BID DOCUMENTS AND SPECIFICATIONS FOR:

Improvements to the Arlington Reservoir

Arlington, Massachusetts

Bid # 19-05

Prepared for:

Park & Recreation Commission

Town of Arlington, Massachusetts

Prepared by: Weston & Sampson

SEALED BIDS will be received:

Date: Thursday February 21, 2018

Time: 10:00 AM

Place: Office of the Purchasing Agent

730 Massachusetts Avenue

Arlington, MA 02476

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END OF SECTION

TOWN OF ARLINGTON
MASSACHUSETTS

INVITATION TO BID

BID No. 19-05 IMPROVEMENTS TO ARLINGTON RESERVOIR

Sealed bids for Improvements to Arlington Reservoir for the Town of Arlington, Massachusetts, will be received at the Purchasing Department, 730 Massachusetts Avenue, Arlington, MA 02476 until **10:00 AM prevailing time, on Thursday February 21 , 2018** at which time and place said bids will be publicly opened and read aloud.

All bids must be in a sealed envelope plainly marked: **BID No. 19-05 IMPROVEMENTS TO ARLINGTON RESERVOIR.**

A pre-bid walk through is scheduled for 11:00 AM prevailing time, on Tuesday February 5, 2019 at Arlington Reservoir, Lowell Street, Arlington, MA.

The scope of work of the Base Bid includes improvements to Arlington Reservoir in the Town of Arlington, Massachusetts. The project includes structural and architectural upgrades to the pump house building, including a new corrugated metal awning off one side of the building, new mechanical equipment within the pump house, and a new piping system within the bathing beach. Utility improvements include recirculating reservoir water into the bathing beach system and electrical upgrades within the pump house building to support the new mechanical equipment.

Bid Security in the form of a bid bond, cash, certified check, treasurer's or cashier's check payable to the Owner, is required in the amount of five percent of the bid, in accordance with Section 00200, INSTRUCTIONS TO BIDDERS.

The contract duration for the Base Bid is 90 consecutive days.

Contract Documents and plans are available for down load and review on the Town Website:

www.arlingtonma.gov/purchasing

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

By-law of the Town of Arlington, Title 1, Article 16, Minority/Woman Workforce Participation in Construction Projects which exceed $200,000.00 is part and parcel of the bid.

Minimum Wage Rates as determined by the Commissioner of the Division of Occupational Safety of the Executive Office of Labor and Workforce Development under the provisions of the Massachusetts General Laws Chapter 149, Section 26 to 27D, as amended, apply to this project. It is the responsibility of the Bidder, before bid opening, to request if necessary, any additional information on Minimum Wage Rates for those trades people who may be employed for the proposed work under this contract.

All bids for this project are subject to applicable bidding laws of Massachusetts, including General Laws Chapter 30, Section 39M as amended.

The Bidder agrees that this bid shall be good and may not be withdrawn for a period of 30 working days, Saturdays, Sundays and legal holidays excluded after the opening of bids.

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

TOWN OF ARLINGTON

Adam W. Chapdelaine
Town Manager

INSTRUCTIONS TO BIDDERS

1. COMPLEMENTARY DOCUMENT

   A. INVITIATION TO BID, including herewith, is complementary to this document and shall be reviewed by bidder for specific instruction which are not repeated herein.

2. STATUTES REGUALTING COMPETITIVE BIDDING

   A. Bidding procedures and award of general contract and subcontracts shall be in accordance with the provisions of Chapter 30, Section 39M and Chapter 149, Section 44A through 44L inclusive, of the General Laws of the Commonwealth of Massachusetts, including all current amendments.

   B. In the event of any discrepancy or inconsistency between the provisions of these Bid and Contract Documents and the above-mentioned statutes, the provisions of the above-mentioned statutes shall govern. In such event, the application of all remaining provisions not in conflict to any circumstance other than that in which the conflict occurs shall not be affected thereby.

3. BIDDER'S QUALIFICATIONS

   A. DCPO Certification not required.

   B. The Contractors' Update Statements are not public records and will not be open to public inspection.

4. INTERPRETATION OF DOCUMENTS: NOTIFICATION OF ERRORS

   A. Interpretations of the provisions of the Bid and Contract Documents will be made by the designer upon written request of any general bidder or subbidder, provided that such request is received by the Designer at least seven (7) days prior to the date of the applicable bid opening, and that the Designer considers such interpretation to be of sufficient importance. Oral or telephone interpretations will not generally be made, and if made shall be strictly informal and not legally valid or binding.

   B. Such written interpretations shall be in the form of Addenda to the Bid and Contract Documents.

   C. Bidders are urged to communicate all errors and discrepancies found in the Bid and Contract Documents to the Designer. Telephone calls pointing out any such errors or discrepancies will be taken by the Designer, but only for the purpose of receiving the information in order that it may be properly processed, and not for interpretation or clarification.

5. EXAMINATION OF BIDDING AND CONTRACT DOCUMENTS

A. Each Bidder shall carefully examine the Bid and Contract Documents to obtain a thorough understanding of the work of his bid in addition to the work of related trades. In addition, each General Bidder shall personally visit the site to thoroughly acquaint himself/herself with the conditions as they exist hereon.

B. Failure of any Bidder to thoroughly examine the Bid and Contract Documents or to visit and examine the site shall in no way relieve him/her of any obligation with respect to his/her bid or of any responsibility assigned to him under the Contract.

6. PRE-BID CONFERENCE

A. Pre-bid conference will be held at the location and time stipulated in the Invitation to Bid.

7. MODIFICATION AND WITHDRAWAL OF BIDS

A. Modification of withdrawal of Bids will be permitted after the submission of such bids provided clearly written, readily understandable instructions for same are received by the Owner in writing prior to the time established for opening of such bids. No Bid may be withdrawn after that time, except as otherwise provided herein or by law.

8. ADDENDA

A. Addenda may be required during the bidding period to modify, clarify or interpret the Bid and Contract Documents. It is intended, but not guaranteed, that such Addenda shall be mailed by the Owner to all persons or parties to whom Bid and Contract Documents have been issued (Bidders of Record). Failure to receive such Addend shall in no way relieve any bidder from the execution of its provisions. All bidders are cautioned to verify the number of Addenda which have been issued and to secure any needed copies from the Designer before submitting a Bid.

9. FORM FOR BIDS

A. The Owner will make available, to every person applying therefor, a Bid Form. Each bona fide Bidder will be furnished forms for his proposal upon request. Such forms will be made available at the Owner's office during the regular office hours throughout the bidding period. Bids must be submitted on the forms provided by Owner or of forms included in the bid documents of the Project Manual.

B. All blank spaces provided on the bid forms shall be filled in with ink or typewriter. Where space if provided, sums shall be expressed in both words and figures. In case of a discrepancy between the two, the written words shall govern.

C. No interlineations, additional, alterations or erasures shall be made on the forms.

10. SUBMISSION OF BIDS

A. The Bid Form shall be properly executed and enclosed with the required bid deposit in a sealed envelope plainly marked on the outside with the following information.

Bid For:

_____

SUBMITTED
BY:

_____ _____
(Name of Bidder) (Address of Bidder)

B. If Bids are mailed; the above required envelope shall be enclosed in a second envelope identified with the above markings and mailed to the place of bid opening, as described in the Invitation to Bid. Mailed Bids must be received before the time scheduled for opening of Bids.

11. PERFORMANCE AND PAYMENT BONDS

A. The Performance and Labor and Materials Payment Bonds required of the General Contractor shall each be in the amount of 100% of the contract sum from a surety company qualified to do business under the laws of the Commonwealth of Massachusetts and approved by the Owner.

12. FOREIGN CORPORATIONS

A. The attention of bidders is called to General Laws, Chapter 30, Section 39L, as amended by Acts of 1967, Chapter 3, under which the Owner may not enter into a contract with a foreign corporation as a subcontractor unless the foreign corporation has filed with the Owner a certificate by the State Secretary stating that the foreign corporation has complied with

General Laws Chapter 181, Sections 3 and 5 and stating the date of such compliance.

13. AWARD OF CONTRACT

A. The Contract will be awarded to the lowest responsible and eligible bidder except in the event of a substitution as provided by under Chapter 149, Sections 44E and 44F of the above-reference General Laws.

14. COMMENCEMENT AND COMPLETION OF WORK

A. The successful bidder, upon completion of the Contract Agreement, shall commence the work of the Contract within seven (7) calendar days from receipt of written Notice to Proceed issued by the Owner within fourteen (14) calendar days after said execution of the Contract Agreement, and shall therefore diligently and continuously carry on the work in such manner as to substantially complete the work on or before **May 31, 2019** except as noted herein.

15. LIQUIDATED DAMAGES

A. The attention of bidders is particularly called to the requirements as to the conditions of employment to be observed, the minimum wage rates to be paid under the Contract and affirmative action to ensure equal employment opportunity.

B. Contractor shall make full good faith efforts to secure at least ten percent (10%) of the Labor and Materials incorporated in the Work from Minority Business Enterprises and five percent (5%) of the Labor and Materials incorporated in the Work from Women Business Enterprises certified by the Commonwealth of Massachusetts and consistent with the Federal Equal Employment Opportunity requirements attached hereto as Attachment A. Satisfactory documentation of such effort shall be furnished promptly upon request by Owner.

C. The Owner is an equal employment opportunity employer and has an active Affirmative Action Plan (AAP). For more information, direct correspondence to Patricia M. Libby, Affirmative Action Officer for the Town of Arlington.

BID FORM

For: Improvements to Arlington Reservoir (Bid #19-05)

Proposal (BID) of _____
(hereinafter called "Bidder") a corporation, organized and existing under the laws of the Commonwealth of Massachusetts.

_____

doing business as _____
(corporation, proprietorship, partnership)

to the TOWN OF ARLINGTON hereinafter called "Owner". Gentlemen:

A. The Bidder, in compliance with your invitation for bids for the Improvements to the Arlington Reservoir, Arlington Massachusetts, having examined the plan and specifications with related documents and the site of the proposed project including the availability of materials and labor, hereby proposes to furnish all labor, materials and supplies, and to construct the project in accordance with the Contract Documents, within the time set forth therein, and at the prices stated below. These prices are to cover all expenses incurred in performing the work required under the Contract Documents, of which this proposal is a part.

Bidder hereby agrees to commence work under this Contract on or before a date to be specified in the written "Notice to Proceed" from the Owner, and to complete the work by May 31, 2019. The Bidder further agrees to pay as liquidated damages, the sum of $100.00 for each consecutive calendar day thereafter that the works remains incomplete, as provided in the Instruction to Bidders, Modifications to General Conditions. Required completion dates are as follows:

B. Bidder acknowledges receipt of the following addendum:

_____ Dated _____

_____ Dated _____

_____ Dated _____

C. Bidder agrees to perform all work described in the specifications and shown on the drawings, for the following lump sum price of:

1. Total Proposed Base Bid Contract Price:

_____ Dollars ($_____)

2. Bid Deposit on total bid price in the sum of:

_____ Dollars ($_____) in

the form of _____ is submitted herewith in

accordance with the INSTRUCTION FOR BIDDERS and is to become property of the Owner in the event the Contract and bonds are not executed within the time above set forth, as liquidated damages for the delay and additional expense to the Owner caused thereby.

