of furnishing, installing, and construction necessary to complete the shed roof, including the foundation system and jib crane installation, shall be included in the cost for this item.

Sect. 2.05 BASIS OF PAYMENT

The lump sum price bid under this item shall cover all costs of structural work specified and required, including all work specified in the Structural Specifications. Payment shall be made based upon completion of work.

**CONTRACT ITEM 3
PUMP INSTALLATION AND WET WELL MODIFICATIONS**

Sect 3.01 WORK INCLUDED

Under this Item, the Contractor shall retrofit the existing 12-ft diameter wet well used for overflow capacity into the primary pump station structure. The work required under this Bid Item includes:

- 1) Plugging of existing inlet.
- 2) Pumping out existing wet well.
- 3) Removal of existing 4" concrete layer and sand base in structure.
- 4) Installation of two (2) pumps supplied by the WPCA.
- 5) Core drill for discharge forcemains
- 6) Install pump discharges
- 7) Core drill for drain inlet
- 8) Install drain line check valve
- 9) Core drill for electrical conduits
- 10) Installation of pump station appurtenance including but not limited to:
 - Pump Rails
 - Transducer and Stilling Well (Transducer to be supplied by the BWPCA)
 - Floats
 - Supports
 - Hangers
- 11) Form concrete base slope to center.
- 12) Pump start up and testing
- 13) All work within the existing wet-well specified or shown on the Contract Drawings which is not included under any other item.

Sect 3.02 WORK NOT INCLUDED

The following work is not included under this Item.

- a) Furnishing the pumps (To be provided by the BWPCA);
- b) Furnishing the transducer (To be provided by the BWPCA);
- c) Temporary Bypass Work

Sect 3.03 GENERAL REQUIREMENTS

Work under this Bid Item shall conform to the following General Specifications:

- Section S1 – Earthwork and Backfill
- Section S2 – Concrete
- Section S4 – Pipes, Supports and Appurtenances

NOTE: All work in underground chambers to be performed using appropriate confined space requirements. As a minimum, the Contractor shall use approved gas meters, harnesses, radios (above and below grade) trained surface emergency personnel, A-frame hoists, etc. Procedures must meet requirements of the Authority's Regulations, State regulations, OSHA, or the Engineer's requirements. All costs of confined space entry shall be included in the prices bid.

Sect. 3.04 METHOD OF MEASUREMENT

The installation of the pump and modifications to the existing wet well shall be measured by lump sum. Items of work covered by this bid item are as indicated on the drawing as limit of work or as described in the specifications.

Sect. 3.05 BASIS OF PAYMENT

Payment for the lump sums shall be based upon the completion of work identified in a schedule of values to be agreed upon between the engineer and contractor.

CONTRACT ITEM 4 FORCEMAIN

Sect 4.01 WORK INCLUDED

Under this Item, the Contractor shall construct forcemain where shown on the plans. The work required under this Bid Item includes:

- 1) Removal, storage, and replacement of topsoil on sites of trench work;
- 2) Excavation
- 3) Furnishing and placing pipe foundation material as shown or specified;
- 4) Furnishing, placing and compacting backfill as shown or specified.
- 5) Restoring all surfaces removed, disturbed or damaged during the course of the work.
- 6) Connections to existing forcemain, including thrust block and pipe restraints.
- 7) Removal of forcemain from new connection location back to existing valve pit, include valve removal.
- 8) Connections to valve pit
- 9) Gate valve
- 10) Couplings as required.
- 11) Cutting and capping existing force mains as a result of proposed force main installation. Contractor shall note that existing pipes to be cut and capped shall proceed along with the construction sequence as required.
- 12) Disposal of all surplus material from the excavation and from other construction operations;
- 13) Cleaning up as the work progresses, including provision of dust control as required, specified and approved;
- 14) All other work required for a complete and satisfactorily operating pipe line system;
- 15) Conformance with State and Federal Safety Requirements and adhering to all regulations of agencies having jurisdiction (including obtaining all necessary permits):
- 16) Cleaning and testing of lines (physical and hydrostatic).
- 17) All work specified or shown which is not included under any other item.

Sect 4.02 WORK NOT INCLUDED

The following work is not included under this Item.

- a) Core drill and connect into existing 12-ft diameter wet well. (Included under Item 3)
- b) Piping within proposed valve pit (Included under Item 5)

Sect 4.03 GENERAL REQUIREMENTS

Work under this Bid Item shall conform to the following General Specifications:

Section S1 – Earthwork and Backfill

The attention of the Contractor is directed to the requirement that no portion of trench will be permitted to remain exposed overnight, unless otherwise approved.

Connections to existing manholes, pipe stubs, or sewers, shall be made as approved, using approved couplings or adapters so as to make a flexible, watertight joint, even with pipes of different materials.