3. The Bid does not include premiums on Performance/Labor and Materials Bond. Cost of required Bond Premiums (for base bid):

   Bid Premiums Add $_____

4. The Supplemental Unit Prices set forth herein shall be used to determine any equitable adjustment of the Contract in connection with the changes or extra work performed under this Contract as directed by the **Town of Arlington**.

   It is mutually understood and agreed that such Supplemental Unit Prices include all items of costs, equipment, taxes and insurance of every kind, overhead, and profit for the **Contractor** and they shall be used uniformly, without modification for addition and deductions. Prices listed under ADDITIONS and DEDUCTIONS are to be the complete total price billed to and paid by the **Town of Arlington** therefor. There can be no more than fifteen (15) percent difference in price between the additions and deductions.

SUPPLEMENTAL UNIT PRICES FORM

ITEM DESCRIPTION	UNIT	ADDITIONS	Owner Approval
1. Loam Borrow	CY		
2. Seeding	SF		
3. Aggregate base installed, excluding excavation	CY		
4. Bituminous concrete pavement	SY		
5. CIP concrete pavement	CY		
6. New shrub planting	EA		
7. New tree planting	EA		

D. If the Bid is accepted by the Owner, the undersigned agrees to complete the entire work provided to be done under the contract within the time stipulated by the Owner.

E. The undersigned agrees that for extra work, if any, performed in accordance with the AGREEMENT, he will accept compensation as stipulated therein in full payment for such extra work.

F. Bidder understands that the Owner reserves the right to reject any and all bids.

G. The undersigned hereby agrees that he will not withdraw the Bid within sixty (60) consecutive calendar days after the actual date of the opening of Bids and that, if the Owner accepts this Bid, the undersigned will duly execute and acknowledge the required Contract Bonds within 10 days after notification that the AGREEMENT is

ready for signature.

H. Should the undersigned fail to fulfill any of his agreements as here in before set forth, the Owner shall have the right to retain as liquidated damages the amount of the Bid security, which shall become the Owner/s property. If a bid was furnished as bid security, it is agreed that the amount thereof shall be paid as liquidated damages to the Owner by the Surety.

I. The Undersigned certifies under penalty of perjury that this Bid is in all respect bona fide, fair and made without collusion or fraud with any other person. As used in this subsection the "person" shall men natural person, joint venture, partnership, corporation or other business or legal entity.

J. The undersigned certifies that he is able to furnish labor that can work in harmony with all with all laws and regulations applicable to awards made subject forty-four A.

1. Have been in business under the present name for____years.
2. Ever failed to complete any work awarded?_____(Yes),_____(No). If yes, explain: _____
3. Bank Reference: _____

K. The Bidder is required to state below all work he/she and his/her subcontractors (if subcontractors are to perform substantial portions of the work) has compete within the past 5 years of a similar character and value to that of the work included in the proposed Contract and to give references that will enable the Owners to judge the Bidder's experience, skill and business standing. The Bidder is required to list a minimum of 3 completed projects that are comparable in scope, complexity and value. For each project, include the name, location, type, date complete, construction value and owner contact.

_____

_____

_____

_____

_____

_____

_____

_____

_____

(add supplementary page if necessary)

L. The Bidder is required to state below all construction projects he/she currently has under contract. For each project, include the name, location, type, scheduled completion date, construction value and owner contact.

_____

_____

_____

_____

_____

_____

_____

M. The undersigned bidder hereby certifies that the tools and equipment required to meet the specified requirements of the Contract document, with special attention called to Section 31 00 00 Earthwork, will be utilized in the performance of the work.

N. The undersigned further certifies under the penalty of perjury that the said undersigned is not presently debarred from doing public construction work in the Commonwealth of

Massachusetts under the provisions of section 29F, or any other applicable debarment provisions of any other chapter of the General Laws or any rule or regulation declared there under.

O. The undersigned bidder hereby certifies he/she will comply with the minority workforce percentage ratio and specific affirmative action steps contained in the EEO/AA provisions of the Contract, including compliance with Minority/Women Business Enterprise as required under these contract provisions. The contractor receiving the award of the Contract shall be required to obtain from each of its subcontractors a copy of its bidder's certification and submit it to the contracting agency prior to the award of such subcontract, regardless of tier, that it will comply with the minority workforce ratio and specific affirmative action steps contained in these EEO/AA contract provisions.

Date: _____

_____

Name of General Bidder

By:

_____

Name and Title of Person Signing Bond

_____

Business Address

FORM A

CERTIFICATE OF NON-COLLUSION

The undersigned certifies under penalties of perjury that this bid is in all respects bona fide, fir and made without collusion or fraud with any other person. As used in this section the word 'person' shall mean any natural person, joint venture, partnership, corporation or other business or legal entity.

_____

Authorized Name

_____

Authorized Signature Date

_____

Social Security Number or Federal Identification Number

_____

Legal Name of Business Entity (Print or

_____

Type) Address

_____

City, State, Zip Code

Corporate Seal (If applicable)

FORM B

CERTIFICATE OF FOREIGN CORPORATION

The undersigned certifies that it has been duly established, organized, or chartered as a corporation under the laws of:

_____

Jurisdiction

The undersigned further certifies that it complies with the requirements of M.G.L, c. 30, sec. 39L and with the requirements of M.G.L, c. 181 relative to the registration and operation of foreign corporations within the Commonwealth of Massachusetts.

_____

Name of Person Signing the Bid or Proposal Date

_____

Signature of Person Signing the Bid or Proposal Date

_____

Name of Business (Print or Type)

Corporate Seal (If applicable)

FORM C

COMMONWEALTH OF MASSACHUSETTS

SCHEDULE FOR PARTICIPATION BY WOMEN/MINORITY BUSINESS

ENTERPRISE BIDDER CERTIFICATION

A bidder agrees to expend at least the amount of the contract set forth below if awarded, for W/MNE. For the purposes of this commitment, the designation means a business that has been certified by SOMWBA as such. The Bidder must indicate the W/MBE it intends to utilize in this document as follows: (Attach another sheet of necessary.)

Company Name and Address	Nature of Participant	Dollar Value of Participation
1.		$
2.		$
3.		$

The undersigned hereby certifies that he or she read the terms of this condition and is authorized to bind the Bidder to the commitment herein set forth.

_____

Name of Person Signing the Bid or Proposal

_____

Signature of Person Signing the Bid or Proposal Title

_____

Name of Business (Print or Type)

Corporate Seal (If applicable)

FORM D

BIDDER CERTIFICATION REGARDING PAYMENT OF PREVAILING WAGES

The undersigned hereby certifies, under pains and penalties of perjury, that the foregoing bid is based upon the payment to laborers to be employed on the project of wages in an amount no less that the applicable wage rates established for the project by the Massachusetts Department of Labor and Industries. The undersigned bidder agrees to identify the awarding authority for, from, and against any loss, expense, damages, action, or claims, including any expense incurred in connection with any delay or stoppage of the project work, arising out of or as a result of (1) the failure of the said bid to be based upon the payment of the said applicable prevailing wage rates or
(2) the failure of the bidder, of selected as the contractor, to pay laborers employed on the project the said applying prevailing wage rates.

_____
Date

_____
Name of Person Signing the Bid or Proposal

_____
Signature of Person Signing the Bid or Proposal Title

_____
Name of Business (Print or Type)

Corporate Seal (If applicable)

FORM E

CERTIFICATION OF PAYMENT OF STATE TAXES

Legislation enacted by the Commonwealth of Massachusetts, effective, 1983, requires that attestation below be signed:

Pursuant top M.G.L c. 62C, sec. 49A, I certify under the penalties of perjury, that I,to my best knowledge and belief, have filed all state tax returns and paid all state taxes required by law.

APPROVAL OF A CONTRACT OR ANY OTHER AGREEMENT WILL NOT BE GRANTED UNLESS THIS CERITIFCATION CLAUSE IS SIGNED BY AN AUTHORIZED CORPROATE OFFICER.

THE TAX PAYER IDENTIFICATION NUMBER WILL BE FURNISHED TO THE MASSACHUSETIS DPEARTMENT OF REVENUE TO DETERMINE IF TAX FILINGS AND/OR TAX PAYMENT OBLIGATIONS HAVE BEEN MET. PROVIDERS WHO FAIL TO CORRECT THIER NON-FILING AND/OR DELIQUENCY STATUS SHALL NOT HAVE A CONTRACT OR ANY OTHER AGREEMENT ISSUED, RENEWED OR EXTENDED

_____

(Signature of Individual) Title

_____

Social Security Number or Federal Identification Number

_____

Corporate Name

_____

Name of Person Signing the Proposal (Print or Type) Date

_____

Legal Name of Business Entity (Print or

_____

Type) Business Address

Corporate Seal (If applicable)

FORM F

CERTIFICATION OF AUTHORITY MEETING OF BOARD OF DIRECTORS

(Note: if business entity is a partnership or individual, all owners shall sign this form.)

At a meeting of the Directors of the _____ duly called and held at

(Corporation)

_____ on the _____ day of _____, 20 _____,
(Location)

at which a quorum was present and acting, it was voted that _____, the
(Name)

_____ of this Corporation, is hereby authorized and empowered to
(Title/Position)
make,

into, sign, seal and deliver on behalf of the Corporation a Contract for _____

with the _____, and the performance and payment bonds each in the amount as specified by the Owner.

I hereby certify that the above is a true and correct copy of the record, that said vote has not been amended or repealed and is in full force, and effect as of this date and that

_____ is duly elected _____ of the corporation
(Name) (Title/Position)

_____
Clerk or secretary of the Corporation Date

(Note: If the Bidder is a corporation, affix corporate seal and give below the names of its president, treasurer, and general manager, if any: if a partnership, give full names and residential addresses of all partners; and if an individual, give residential dress if different form business address.)

the required names and addresses of all person interested in this proposal, as Principals, are as follows:

_____

CONTRACT FOR IMPROVEMENTS TO ARLINGTON RESERVOIR AGREEMENT

THIS AGREEMENT, made as of this_____day of_____, 20_____, by and between the TOWN OF ARLINGTON, MASSACHUSETTS, acting through its TOWN

MANAGER, hereinafter called the 'Owner' and_____,,
(Name of Contractor)
of_____, country of_____and

State of_____, hereinafter called the 'Contractor'.

WITNESSETH; That the Contractor and the Owner for the consideration hereinafter named agrees as follow:

1. SCOPE: The Contractor will furnish at his own proper cost and expense all materials, supplies, machinery, equipment, appliances, tools, superintendence, labor, insurance and other items and services necessary to complete the work as shown and described on the Contract Documents entitled "Improvements to the Arlington Reservoir", Arlington, Massachusetts, hereinafter called the 'Project', prepared by Weston & Sampson, Inc. hereinafter called the 'Designer', or 'Landscape Architect'.

2. CONTRACT SUM: The owner agrees to pay the contractor, and the contractor agrees to accept in full consideration for the performance of the contract, subject to additions and deductions provided for in the contract documents, in current funds, the sum of dollars ($), hereinafter called the 'Contract Sum' and to make payments on account thereof, as described below and elsewhere in the Contract Documents.

3. COMMENCEMENT OF WORK AND TIME OF COMPLETION: The contractor agrees to commence work on the contract within seven (7) calendar days from the receipt of written Notice to Proceed issued by the Owner and/or within fourteen (14) calendar days after execution of the contract Agreement and to thereafter diligently and continuously carry on the work. He agrees to complete the work on or before Friday, May 31, 2019, except as herein noted.

4. LIQUIDATED DAMAGES: The Contractor agrees to pay the Owner liquidated damages for failure to complete the Project in conformance with the time allowances as set forth above at the rate of $100.00 per calendar day.

5. PAYMENTS TO CONTRACTOR: Payments shall be made in accordance with Chapter 30, Section 39K of the General Laws of the Commonwealth of Massachusetts, including all current amendments, generally as follows:

   A. Within fifteen days after receipt from the Contractor, at the place designated by the Owner if such a place is so designated, of a period estimate requesting payment of the amount due for the preceding month, the Owner will make a periodic payment to the Contractor for the work performed during the

preceding month and for the - materials not incorporated in the work but delivered and suitably stored at the site (or at some location agreed upon in writing) to which the Contractor has title or to which pa subcontractor has title and has authorized to Contractor to transfer title to the Owner, less (1) a retention based on its estimate of the fair value of its claims against the Contractor and less (2) a retention for direct payments to subcontractors based on demands for same in accordance with the provisions of Section 39F, and less (3) a retention not exceeding five percent of the approved amount of the periodic payment. After the receipt of a periodic estimate requesting final payment and within sixty-five days after (a) the Contractor fully completes the work or substantially completes the work so that the value of the work remaining to be done is, in the estimate of the Owner, less than one percent of the original contract price, or (b) the Contractor substantially completes the work and the Owner takes possession for occupancy, whichever occurs first, the Owner shall pay the Contractor the entire balance due on the Contract less (1) a retention based on its estimate of the fair value of its claim against the Contractor and of the cost of completing the incomplete and unsatisfactory items of work and less (2) a retention for direct payments to subcontractors based on the demands for same in accordance with the provisions of Section 39F, or based on the record of payments by the Contractor to the subcontractors under this contract if such record of payment indicates that the Contractor has not paid subcontractors as provided in Section 39F. If the Owner fails to make payment as herein provided, there shall be added to each such payment daily interest at the rate of five percent per annum commencing on the first day after said payment is due and continuing until the payment is delivered or mailed to the Contractor, provided, that no interest shall be due, in any event, on the amount due on a periodic estimate for Final Payment until fifteen days after receipt of such a periodic estimate from the Contractor, at the place designated by the Owner if such a place is so designated. The Contractor agrees to pay to each subcontractor a portion of any such interest paid in accordance with the amount due each subcontractor.

B. The Owner may make changes in any periodic estimate submitted by the Contractor and the payment due on said periodic estimate shall be computed in accordance with the changes so made, but such changes or any requirement for a corrected periodic estimate shall not affect the due date for the periodic payment or the date for the commencement of interest charges on the amount of the periodic payment computed in accordance with the changes made, as provided herein; provided that the Owner may, within seven days after receipt, return to the Contractor for correction any periodic estimate which is not in the required form or which contains computations not arithmetically correct and, in that event, the date of receipt for such periodic estimate in proper form and with arithmetically correct computations. The date of receipt of a periodic estimate received on a Saturday shall be the first working day thereafter. The provisions of Section 39G shall not apply to any contract for the construction, reconstruction, remodeling, repair or demolition of any public building to which this section applies.

6. PAYMENTS TO SUBCONTRACTORS: Payments shall be made in accordance with Chapter 30, Section 39F of the General Laws of the Commonwealth of Massachusetts, including all current amendments, generally as follows:

   A. Forthwith after the General Contractor receives payment on account of a period estimate, the General Contractor shall pay to each Subcontractor the amount paid for the labor performed and the materials furnished in any court proceedings barring such payment and also less any amount claimed due from the Subcontractor by the General Contractor.

   B. Not later than the sixty-fifth day after each Subcontractor substantially completes his work in accordance with the plans and specifications, the entire balance due under the Subcontract less amounts retained by the Owner as the estimated cost of completing the incomplete and unsatisfactory items of work, shall be due the Subcontractor, and the Owner shall pay that amount to the General Contractor. The General Contractor shall forthwith pay to the Subcontractor the full amount received from the Owner less any amount specified in any court proceedings barring such payment and also less any amount claimed due from the Subcontractor by the General Contractor.

   C. Each payment made by the Owner to the General Contract pursuant to subparagraphs (A) and (B) of this paragraph for the labor performed and the materials furnished by a Subcontractor shall be made to the General Contractor for the account of that Subcontractor: and the Owner shall take reasonable steps to compel the General Contractor to make each payment to each such Subcontractor. If the Owner has received a demand for direct payment from a Subcontractor for any amount which has already been included in a payment to the General Contractor for payment to the Subcontractor as provided in subparagraphs (A) and (B), the Owner shall act upon demand as provided in this Section.

   D. If, within seventy days after the Subcontractor has substantially completed the Subcontract work, the Subcontractor has not received from the General Contractor the balance due under the Subcontract including any amount due for extra labor and materials furnished to the General Contractor, less any amount retained by the Owner as the estimated cost of completing the incomplete and unsatisfactory items of work, the Subcontractor may demand direct payment of that balance from the Owner. The demand shall be by a sworn statement delivered to or sent by certified mail to the Owner, and a copy shall be delivered to or sent by certified mail to the General Contractor at the same time. The demand shall contain a detailed breakdown or the balance due under the Subcontract and also a statement of the status of completion of the Subcontract work. Any demand made after Substantial Completion of the Subcontract work shall be- valid even if delivered or mailed prior to the seventieth day after the Subcontractor has substantially completed the Subcontract work Within ten days after the Subcontractor has delivered or so mailed the demand to the Owner and

delivered or so mailed a copy to the General Contractor, the General Contractor may reply to the demand. The reply shall be a sworn statement delivered to or sent by certified mail to the Owner and a copy shall be delivered to or sent by certified mail to the Subcontractor at the same time. The reply shall contain a detailed breakdown of the balance due under the Subcontract including any amount due for extra labor and materials furnished to the General Contractor and of the amount due for each claim made by the General Contractor against the Subcontractor.

E. Within fifteen days after receipt of the demand by the Owner, but in no event prior to the seventieth day after Substantial Completion of the Subcontract work, the Awarding Authority shall make direct payment to the Subcontractor of the balance due under the Subcontract, less any amount (i) retained by the Owner as the estimated cost of completing the incomplete or unsatisfactory items of work, (ii) specified in any court proceedings barring such payment, or (iii) disputed by the General Contractor in the sworn reply: provided, that the Owner shall not deduct from a direct payment any amount as provided in part (iii) if the reply is not sworn to, or for which the sworn reply does not contain the detailed breakdown required in subparagraph (D); The Owner shall make further direct payments to the Subcontractor forthwith after the removal of the basis for deductions from direct payments made as provided in pans (i) and (ii) of this subparagraph.

F. The Owner shall forthwith deposit the amount deducted from a direct payment as provided in part (iii) of subparagraph (E) in an interest-bearing joint account in the names of the General Contractor and the Subcontractor in a bank in Massachusetts; selected by the Owner and agreed upon by the General Contractor and the Subcontractor and shall notify the General Contractor and the Subcontractor of the date of deposit and the bank receiving the deposit. The bank shall pay the amount on the account, including accrued interest, as provided in an agreement between the General Contractor and the Subcontractor or as determined by decree of a court of competent jurisdiction.

G. All direct payments and all deductions from demands for direct payments deposited in an interest-bearing account or accounts in a bank pursuant to subparagraph (F) shall be made out of amounts payable to the General Contractor at the time of receipt of a demand for direct payment from a Subcontractor and out of amounts later become payable to the General Contractor and in order of receipt of such demands from Subcontractors. All direct payments shall discharge the obligation of the Owner to the General Contractor to the extent of such payment.

H. The Owner shall deduct from payments to a General Contractor amounts which, together with the deposits in interest-bearing accounts pursuant to subparagraph (F), are sufficient to satisfy all unpaid balances of demands for direct payment received from Subcontractors. All such amounts shall be earmarked for such direct payments, and the Subcontractors shall have a right in such deductions prior to any claims against such amounts by creditors of the

General Contractor.

I. On all contracts for building construction subject to the provisions of Sections 44A to 44L, inclusive, of Chapter 149, periodic payments for work performed by a Subcontractor shall be made to the General Contractor for payment to the Subcontractor and shall be paid to the Subcontractor forthwith after receipt thereof by the General Contractor and without any ten day waiting period as provided above, less any amount claimed by the General Contractor it a letter containing a breakdown of the claim and sent to the Subcontractor with such payment, provided that a General Contractor, who has received a periodic estimate for a periodic payment in proper form from a Subcontractor three days, Saturdays, Sundays and holidays excluded, before the due date of the General Contractor's periodic estimate for the same periodic payment period less any amount claimed by the General Contractor in a letter containing a breakdown of the claim and sent to the Subcontractor with such payment, even though the General Contractor does not submit a periodic estimate to the Owner for that payment period; and provided, further, that the Owner shall take all reasonable steps to compel the General Contractor to make payment to the Subcontractors as provided in this paragraph, and upon the written request of a Subcontractor setting forth the amount payable but not paid, a copy of which shall be sent to the General Contractor, shall make direct payment to a Subcontractor, as provided for above, which shall discharge the obligation of the Owner to the General Contractor to extent of any such payment.

J. The Owner shall not include in any direct payment to a Subcontractor pursuant to this section any amount claimed from that Subcontractor by the General Contractor in a letter containing a breakdown of the claim and sent to the Owner within ten days after the receipt by the General Contractor of the copy of the request of the Subcontractor to the Owner for direct payment.

7. CONDITIONS OF EMPLOYMENT

A. The schedule of Minimum Wage Rates and Health and Pension Fund Contributions as determined by the Commissioner under the provisions of the Massachusetts General Laws, Chapter 149, Sections 26 m 27D, inclusive, AS amended, is hereby made a part of this Agreement.

B. The Contractor shall pay to any reserve police officer employed by him in any city or town the prevailing rate of wages paid to regular police officers in such city or town.

C. No laborer, workman, mechanic, foreman o inspector working within the Commonwealth, in the employ of the Contractor, Subcontractor or any other person doing or contracting to do the whole or a part of the work contemplated by the Contract, shall be required or permitted to work more than eight hours in any one day or forty-eight hours in any one week, or

more than six days in any one week, except in cases of emergency.