Sect. 4.04 METHOD OF MEASUREMENT

Item 4 – 6" Diameter PVC Force Main Sewer,

The quantity of force main pipe to be measured shall be the number of feet of pipe installed as indicated in the proposal as measured from outside wall to outside wall of force main structures and within the limits of the Contract. Measurement shall be through buried valves and fittings. For dual pipe force mains, only the footage of one pipe shall be measured. Prices shall include construction layout; pipe, fittings and appurtenances; excavation; protecting subsurface facilities; removing and disposing of all excess material including unsuitable excavation materials, pipe, manholes and structures within the same trench; bedding; backfilling; compaction as directed; temporary / final surface restoration; installation of thrust blocking, testing and all other work and materials described hereinabove. Depth category shall be measured from finish grade to the invert of the pipe.

Sect. 4.05 BASIS OF PAYMENT

The prices bid shall cover all costs of furnishing and installing the force main pipe and all materials, equipment, tools and labor incidental thereto. Payment shall be made upon the completion of satisfactory testing results.

**CONTRACT ITEM 5
VALVE PIT**

Sect 5.01 WORK INCLUDED

Under this Item, the Contractor shall furnish and install the precast concrete valve pit, complete with piping and appurtenances of the types and sizes, and depth ranges shown and as specified. Work including couplings, fitting, supports, gate valves, check valves, flow meter, quick connect, concrete base, sump, drain line, precast structure, ladder rungs, hatch access, stone bedding, and removal of excess material.

Sect. 5.02 WORK NOT INCLUDED

This Item does not include work described in, or payable under, other items in this contract.

Sect. 5.03 GENERAL REQUIREMENTS

Work under this Item, shall conform to the following General Specifications:

- Sect. S 1 – Earthwork and Backfill
- Sect. S 4 – Pipes, Support and Appurtenances
- Sect. S 5 – Concrete Valve Pit
- Sect. S 6 – Valves

Sect. 5.04 METHOD OF MEASUREMENT

Item 5 – Valve Pit

The pump station valve pit shall be considered one unit. The cost of furnishing and installing the precast valve pit chamber with all interconnecting piping necessary to complete the chamber shall be included in the cost for this item. All other necessary components to complete the chamber shall be included in the cost for this item, as described in Section 5.01, Work Included.

Sect. 5.05 BASIS OF PAYMENT

The prices bid shall cover all costs of furnishing and installing the valve pit and all materials, equipment, tools and labor incidental thereto. Payment shall be made upon the completion of the work as described in this item.

CONTRACT ITEM 6 EROSION AND SEDIMENTATION CONTROL DEVICES

Sect 6.01 WORK INCLUDED

Under this Item, the Contractor shall furnish and install temporary erosion and sedimentation control devices complete with appurtenances of the types and sizes, and depth ranges shown and as specified within the contract documents. This Item includes silt fencing, tree protection, and inlet protection.

Sect. 6.02 WORK NOT INCLUDED

This Item does not include work described in, or payable under, other items in this contract.

Sect. 6.03 GENERAL REQUIREMENTS

Work under this Item, shall conform to the following General Specifications:

- Sect. S 1 - Earthwork and Backfill
- Sect. S 8 – Erosion and Sediment Control

Sect. 6.04 METHOD OF MEASUREMENT

Item 6A - Silt Fence: This work will be measured by the number of linear feet (measured horizontally between the extreme outer limits of the silt fence installed in accordance to the plans) installed as shown on the plans or as ordered by the Engineer. No measurement will be made for maintenance, repairs, or replacement of defective material, seams, overlaps, or removal of fencing after the project area has been deemed stabilized by the WPCA.

Item 6B – Inlet Filters: This work will be measured by the number of each inlet filter units installed as shown on the plans or as ordered by the Engineer or WPCA Authorized representative. No measurement will be made for maintenance, repairs, or replacement of defective material, or removal.

Item 6C - Tree Protection: This work will be measured by the horizontal linear feet of tree protection installed as shown on the plans or as ordered by the Engineer or WPCA. No measurement will be made for maintenance, repairs, or replacement of defective material, or removal.

Sect. 6.05 BASIS OF PAYMENT

The unit price bids for each item shall cover all costs of furnishing and installing erosion and sediment control devices in the contract documents including all materials, equipment, tools and labor incidental thereto.

**CONTRACT ITEM 7
DECOMMISSIONING OF EXISTING 7-FT DIAMETER PUMP STATION**

Sect 7.01 WORK INCLUDED

The following principal items of work are included in this item(s):

- 1) Coordinate with BWPCA to temporarily bypass flow around structure.
- 2) Pump out structure
- 3) Removal and disposal of pumps, rails, valves, fittings, piping, transducer, stilling well, supports, hangers, floats and associated appurtenances of existing wet well.
- 4) Parge remaining openings that are no longer in use after decommissioning.
- 5) Filling base / creating bench after pump removal in existing wet well.
- 6) All other work associated with the existing pump station abandonment / modification that is not covered under other items.