D. Every employee of the Contractor or any Subcontractor shall lodge, board and trade where and with whom he elects; and no person or his agents or employees shall be directly or indirectly required, as a condition of employment that the employee to lodge, board or trade at a particular place or with a particular person.

8. SUBCONTRACTORS

A. The Contractor will employ the following Subcontractors on the work and will pay for the execution of his as defined in the Contract Documents; and subject to the additions and deductions provided in the subject to the additions and deductions provided in the Contract Documents, the sum shown opposite his name.

Class Of Work	Subcontractor	Subcontractor Sum

B. The names of any additional Subcontractors whom the Contractor proposed to employ shall be submitted to the Designer for approval. No such Subcontractor shall be employed to whose standing or ability the Owner or the Designer has any reasonable objection.

10. THE CONTRACT DOCUMENTS: The General Conditions of the Contract, the Specifications and the Drawings, together with this Agreement, for the Contract, and they are as fully a part of the Contract as if hereto attached or herein repeated Drawings and Specifications titled: Improvements to the Arlington Reservoir

11. INCORPORATION OF STATUTES BY REFERENCE: If statutes of the Commonwealth of Massachusetts in any way relating to the construction, alterations, repair and installation of public works, particularly with reference to labor and labor rates, they shall be strictly complied with by the Contractor and it is understood that all such statutes are incorporated by reference in this Contract.

12. It is expressly agreed that this Agreement is to be executed for and in behalf of the Owner by the members of its Board of Selectmen and any of its appoints and that such persons are acting in a representative capacity for and in behalf of Owner, and that such persons shall not incur any personal liability hereunder.

IN WITNESS whereof, inhabitants of the Town of Arlington and

_____

have caused these presents to be executed by their

_____

hereunto duly authorized the day and year first written.

TOWN OF ARLINGTON

_____
Adam W. Chapdelaine, Town Manager

_____

_____

Certification:
I hereby Certify that an
appropriation in the amount
of the Contract is available.

_____

Town Accountant

_____

Contractor

By: (Title)

Approved as to Matter of Form:

_____

Town Counsel

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PERFORMANCE BOND

KNOW ALL MEN BY THESE PRESENTS: That we

_____

(Name of Contractor)

a_____

(Corporation, Partnership or Individual)

hereinafter called "Principal" and

_____

(Surety)
of_____, State of_____, hereinafter called the "Surety", are held and firmly bound into

THE TOWN OF ARLINGTON, MASSACHUSETTS
(Owner)

acting through its TOWN MANAGER

ARLINGTON, MASSACHUSETTS
(City and State)

hereinafter called "Owner", in the penal sum of
_____Dollars ($_____) in lawful money of the United states, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators and successors, jointly and severally, firmly
by these presents.

THE CONDITION OF THIS OBLIGATION is such that Whereas, the Principal entered into a certain contract with the Owner, dated_____day of a copy of which is hereto attached and made a part hereof for the construction of

_____

Arlington, Massachusetts

NOW, THEREFORE, if the Principal shall well, truly and faithfully perform its duties, all the undertakings, covenants, terms, conditions, and agreements of said contract during the original term thereof, and any extensions thereof which may be granted by, the Owner, with or without notice to the Surety, and if he shall satisfy all claims and demands incurred under such contract, and shall fully indemnify and save harmless the Owner from all costs and damages which it may suffer by reason of failure to do so, and shall reimburse and repay

the Owner all outlay and expense which the Owner may incur in making good any default, then this obligation shall be void; otherwise to remain in full force and effect.

PROVIDED, FURTHER, that the said Surety, for value received hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the Contract or to the work to be performed thereunder or the specifications accompanying the same

shall in any way affect its obligation of this, Bond, and it does hereby waive notice of any such change, extension of time, alteration or addition to the terms of the contract or to the work or to the specifications.

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

INWITNESS WHEREOF, the parties to these present have duly executed in this Bond on the day of_____

ATTEST:

_____

Principal

By_____

Secretary

_____

_____

_____

(Address - zip code)

_____ (Seal)

Witness as to Principal

_____

_____

_____

(Address - zip code)

ATTEST:

_____

Surety

BY _____

(Surety)

_____

Secretary

_____

_____

_____

(Address-Zip Code)

_____ (Seal)

Witness as to Surety

_____

_____

_____

(Address-Zip Code)

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

END OF DOCUMENT

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LABOR AND MATERIALS PAYMENT BOND

KNOW ALL MEN BY THESE PRESENTS: That we

_____

(Name of Contractor)

a _____

(Corporation, Partnership of Individual)
hereinafter called "Principal" and

_____

(Surety)

of_____, State of_____, hereinafter called the "Surety", are held and firmly bound into

TOWN OF ARLINGTON, MASSACHUSETTS
(Owner)
acting through its TOWN MANAGER

ARLINGTON, MASSACHUSETTS
(City and State)

herein called "Owner", in the penal sum of

_____,Dollars ($) in lawful money of the United States, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators and successors, jointly and severally, firmly by these presents.

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

IMPROVEMENTS TO ARLINGTON RESERVOIRIN ARLINGTON MASSACHUSETTS

NOW, THEREFORE, if the Principal shall promptly make payment to all persons, firms, subcontractors, and corporations furnishing materials for or performing labor in the prosecution of the work provided for in such contract, and any authorized extension or modification thereof, including all amounts due for materials, lubricants, oil, gasoline, coal and coke, repairs on machinery, equipment and tools, consumed or

used in connection with the construction of such work, and all insurance premiums on said work, and for all labor, performed in such work whether by subcontractor or otherwise, then this obligation shall be void; otherwise to remain in full force and effect.

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

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

IN WITNESS WHEREOF, the parties to these present have duly executed in this Bond on the day of_____,

ATTEST:

_____

Principal

BY
Secretary

_____

_____

_____
(Address - zip code)

_____ (Seal)
Witness as to Principal

_____

_____

_____
(Address - zip code)

ATTEST:

_____

Surety

_____

Secretary

_____

_____

_____

(Address-Zip Code)

_____ (Seal)

Witness as to Surety

_____

_____

_____

(Address-Zip Code)

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

END OF DOCUMENT

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To view and print Weekly Payroll & Statement of Compliance Forms, click on www.mass.gov/dols/pw.

PLEASE NOTE: The attached Prevailing Wage Schedule is valid for 90 days. An Awarding Authority should re-request an up to date Prevailing Wage Schedule if it has NOT opened bids or selected a contractor within 90 days of the issuance date of the attached prevailing wage schedule.

*For MULTI-YEAR projects bid on or after 8/8/08, Awarding Authorities must request an Annual Update to this Prevailing Wage Schedule each year for the duration of the project, no later than two weeks before the anniversary date of the execution of the general contract. Annual updates are not required for projects that last LESS THAN ONE YEAR.

*For CM AT RISK projects (bid pursuant to GL c.149A), Awarding Authorities must request a Prevailing Wage Schedule NOT sooner than 90-days before the earlier of: (a) the execution date of the GMP Amendment, or (b) the bid for the first construction scope of work.

*For MULTI-YEAR CM AT RISK projects, Awarding Authorities must request an Annual Update to this Prevailing Wage Schedule each year for the duration of the project, no later than two weeks before the anniversary date, which is the earlier of: (a)the execution date of the GMP Amendment, or (b) the execution date of the first amendment to procure construction scopes of work.

Apprentice wages (expressed as dollar figures) and the required benefits are listed on the Prevailing Wage Schedule. For further details, please see opinion letter PW-2010-03-03.16.10 (dated March 18, 2010) at www.mass.gov/dols/pw.

Request Prevailing Wage Rates online at: www.mass.gov/dols/pw.

THIS IS A SYSTEM-GENERATED EMAIL. PLEASE DO NOT REPLY TO THIS EMAIL. TO CONTACT DLS REGARDING PREVAILING WAGE MATTERS, CALL 617-626-6953.
==========

APPROVAL/DENIAL COMMENTS

THE COMMONWEALTH OF MASSACHUSETTS
EXECUTIVE OFFICE OF LABOR AND WORKFORCE DEVELOPMENT
DEPARTMENT OF LABOR STANDARDS

Prevailing Wage Rates

As determined by the Director under the provisions of the Massachusetts General Laws, Chapter 149, Sections 26 to 27H

CHARLES D. BAKER
Governor

KARYN E. POLITO
Lt. Governor

ROSALIN ACOSTA
Secretary

WILLIAM D MCKINNEY
Director

Awarding Authority: Town of Arlington

Contract Number: 19-05 **City/Town:** ARLINGTON

Description of Work: Arlington Reservoir Improvements includes structural upgrades to Pump House, mechanical equipment, piping system and Electrical upgrades.

Job Location: Lowell St

Information about Prevailing Wage Schedules for Awarding Authorities and Contractors

- This wage schedule applies only to the specific project referenced at the top of this page and uniquely identified by the "Wage Request Number" on all pages of this schedule.
- An Awarding Authority must request an updated wage schedule from the Department of Labor Standards ("DLS") if it has not opened bids or selected a contractor within 90 days of the date of issuance of the wage schedule. For CM AT RISK projects (bid pursuant to G.L. c.149A), the earlier of: (a) the execution date of the GMP Amendment, or (b) the bid for the first construction scope of work must be within 90-days of the wage schedule issuance date.
- The wage schedule shall be incorporated in any advertisement or call for bids for the project as required by M.G.L. c. 149, § 27. The wage schedule shall be made a part of the contract awarded for the project. The wage schedule must be posted in a conspicuous place at the work site for the life of the project in accordance with M.G.L. c. 149 § 27. The wages listed on the wage schedule must be paid to employees performing construction work on the project whether they are employed by the prime contractor, a filed sub-bidder, or any sub-contractor.
- All apprentices working on the project are required to be registered with the Massachusetts Department of Labor Standards, Division of Apprentice Standards (DLS/DAS). Apprentice must keep his/her apprentice identification card on his/her person during all work hours on the project. An apprentice registered with DAS may be paid the lower apprentice wage rate at the applicable step as provided on the prevailing wage schedule. **Any apprentice not registered with DLS/DAS regardless of whether or not they are registered with any other federal, state, local, or private agency must be paid the journeyworker's rate for the trade.**
- The wage rates will remain in effect for the duration of the project, except in the case of multi-year public construction projects. For construction projects lasting longer than one year, awarding authorities must request an updated wage schedule. Awarding authorities are required to request these updates no later than two weeks before the anniversary of the date the contract was executed by the awarding authority and the general contractor. For multi-year CM AT RISK projects, awarding authority must request an annual update no later than two weeks before the anniversary date, determined as the earlier of: (a) the execution date of the GMP Amendment, or (b) the execution date of the first amendment to permit procurement of construction services. Contractors are required to obtain the wage schedules from awarding authorities, and to pay no less than these rates to covered workers. The annual update requirement is not applicable to 27F "rental of equipment" contracts.
- Every contractor or subcontractor which performs construction work on the project is required to submit weekly payroll reports and a Statement of Compliance directly to the awarding authority by mail or email and keep them on file for three years. Each weekly payroll report must contain: the employee's name, address, occupational classification, hours worked, and wages paid. Do not submit weekly payroll reports to DLS. A sample of a payroll reporting form may be obtained at http://www.mass.gov/dols/pw.
- Contractors with questions about the wage rates or classifications included on the wage schedule have an affirmative obligation to inquire with DLS at (617) 626-6953.
- Employees not receiving the prevailing wage rate set forth on the wage schedule may report the violation to the Fair Labor Division of the office of the Attorney General at (617) 727-3465.
- Failure of a contractor or subcontractor to pay the prevailing wage rates listed on the wage schedule to all employees who perform construction work on the project is a violation of the law and subjects the contractor or subcontractor to civil and

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
Construction						
(2 AXLE) DRIVER - EQUIPMENT *TEAMSTERS JOINT COUNCIL NO. 10 ZONE A*	12/01/2018	$34.35	$11.91	$12.70	$0.00	$58.96
	06/01/2019	$35.35	$11.91	$12.70	$0.00	$59.96
	08/01/2019	$35.35	$12.41	$12.70	$0.00	$60.46
	12/01/2019	$35.35	$12.41	$13.72	$0.00	$61.48
	06/01/2020	$36.25	$12.41	$13.72	$0.00	$62.38
	08/01/2020	$36.25	$12.91	$13.72	$0.00	$62.88
	12/01/2020	$36.25	$12.91	$14.82	$0.00	$63.98
	06/01/2021	$37.05	$12.91	$14.82	$0.00	$64.78
	08/01/2021	$37.05	$13.41	$14.82	$0.00	$65.28
	12/01/2021	$37.05	$13.41	$16.01	$0.00	$66.47
(3 AXLE) DRIVER - EQUIPMENT *TEAMSTERS JOINT COUNCIL NO. 10 ZONE A*	12/01/2018	$34.42	$11.91	$12.70	$0.00	$59.03
	06/01/2019	$35.42	$11.91	$12.70	$0.00	$60.03
	08/01/2019	$35.42	$12.41	$12.70	$0.00	$60.53
	12/01/2019	$35.42	$12.41	$13.72	$0.00	$61.55
	06/01/2020	$36.32	$12.41	$13.72	$0.00	$62.45
	08/01/2020	$36.32	$12.91	$13.72	$0.00	$62.95
	12/01/2020	$36.32	$12.91	$14.82	$0.00	$64.05
	06/01/2021	$37.12	$12.91	$14.82	$0.00	$64.85
	08/01/2021	$37.12	$13.41	$14.82	$0.00	$65.35
	12/01/2021	$37.12	$13.41	$16.01	$0.00	$66.54
(4 & 5 AXLE) DRIVER - EQUIPMENT *TEAMSTERS JOINT COUNCIL NO. 10 ZONE A*	12/01/2018	$34.54	$11.91	$12.70	$0.00	$59.15
	06/01/2019	$35.54	$11.91	$12.70	$0.00	$60.15
	08/01/2019	$35.54	$12.41	$12.70	$0.00	$60.65
	12/01/2019	$35.54	$12.41	$13.72	$0.00	$61.67
	06/01/2020	$36.44	$12.41	$13.72	$0.00	$62.57
	08/01/2020	$36.44	$12.91	$13.72	$0.00	$63.07
	12/01/2020	$36.44	$12.91	$14.82	$0.00	$64.17
	06/01/2021	$37.24	$12.91	$14.82	$0.00	$64.97
	08/01/2021	$37.24	$13.41	$14.82	$0.00	$65.47
	12/01/2021	$37.24	$13.41	$16.01	$0.00	$66.66
ADS/SUBMERSIBLE PILOT *PILE DRIVER LOCAL 56 (ZONE 1)*	08/01/2018	$97.80	$9.90	$21.15	$0.00	$128.85
	08/01/2019	$102.78	$9.90	$21.15	$0.00	$133.83
For apprentice rates see "Apprentice- PILE DRIVER"						
AIR TRACK OPERATOR *LABORERS - ZONE 1*	12/01/2018	$39.40	$7.85	$15.35	$0.00	$62.60
	06/01/2019	$40.40	$7.85	$15.35	$0.00	$63.60
	12/01/2019	$41.40	$7.85	$15.35	$0.00	$64.60
	06/01/2020	$42.39	$7.85	$15.35	$0.00	$65.59
	12/01/2020	$43.37	$7.85	$15.35	$0.00	$66.57
	06/01/2021	$44.39	$7.85	$15.35	$0.00	$67.59
	12/01/2021	$45.40	$7.85	$15.35	$0.00	$68.60
For apprentice rates see "Apprentice- LABORER"						

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
ASBESTOS REMOVER - PIPE / MECH. EQUIPT. *HEAT & FROST INSULATORS LOCAL 6 (BOSTON)*	12/01/2018	$37.90	$11.50	$7.10	$0.00	$56.50
	06/01/2019	$38.90	$11.50	$7.10	$0.00	$57.50
	12/01/2019	$39.90	$11.50	$7.10	$0.00	$58.50
	06/01/2020	$40.90	$11.50	$7.10	$0.00	$59.50
	12/01/2020	$41.90	$11.50	$7.10	$0.00	$60.50
ASPHALT RAKER *LABORERS - ZONE 1*	12/01/2018	$38.90	$7.85	$15.35	$0.00	$62.10
	06/01/2019	$39.90	$7.85	$15.35	$0.00	$63.10
	12/01/2019	$40.90	$7.85	$15.35	$0.00	$64.10
	06/01/2020	$41.89	$7.85	$15.35	$0.00	$65.09
	12/01/2020	$42.87	$7.85	$15.35	$0.00	$66.07
	06/01/2021	$43.89	$7.85	$15.35	$0.00	$67.09
	12/01/2021	$44.90	$7.85	$15.35	$0.00	$68.10
For apprentice rates see "Apprentice- LABORER"						
ASPHALT/CONCRETE/CRUSHER PLANT-ON SITE *OPERATING ENGINEERS LOCAL 4*	12/01/2018	$47.58	$11.50	$15.60	$0.00	$74.68
	06/01/2019	$48.68	$11.50	$15.60	$0.00	$75.78
	12/01/2019	$49.83	$11.50	$15.60	$0.00	$76.93
	06/01/2020	$50.93	$11.50	$15.60	$0.00	$78.03
	12/01/2020	$52.08	$11.50	$15.60	$0.00	$79.18
	06/01/2021	$53.18	$11.50	$15.60	$0.00	$80.28
	12/01/2021	$54.33	$11.50	$15.60	$0.00	$81.43
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
BACKHOE/FRONT-END LOADER *OPERATING ENGINEERS LOCAL 4*	12/01/2018	$47.58	$11.50	$15.60	$0.00	$74.68
	06/01/2019	$48.68	$11.50	$15.60	$0.00	$75.78
	12/01/2019	$49.83	$11.50	$15.60	$0.00	$76.93
	06/01/2020	$50.93	$11.50	$15.60	$0.00	$78.03
	12/01/2020	$52.08	$11.50	$15.60	$0.00	$79.18
	06/01/2021	$53.18	$11.50	$15.60	$0.00	$80.28
	12/01/2021	$54.33	$11.50	$15.60	$0.00	$81.43
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
BARCO-TYPE JUMPING TAMPER *LABORERS - ZONE 1*	12/01/2018	$38.90	$7.85	$15.35	$0.00	$62.10
	06/01/2019	$39.90	$7.85	$15.35	$0.00	$63.10
	12/01/2019	$40.90	$7.85	$15.35	$0.00	$64.10
	06/01/2020	$41.89	$7.85	$15.35	$0.00	$65.09
	12/01/2020	$42.87	$7.85	$15.35	$0.00	$66.07
	06/01/2021	$43.89	$7.85	$15.35	$0.00	$67.09
	12/01/2021	$44.90	$7.85	$15.35	$0.00	$68.10
For apprentice rates see "Apprentice- LABORER"						
BLOCK PAVER, RAMMER / CURB SETTER *LABORERS - ZONE 1*	12/01/2018	$39.40	$7.85	$15.35	$0.00	$62.60
	06/01/2019	$40.40	$7.85	$15.35	$0.00	$63.60
	12/01/2019	$41.40	$7.85	$15.35	$0.00	$64.60
	06/01/2020	$42.39	$7.85	$15.35	$0.00	$65.59
	12/01/2020	$43.37	$7.85	$15.35	$0.00	$66.57
	06/01/2021	$44.39	$7.85	$15.35	$0.00	$67.59
	12/01/2021	$45.40	$7.85	$15.35	$0.00	$68.60
For apprentice rates see "Apprentice- LABORER"						

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
BOILER MAKER *BOILERMAKERS LOCAL 29*	01/01/2019	$44.71	$7.07	$17.72	$0.00	$69.50
	01/01/2020	$46.10	$7.07	$17.98	$0.00	$71.15

Apprentice - *BOILERMAKER - Local 29*

Effective Date - 01/01/2019

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	65	$29.06	$7.07	$11.52	$0.00	$47.65
2	65	$29.06	$7.07	$11.52	$0.00	$47.65
3	70	$31.30	$7.07	$12.40	$0.00	$50.77
4	75	$33.53	$7.07	$13.30	$0.00	$53.90
5	80	$35.77	$7.07	$14.18	$0.00	$57.02
6	85	$38.00	$7.07	$15.07	$0.00	$60.14
7	90	$40.24	$7.07	$15.95	$0.00	$63.26
8	95	$42.47	$7.07	$16.84	$0.00	$66.38

Effective Date - 01/01/2020

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	65	$29.97	$7.07	$11.69	$0.00	$48.73
2	65	$29.97	$7.07	$11.69	$0.00	$48.73
3	70	$32.27	$7.07	$12.59	$0.00	$51.93
4	75	$34.58	$7.07	$13.49	$0.00	$55.14
5	80	$36.88	$7.07	$14.38	$0.00	$58.33
6	85	$39.19	$7.07	$15.29	$0.00	$61.55
7	90	$41.49	$7.07	$16.18	$0.00	$64.74
8	95	$43.80	$7.07	$17.09	$0.00	$67.96

Notes:

Apprentice to Journeyworker Ratio:1:4

BRICK/STONE/ARTIFICIAL MASONRY (INCL. MASONRY WATERPROOFING) *BRICKLAYERS LOCAL 3 (BOSTON)*	08/01/2018	$52.91	$10.75	$20.66	$0.00	$84.32
	02/01/2019	$53.55	$10.75	$20.66	$0.00	$84.96
	08/01/2019	$54.90	$10.75	$20.80	$0.00	$86.45
	02/01/2020	$55.54	$10.75	$20.80	$0.00	$87.09
	08/01/2020	$56.89	$10.75	$20.95	$0.00	$88.59
	02/01/2021	$57.53	$10.75	$20.95	$0.00	$89.23
	08/01/2021	$58.93	$10.75	$21.11	$0.00	$90.79
	02/01/2022	$59.52	$10.75	$21.11	$0.00	$91.38