Sect 7.02 WORK NOT INCLUDED

Temporary Bypass System Design is not included in this item. (Shall be coordinated with the BWPCA).

Sect 7.03 GENERAL REQUIREMENTS

NOTE: All work in underground chambers to be performed using appropriate confined space requirements. As a minimum, the Contractor shall use approved gas meters, harnesses, radios (above and below grade) trained surface emergency personnel, A-frame hoists, etc. Procedures must meet requirements of the Authority's Regulations, State regulations, OSHA, or the Engineer's requirements. All costs of confined space entry shall be included in the prices bid.

Sect. 7.04 METHOD OF MEASUREMENT

Item 7 – Decommissioning of Existing 7-FT Diameter Wet Well Pump Station.

Decommissioning and abandonment of the wet well shall be measured by the lump sum. Items of work covered by this bid item are as indicated on the drawing as limit of work or as described in the specifications.

Sect. 7.05 BASIS OF PAYMENT

Payment for the lump sums shall be based upon the completion of work as described herein.

**CONTRACT ITEM 8
DECOMMISSIONING AND ABANDONMENT OF EXISTING VALVE PIT**

Sect 8.01 WORK INCLUDED

The following principal items of work are included in this item(s):

- 1) Removal and disposal of valves, fittings, piping, supports, drains, ladder, bollards, and associated appurtenances of existing valve pit.
- 2) Removal and disposal of the existing top slab and access hatch.
- 3) Drilling six (6) weep holes spaces evenly in the base.
- 4) Backfilling structure with sand.
- 5) Abandonment of valve pit to the satisfaction of applicable agencies and the Engineer as specified on the Drawings.

Sect 8.02 WORK NOT INCLUDED

Temporary Bypass System Design is not included in this item. (Shall be coordinated with the BWPCA).

Topsoil and seed shall be covered under Item 14.

Sect 8.03 GENERAL REQUIREMENTS

NOTE: All work in underground chambers to be performed using appropriate confined space requirements. As a minimum, the Contractor shall use approved gas meters, harnesses, radios (above and below grade) trained surface emergency personnel, A-frame hoists, etc. Procedures must meet requirements of the Authority's Regulations, State regulations, OSHA, or the Engineer's requirements. All costs of confined space entry shall be included in the prices bid.

Sect. 8.04 METHOD OF MEASUREMENT

Item 8 – Decommissioning and Abandonment of Valve Pit

Decommissioning and abandonment of the existing valve pit shall be measured by the lump sum.

Sect. 8.05 BASIS OF PAYMENT

Payment for the lump sums shall be based upon the completion of work as described herein.

**CONTRACT ITEM 9
MISCELLANEOUS ADDITIONAL WORK**

Sect. 9.01 DESCRIPTION

Under this item, the Contractor shall furnish all labor, material, and equipment required to accomplish miscellaneous additional work, necessitated by having encountered, during the course of the work, field conditions of a nature not determinable during design, or for which no unit prices are applicable.

Section 9.02 METHOD OF MEASUREMENT

Only that miscellaneous additional work shall be performed by the Contractor and will be paid for by the WPCA as has been authorized by the Engineer in writing, prior to this commencement.

Special Conditions, entitled "Deletion of Work" will still apply regarding that the work under the contract may be increased or decreased.

Section 9.03 BASIS OF PAYMENT

Item 15 – Misc. Additional Work

The total amount paid to the Contractor will be determined in accordance with the signed contract defining additional work, and such payment will include only that overhead and profit that is applicable to the work performed under this item.

The Contractor shall include in his total bid the lump sum printed in the proposal opposite this item. This amount is given for the purpose of canvas, and any bid other than the specified amount will be considered informal.

**CONTRACT ITEM 10
AS-BUILT**

Sect 10.01 WORK INCLUDED

This item shall include the submission of a final as-built to the WPCA upon completion of the project. As-built Plans shall be provided in digital format prepared by a licensed Connecticut Land Surveyor. The as-built shall include:

- 1) Above ground site features
- 2) Topography
- 3) Rims / Grates
- 4) Invert Elevations; and
- 5) Underground utility locations
- 6) Acceptable vertical datum to be approved by the Brookfield WCPA.

Sect 10.02 WORK NOT INCLUDED - Not Used

Sect 10.03 GENERAL REQUIREMENTS

Work under this item shall conform to the following Supplementary Specifications:

Section S-13 – Execution Requirements

Sect. 10.04 METHOD OF MEASUREMENT

The as-built shall be measured by the lump sum.

Sect. 10.05 BASIS OF PAYMENT

Payment for this item shall be made upon the Brookfield WPCA acceptance of the as-built. The as-built submission will be considered as a shop drawing and will be reviewed by the ENGINEER and returned to the CONTRACTOR with comments as necessary.