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *BRICK/PLASTER/CEMENT MASON - Local 3 Boston*

Effective Date - 08/01/2018

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$26.46	$10.75	$20.66	$0.00	$57.87
2	60	$31.75	$10.75	$20.66	$0.00	$63.16
3	70	$37.04	$10.75	$20.66	$0.00	$68.45
4	80	$42.33	$10.75	$20.66	$0.00	$73.74
5	90	$47.62	$10.75	$20.66	$0.00	$79.03

Effective Date - 02/01/2019

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$26.78	$10.75	$20.66	$0.00	$58.19
2	60	$32.13	$10.75	$20.66	$0.00	$63.54
3	70	$37.49	$10.75	$20.66	$0.00	$68.90
4	80	$42.84	$10.75	$20.66	$0.00	$74.25
5	90	$48.20	$10.75	$20.66	$0.00	$79.61

Notes:

Apprentice to Journeyworker Ratio:1:5

BULLDOZER/GRADER/SCRAPER *OPERATING ENGINEERS LOCAL 4*	12/01/2018	$47.10	$11.50	$15.60	$0.00	$74.20
	06/01/2019	$48.19	$11.50	$15.60	$0.00	$75.29
	12/01/2019	$49.33	$11.50	$15.60	$0.00	$76.43
	06/01/2020	$50.41	$11.50	$15.60	$0.00	$77.51
	12/01/2020	$51.55	$11.50	$15.60	$0.00	$78.65
	06/01/2021	$52.64	$11.50	$15.60	$0.00	$79.74
	12/01/2021	$53.78	$11.50	$15.60	$0.00	$80.88
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
CAISSON & UNDERPINNING BOTTOM MAN *LABORERS - FOUNDATION AND MARINE*	12/01/2018	$39.75	$7.85	$15.55	$0.00	$63.15
	06/01/2019	$40.75	$7.85	$15.55	$0.00	$64.15
	12/01/2019	$41.75	$7.85	$15.55	$0.00	$65.15
	06/01/2020	$42.74	$7.85	$15.55	$0.00	$66.14
	12/01/2020	$43.72	$7.85	$15.55	$0.00	$67.12
	06/01/2021	$44.74	$7.85	$15.55	$0.00	$68.14
	12/01/2021	$45.75	$7.85	$15.55	$0.00	$69.15
For apprentice rates see "Apprentice- LABORER"						
CAISSON & UNDERPINNING LABORER *LABORERS - FOUNDATION AND MARINE*	12/01/2018	$38.60	$7.85	$15.55	$0.00	$62.00
	06/01/2019	$39.60	$7.85	$15.55	$0.00	$63.00
	12/01/2019	$40.60	$7.85	$15.55	$0.00	$64.00
	06/01/2020	$41.59	$7.85	$15.55	$0.00	$64.99
	12/01/2020	$42.57	$7.85	$15.55	$0.00	$65.97
	06/01/2021	$43.59	$7.85	$15.55	$0.00	$66.99
	12/01/2021	$44.60	$7.85	$15.55	$0.00	$68.00
For apprentice rates see "Apprentice- LABORER"						

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
CAISSON & UNDERPINNING TOP MAN *LABORERS - FOUNDATION AND MARINE*	12/01/2018	$38.60	$7.85	$15.55	$0.00	$62.00
	06/01/2019	$39.60	$7.85	$15.55	$0.00	$63.00
	12/01/2019	$40.60	$7.85	$15.55	$0.00	$64.00
	06/01/2020	$41.59	$7.85	$15.55	$0.00	$64.99
	12/01/2020	$42.57	$7.85	$15.55	$0.00	$65.97
	06/01/2021	$43.59	$7.85	$15.55	$0.00	$66.99
	12/01/2021	$44.60	$7.85	$15.55	$0.00	$68.00
For apprentice rates see "Apprentice- LABORER"						
CARBIDE CORE DRILL OPERATOR *LABORERS - ZONE 1*	12/01/2018	$38.90	$7.85	$15.35	$0.00	$62.10
	06/01/2019	$39.90	$7.85	$15.35	$0.00	$63.10
	12/01/2019	$40.90	$7.85	$15.35	$0.00	$64.10
	06/01/2020	$41.89	$7.85	$15.35	$0.00	$65.09
	12/01/2020	$42.87	$7.85	$15.35	$0.00	$66.07
	06/01/2021	$43.89	$7.85	$15.35	$0.00	$67.09
	12/01/2021	$44.90	$7.85	$15.35	$0.00	$68.10
For apprentice rates see "Apprentice- LABORER"						
CARPENTER *CARPENTERS -ZONE 2 (Eastern Massachusetts)*	09/01/2018	$41.32	$9.90	$17.50	$0.00	$68.72
	03/01/2019	$42.35	$9.90	$17.50	$0.00	$69.75

Apprentice - *CARPENTER - Zone 2 Eastern MA*

Effective Date - 09/01/2018

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$20.66	$9.90	$1.73	$0.00	$32.29
2	60	$24.79	$9.90	$1.73	$0.00	$36.42
3	70	$28.92	$9.90	$12.31	$0.00	$51.13
4	75	$30.99	$9.90	$12.31	$0.00	$53.20
5	80	$33.06	$9.90	$14.04	$0.00	$57.00
6	80	$33.06	$9.90	$14.04	$0.00	$57.00
7	90	$37.19	$9.90	$15.77	$0.00	$62.86
8	90	$37.19	$9.90	$15.77	$0.00	$62.86

Effective Date - 03/01/2019

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$21.18	$9.90	$1.73	$0.00	$32.81
2	60	$25.41	$9.90	$1.73	$0.00	$37.04
3	70	$29.65	$9.90	$12.31	$0.00	$51.86
4	75	$31.76	$9.90	$12.31	$0.00	$53.97
5	80	$33.88	$9.90	$14.04	$0.00	$57.82
6	80	$33.88	$9.90	$14.04	$0.00	$57.82
7	90	$38.12	$9.90	$15.77	$0.00	$63.79
8	90	$38.12	$9.90	$15.77	$0.00	$63.79

Notes:

% Indentured After 10/1/17; 45/45/55/55/70/70/80/80

Step 1&2 $30.22/ 3&4 $36.03/ 5&6 $52.86/ 7&8 $58.73

Apprentice to Journeyworker Ratio:1:5

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
CARPENTER WOOD FRAME *CARPENTERS -ZONE 2 (Wood Frame)*	10/01/2018	$27.09	$7.07	$7.86	$0.00	$42.02
	04/01/2019	$27.52	$7.07	$7.86	$0.00	$42.45
	10/01/2019	$27.95	$7.07	$7.86	$0.00	$42.88

All Aspects of New Wood Frame Work - As of 9/1/09 Carpentry work on wood-frame WEATHERIZATION projects shall be paid the WOOD FRAME CARPENTER rate.

Apprentice - *CARPENTER (Wood Frame) - Zone 2*

Effective Date - 10/01/2018

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	60	$16.25	$7.07	$0.00	$0.00	$23.32
2	60	$16.25	$7.07	$0.00	$0.00	$23.32
3	65	$17.61	$7.07	$7.86	$0.00	$32.54
4	70	$18.96	$7.07	$7.86	$0.00	$33.89
5	75	$20.32	$7.07	$7.86	$0.00	$35.25
6	80	$21.67	$7.07	$7.86	$0.00	$36.60
7	85	$23.03	$7.07	$7.86	$0.00	$37.96
8	90	$24.38	$7.07	$7.86	$0.00	$39.31

Effective Date - 04/01/2019

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	60	$16.51	$7.07	$0.00	$0.00	$23.58
2	60	$16.51	$7.07	$0.00	$0.00	$23.58
3	65	$17.89	$7.07	$7.86	$0.00	$32.82
4	70	$19.26	$7.07	$7.86	$0.00	$34.19
5	75	$20.64	$7.07	$7.86	$0.00	$35.57
6	80	$22.02	$7.07	$7.86	$0.00	$36.95
7	85	$23.39	$7.07	$7.86	$0.00	$38.32
8	90	$24.77	$7.07	$7.86	$0.00	$39.70

Notes:

% Indentured After 10/1/17; 45/45/55/55/70/70/80/80
Step 1&2 $19.26/ 3&4 $26.72/ 5&6 $33.89/ 7&8 $36.60

Apprentice to Journeyworker Ratio:1:5

CEMENT MASONRY/PLASTERING *BRICKLAYERS LOCAL 3 (BOSTON)*	01/01/2019	$47.50	$12.50	$22.41	$0.30	$82.71
	07/01/2019	$48.24	$12.50	$22.41	$0.30	$83.45
	01/01/2020	$49.64	$12.50	$22.41	$0.30	$84.85

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *CEMENT MASONRY/PLASTERING - Eastern Mass (Boston)*

Effective Date - 01/01/2019

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$23.75	$12.50	$15.41	$0.00	$51.66
2	60	$28.50	$12.50	$17.41	$0.30	$58.71
3	65	$30.88	$12.50	$18.41	$0.30	$62.09
4	70	$33.25	$12.50	$19.41	$0.30	$65.46
5	75	$35.63	$12.50	$20.41	$0.30	$68.84
6	80	$38.00	$12.50	$21.41	$0.30	$72.21
7	90	$42.75	$12.50	$22.41	$0.30	$77.96

Effective Date - 07/01/2019

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$24.12	$12.50	$15.41	$0.00	$52.03
2	60	$28.94	$12.50	$17.41	$0.30	$59.15
3	65	$31.36	$12.50	$18.41	$0.30	$62.57
4	70	$33.77	$12.50	$19.41	$0.30	$65.98
5	75	$36.18	$12.50	$20.41	$0.30	$69.39
6	80	$38.59	$12.50	$21.41	$0.30	$72.80
7	90	$43.42	$12.50	$22.41	$0.30	$78.63

Notes:

Steps 3,4 are 500 hrs. All other steps are 1,000 hrs.

Apprentice to Journeyworker Ratio:1:3

CHAIN SAW OPERATOR *LABORERS - ZONE 1*	12/01/2018	$38.90	$7.85	$15.35	$0.00	$62.10
	06/01/2019	$39.90	$7.85	$15.35	$0.00	$63.10
	12/01/2019	$40.90	$7.85	$15.35	$0.00	$64.10
	06/01/2020	$41.89	$7.85	$15.35	$0.00	$65.09
	12/01/2020	$42.87	$7.85	$15.35	$0.00	$66.07
	06/01/2021	$43.89	$7.85	$15.35	$0.00	$67.09
	12/01/2021	$44.90	$7.85	$15.35	$0.00	$68.10
For apprentice rates see "Apprentice- LABORER"						
CLAM SHELLS/SLURRY BUCKETS/HEADING MACHINES *OPERATING ENGINEERS LOCAL 4*	12/01/2018	$48.58	$11.50	$15.60	$0.00	$75.68
	06/01/2019	$49.68	$11.50	$15.60	$0.00	$76.78
	12/01/2019	$50.83	$11.50	$15.60	$0.00	$77.93
	06/01/2020	$51.93	$11.50	$15.60	$0.00	$79.03
	12/01/2020	$53.08	$11.50	$15.60	$0.00	$80.18
	06/01/2021	$54.18	$11.50	$15.60	$0.00	$81.28
	12/01/2021	$55.33	$11.50	$15.60	$0.00	$82.43
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
COMPRESSOR OPERATOR *OPERATING ENGINEERS LOCAL 4*	12/01/2018	$32.03	$11.50	$15.60	$0.00	$59.13
	06/01/2019	$32.78	$11.50	$15.60	$0.00	$59.88
	12/01/2019	$33.57	$11.50	$15.60	$0.00	$60.67
	06/01/2020	$34.32	$11.50	$15.60	$0.00	$61.42
	12/01/2020	$35.10	$11.50	$15.60	$0.00	$62.20
	06/01/2021	$35.85	$11.50	$15.60	$0.00	$62.95
	12/01/2021	$36.64	$11.50	$15.60	$0.00	$63.74
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
DELEADER (BRIDGE) *PAINTERS LOCAL 35 - ZONE 2*	01/01/2019	$50.36	$8.15	$20.85	$0.00	$79.36
	07/01/2019	$51.46	$8.15	$20.85	$0.00	$80.46
	01/01/2020	$52.56	$8.15	$20.85	$0.00	$81.56
	07/01/2020	$53.66	$8.15	$20.85	$0.00	$82.66
	01/01/2021	$54.76	$8.15	$20.85	$0.00	$83.76

Apprentice - *PAINTER Local 35 - BRIDGES/TANKS*

Effective Date - 01/01/2019

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$25.18	$8.15	$0.00	$0.00	$33.33
2	55	$27.70	$8.15	$5.64	$0.00	$41.49
3	60	$30.22	$8.15	$6.15	$0.00	$44.52
4	65	$32.73	$8.15	$6.66	$0.00	$47.54
5	70	$35.25	$8.15	$17.78	$0.00	$61.18
6	75	$37.77	$8.15	$18.29	$0.00	$64.21
7	80	$40.29	$8.15	$18.80	$0.00	$67.24
8	90	$45.32	$8.15	$19.83	$0.00	$73.30

Effective Date - 07/01/2019

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$25.73	$8.15	$0.00	$0.00	$33.88
2	55	$28.30	$8.15	$5.64	$0.00	$42.09
3	60	$30.88	$8.15	$6.15	$0.00	$45.18
4	65	$33.45	$8.15	$6.66	$0.00	$48.26
5	70	$36.02	$8.15	$17.78	$0.00	$61.95
6	75	$38.60	$8.15	$18.29	$0.00	$65.04
7	80	$41.17	$8.15	$18.80	$0.00	$68.12
8	90	$46.31	$8.15	$19.83	$0.00	$74.29

Notes:

Steps are 750 hrs.

Apprentice to Journeyworker Ratio:1:1

DEMO: ADZEMAN *LABORERS - ZONE 1*	12/01/2018	$38.80	$7.85	$15.35	$0.00	$62.00
	06/01/2019	$39.80	$7.85	$15.35	$0.00	$63.00
	12/01/2019	$40.80	$7.85	$15.35	$0.00	$64.00
For apprentice rates see "Apprentice- LABORER"						

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
DEMO: BACKHOE/LOADER/HAMMER OPERATOR *LABORERS - ZONE 1*	12/01/2018	$39.80	$7.85	$15.35	$0.00	$63.00
	06/01/2019	$40.80	$7.85	$15.35	$0.00	$64.00
	12/01/2019	$41.80	$7.85	$15.35	$0.00	$65.00
For apprentice rates see "Apprentice- LABORER"						
DEMO: BURNERS *LABORERS - ZONE 1*	12/01/2018	$39.55	$7.85	$15.35	$0.00	$62.75
	06/01/2019	$40.55	$7.85	$15.35	$0.00	$63.75
	12/01/2019	$41.55	$7.85	$15.35	$0.00	$64.75
For apprentice rates see "Apprentice- LABORER"						
DEMO: CONCRETE CUTTER/SAWYER *LABORERS - ZONE 1*	12/01/2018	$39.80	$7.85	$15.35	$0.00	$63.00
	06/01/2019	$40.80	$7.85	$15.35	$0.00	$64.00
	12/01/2019	$41.80	$7.85	$15.35	$0.00	$65.00
For apprentice rates see "Apprentice- LABORER"						
DEMO: JACKHAMMER OPERATOR *LABORERS - ZONE 1*	12/01/2018	$39.55	$7.85	$15.35	$0.00	$62.75
	06/01/2019	$40.55	$7.85	$15.35	$0.00	$63.75
	12/01/2019	$41.55	$7.85	$15.35	$0.00	$64.75
For apprentice rates see "Apprentice- LABORER"						
DEMO: WRECKING LABORER *LABORERS - ZONE 1*	12/01/2018	$38.80	$7.85	$15.35	$0.00	$62.00
	06/01/2019	$39.80	$7.85	$15.35	$0.00	$63.00
	12/01/2019	$40.80	$7.85	$15.35	$0.00	$64.00
For apprentice rates see "Apprentice- LABORER"						
DIRECTIONAL DRILL MACHINE OPERATOR *OPERATING ENGINEERS LOCAL 4*	12/01/2018	$47.10	$11.50	$15.60	$0.00	$74.20
	06/01/2019	$48.19	$11.50	$15.60	$0.00	$75.29
	12/01/2019	$49.33	$11.50	$15.60	$0.00	$76.43
	06/01/2020	$50.41	$11.50	$15.60	$0.00	$77.51
	12/01/2020	$51.55	$11.50	$15.60	$0.00	$78.65
	06/01/2021	$52.64	$11.50	$15.60	$0.00	$79.74
	12/01/2021	$53.78	$11.50	$15.60	$0.00	$80.88
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
DIVER *PILE DRIVER LOCAL 56 (ZONE 1)*	08/01/2018	$65.20	$9.90	$21.15	$0.00	$96.25
	08/01/2019	$68.52	$9.90	$21.15	$0.00	$99.57
For apprentice rates see "Apprentice- PILE DRIVER"						
DIVER TENDER *PILE DRIVER LOCAL 56 (ZONE 1)*	08/01/2018	$46.57	$9.90	$21.15	$0.00	$77.62
	08/01/2019	$48.94	$9.90	$21.15	$0.00	$79.99
For apprentice rates see "Apprentice- PILE DRIVER"						
DIVER TENDER (EFFLUENT) *PILE DRIVER LOCAL 56 (ZONE 1)*	08/01/2018	$69.86	$9.90	$21.15	$0.00	$100.91
	08/01/2019	$73.41	$9.90	$21.15	$0.00	$104.46
For apprentice rates see "Apprentice- PILE DRIVER"						
DIVER/SLURRY (EFFLUENT) *PILE DRIVER LOCAL 56 (ZONE 1)*	08/01/2018	$97.80	$9.90	$21.15	$0.00	$128.85
	08/01/2019	$102.78	$9.90	$21.15	$0.00	$133.83
For apprentice rates see "Apprentice- PILE DRIVER"						
DRAWBRIDGE OPERATOR (Construction) *ELECTRICIANS LOCAL 103*	09/01/2018	$50.62	$13.00	$18.37	$0.00	$81.99
	03/01/2019	$51.10	$13.00	$18.88	$0.00	$82.98
For apprentice rates see "Apprentice- ELECTRICIAN"						
ELECTRICIAN *ELECTRICIANS LOCAL 103*	09/01/2018	$50.62	$13.00	$18.37	$0.00	$81.99
	03/01/2019	$51.10	$13.00	$18.88	$0.00	$82.98

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *ELECTRICIAN - Local 103*

Effective Date - 09/01/2018

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	40	$20.25	$13.00	$0.61	$0.00	$33.86
2	40	$20.25	$13.00	$0.61	$0.00	$33.86
3	45	$22.78	$13.00	$13.97	$0.00	$49.75
4	45	$22.78	$13.00	$13.97	$0.00	$49.75
5	50	$25.31	$13.00	$14.38	$0.00	$52.69
6	55	$27.84	$13.00	$14.78	$0.00	$55.62
7	60	$30.37	$13.00	$15.17	$0.00	$58.54
8	65	$32.90	$13.00	$15.58	$0.00	$61.48
9	70	$35.43	$13.00	$15.97	$0.00	$64.40
10	75	$37.97	$13.00	$16.37	$0.00	$67.34

Effective Date - 03/01/2019

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	40	$20.44	$13.00	$0.61	$0.00	$34.05
2	40	$20.44	$13.00	$0.61	$0.00	$34.05
3	45	$23.00	$13.00	$14.34	$0.00	$50.34
4	45	$23.00	$13.00	$14.34	$0.00	$50.34
5	50	$25.55	$13.00	$14.76	$0.00	$53.31
6	55	$28.11	$13.00	$15.17	$0.00	$56.28
7	60	$30.66	$13.00	$15.58	$0.00	$59.24
8	65	$33.22	$13.00	$16.00	$0.00	$62.22
9	70	$35.77	$13.00	$16.40	$0.00	$65.17
10	75	$38.33	$13.00	$16.82	$0.00	$68.15

Notes: :

App Prior 1/1/03; 30/35/40/45/50/55/65/70/75/80

Apprentice to Journeyworker Ratio:2:3***

ELEVATOR CONSTRUCTOR *ELEVATOR CONSTRUCTORS LOCAL 4*	01/01/2019	$59.47	$15.58	$17.51	$0.00	$92.56
	01/01/2020	$61.42	$15.73	$18.41	$0.00	$95.56
	01/01/2021	$63.47	$15.88	$19.31	$0.00	$98.66
	01/01/2022	$65.62	$16.03	$20.21	$0.00	$101.86

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *ELEVATOR CONSTRUCTOR - Local 4*

Effective Date - 01/01/2019

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$29.74	$15.58	$0.00	$0.00	$45.32
2	55	$32.71	$15.58	$17.51	$0.00	$65.80
3	65	$38.66	$15.58	$17.51	$0.00	$71.75
4	70	$41.63	$15.58	$17.51	$0.00	$74.72
5	80	$47.58	$15.58	$17.51	$0.00	$80.67

Effective Date - 01/01/2020

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$30.71	$15.73	$0.00	$0.00	$46.44
2	55	$33.78	$15.73	$18.41	$0.00	$67.92
3	65	$39.92	$15.73	$18.41	$0.00	$74.06
4	70	$42.99	$15.73	$18.41	$0.00	$77.13
5	80	$49.14	$15.73	$18.41	$0.00	$83.28

Notes:
Steps 1-2 are 6 mos.; Steps 3-5 are 1 year

Apprentice to Journeyworker Ratio:1:1

ELEVATOR CONSTRUCTOR HELPER *ELEVATOR CONSTRUCTORS LOCAL 4*	01/01/2019	$41.63	$15.58	$17.51	$0.00	$74.72
	01/01/2020	$42.99	$15.73	$18.41	$0.00	$77.13
	01/01/2021	$44.43	$15.88	$19.31	$0.00	$79.62
	01/01/2022	$45.93	$16.03	$20.21	$0.00	$82.17
For apprentice rates see "Apprentice - ELEVATOR CONSTRUCTOR"						
FENCE & GUARD RAIL ERECTOR *LABORERS - ZONE 1*	12/01/2018	$38.90	$7.85	$15.35	$0.00	$62.10
	06/01/2019	$39.90	$7.85	$15.35	$0.00	$63.10
	12/01/2019	$40.90	$7.85	$15.35	$0.00	$64.10
	06/01/2020	$41.89	$7.85	$15.35	$0.00	$65.09
	12/01/2020	$42.87	$7.85	$15.35	$0.00	$66.07
	06/01/2021	$43.89	$7.85	$15.35	$0.00	$67.09
	12/01/2021	$44.90	$7.85	$15.35	$0.00	$68.10
For apprentice rates see "Apprentice- LABORER"						
FIELD ENG.INST.PERSON-BLDG,SITE,HVY/HWY *OPERATING ENGINEERS LOCAL 4*	11/01/2018	$43.19	$11.00	$15.50	$0.00	$69.69
	05/01/2019	$44.33	$11.00	$15.50	$0.00	$70.83
	11/01/2019	$45.33	$11.00	$15.50	$0.00	$71.83
	05/01/2020	$46.48	$11.00	$15.50	$0.00	$72.98
	11/01/2020	$47.48	$11.00	$15.50	$0.00	$73.98
	05/01/2021	$48.68	$11.00	$15.50	$0.00	$75.18
	11/01/2021	$49.63	$11.00	$15.50	$0.00	$76.13
	05/01/2022	$50.78	$11.00	$15.50	$0.00	$77.28
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
FIELD ENG.PARTY CHIEF-BLDG,SITE,HVY/HWY *OPERATING ENGINEERS LOCAL 4*	11/01/2018	$44.67	$11.00	$15.50	$0.00	$71.17
	05/01/2019	$45.82	$11.00	$15.50	$0.00	$72.32
	11/01/2019	$46.83	$11.00	$15.50	$0.00	$73.33
	05/01/2020	$47.98	$11.00	$15.50	$0.00	$74.48
	11/01/2020	$48.99	$11.00	$15.50	$0.00	$75.49
	05/01/2021	$50.15	$11.00	$15.50	$0.00	$76.65
	11/01/2021	$51.16	$11.00	$15.50	$0.00	$77.66
	05/01/2022	$52.32	$11.00	$15.50	$0.00	$78.82
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
FIELD ENG.ROD PERSON-BLDG,SITE,HVY/HWY *OPERATING ENGINEERS LOCAL 4*	11/01/2018	$22.45	$11.00	$15.50	$0.00	$48.95
	05/01/2019	$23.13	$11.00	$15.50	$0.00	$49.63
	11/01/2019	$23.72	$11.00	$15.50	$0.00	$50.22
	05/01/2020	$24.39	$11.00	$15.50	$0.00	$50.89
	11/01/2020	$24.98	$11.00	$15.50	$0.00	$51.48
	05/01/2021	$25.66	$11.00	$15.50	$0.00	$52.16
	11/01/2021	$26.26	$11.00	$15.50	$0.00	$52.76
	05/01/2022	$26.93	$11.00	$15.50	$0.00	$53.43
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
FIRE ALARM INSTALLER *ELECTRICIANS LOCAL 103*	09/01/2018	$50.62	$13.00	$18.37	$0.00	$81.99
	03/01/2019	$51.10	$13.00	$18.88	$0.00	$82.98
For apprentice rates see "Apprentice- ELECTRICIAN"						
FIRE ALARM REPAIR / MAINTENANCE / COMMISSIONING*ELECTRICIANS LOCAL 103*	09/01/2018	$37.97	$13.00	$16.35	$0.00	$67.32
	03/01/2019	$38.33	$13.00	$16.82	$0.00	$68.15
For apprentice rates see "Apprentice- TELECOMMUNICATIONS TECHNICIAN"						
FIREMAN (ASST. ENGINEER) *OPERATING ENGINEERS LOCAL 4*	12/01/2018	$39.13	$11.50	$15.60	$0.00	$66.23
	06/01/2019	$40.04	$11.50	$15.60	$0.00	$67.14
	12/01/2019	$40.99	$11.50	$15.60	$0.00	$68.09
	06/01/2020	$41.90	$11.50	$15.60	$0.00	$69.00
	12/01/2020	$42.85	$11.50	$15.60	$0.00	$69.95
	06/01/2021	$43.76	$11.50	$15.60	$0.00	$70.86
	12/01/2021	$44.71	$11.50	$15.60	$0.00	$71.81
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
FLAGGER & SIGNALER *LABORERS - ZONE 1*	12/01/2018	$22.50	$7.85	$15.35	$0.00	$45.70
	06/01/2019	$22.50	$7.85	$15.35	$0.00	$45.70
	12/01/2019	$23.50	$7.85	$15.35	$0.00	$46.70
	06/01/2020	$23.50	$7.85	$15.35	$0.00	$46.70
	12/01/2020	$24.50	$7.85	$15.35	$0.00	$47.70
	06/01/2021	$24.50	$7.85	$15.35	$0.00	$47.70
	12/01/2021	$24.50	$7.85	$15.35	$0.00	$47.70
For apprentice rates see "Apprentice- LABORER"						
FLOORCOVERER *FLOORCOVERERS LOCAL 2168 ZONE I*	03/01/2016	$42.13	$9.80	$17.62	$0.00	$69.55

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *FLOORCOVERER - Local 2168 Zone I*

Effective Date - 03/01/2016

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$21.07	$9.80	$1.79	$0.00	$32.66
2	55	$23.17	$9.80	$1.79	$0.00	$34.76
3	60	$25.28	$9.80	$12.25	$0.00	$47.33
4	65	$27.38	$9.80	$12.25	$0.00	$49.43
5	70	$29.49	$9.80	$14.04	$0.00	$53.33
6	75	$31.60	$9.80	$14.04	$0.00	$55.44
7	80	$33.70	$9.80	$15.83	$0.00	$59.33
8	85	$35.81	$9.80	$15.83	$0.00	$61.44

Notes: Steps are 750 hrs.
% After 09/1/17; 45/45/55/55/70/70/80/80 (1500hr Steps)
Step 1&2 $30.55/ 3&4 $36.49/ 5&6 $53.33/ 7&8 $59.33

Apprentice to Journeyworker Ratio:1:1

FORK LIFT/CHERRY PICKER *OPERATING ENGINEERS LOCAL 4*	12/01/2018	$47.58	$11.50	$15.60	$0.00	$74.68
	06/01/2019	$48.68	$11.50	$15.60	$0.00	$75.78
	12/01/2019	$49.83	$11.50	$15.60	$0.00	$76.93
	06/01/2020	$50.93	$11.50	$15.60	$0.00	$78.03
	12/01/2020	$52.08	$11.50	$15.60	$0.00	$79.18
	06/01/2021	$53.18	$11.50	$15.60	$0.00	$80.28
	12/01/2021	$54.33	$11.50	$15.60	$0.00	$81.43
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
GENERATOR/LIGHTING PLANT/HEATERS *OPERATING ENGINEERS LOCAL 4*	12/01/2018	$32.03	$11.50	$15.60	$0.00	$59.13
	06/01/2019	$32.78	$11.50	$15.60	$0.00	$59.88
	12/01/2019	$33.57	$11.50	$15.60	$0.00	$60.67
	06/01/2020	$34.32	$11.50	$15.60	$0.00	$61.42
	12/01/2020	$35.10	$11.50	$15.60	$0.00	$62.20
	06/01/2021	$35.85	$11.50	$15.60	$0.00	$62.95
	12/01/2021	$36.64	$11.50	$15.60	$0.00	$63.74
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
GLAZIER (GLASS PLANK/AIR BARRIER/INTERIOR SYSTEMS) *GLAZIERS LOCAL 35 (ZONE 2)*	01/01/2019	$39.86	$8.15	$20.85	$0.00	$68.86
	07/01/2019	$40.96	$8.15	$20.85	$0.00	$69.96
	01/01/2020	$42.06	$8.15	$20.85	$0.00	$71.06
	07/01/2020	$43.16	$8.15	$20.85	$0.00	$72.16
	01/01/2021	$44.26	$8.15	$20.85	$0.00	$73.26

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *GLAZIER - Local 35 Zone 2*

Effective Date - 01/01/2019

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$19.93	$8.15	$0.00	$0.00	$28.08
2	55	$21.92	$8.15	$5.64	$0.00	$35.71
3	60	$23.92	$8.15	$6.15	$0.00	$38.22
4	65	$25.91	$8.15	$6.66	$0.00	$40.72
5	70	$27.90	$8.15	$17.78	$0.00	$53.83
6	75	$29.90	$8.15	$18.29	$0.00	$56.34
7	80	$31.89	$8.15	$18.80	$0.00	$58.84
8	90	$35.87	$8.15	$19.83	$0.00	$63.85

Effective Date - 07/01/2019

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$20.48	$8.15	$0.00	$0.00	$28.63
2	55	$22.53	$8.15	$5.64	$0.00	$36.32
3	60	$24.58	$8.15	$6.15	$0.00	$38.88
4	65	$26.62	$8.15	$6.66	$0.00	$41.43
5	70	$28.67	$8.15	$17.78	$0.00	$54.60
6	75	$30.72	$8.15	$18.29	$0.00	$57.16
7	80	$32.77	$8.15	$18.80	$0.00	$59.72
8	90	$36.86	$8.15	$19.83	$0.00	$64.84

Notes:
Steps are 750 hrs.

Apprentice to Journeyworker Ratio:1:1

HOISTING ENGINEER/CRANES/GRADALLS *OPERATING ENGINEERS LOCAL 4*	12/01/2018	$47.58	$11.50	$15.60	$0.00	$74.68
	06/01/2019	$48.68	$11.50	$15.60	$0.00	$75.78
	12/01/2019	$49.83	$11.50	$15.60	$0.00	$76.93
	06/01/2020	$50.93	$11.50	$15.60	$0.00	$78.03
	12/01/2020	$52.08	$11.50	$15.60	$0.00	$79.18
	06/01/2021	$53.18	$11.50	$15.60	$0.00	$80.28
	12/01/2021	$54.33	$11.50	$15.60	$0.00	$81.43

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *OPERATING ENGINEERS - Local 4*

Effective Date - 12/01/2018

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	55	$26.17	$11.50	$0.00	$0.00	$37.67
2	60	$28.55	$11.50	$15.60	$0.00	$55.65
3	65	$30.93	$11.50	$15.60	$0.00	$58.03
4	70	$33.31	$11.50	$15.60	$0.00	$60.41
5	75	$35.69	$11.50	$15.60	$0.00	$62.79
6	80	$38.06	$11.50	$15.60	$0.00	$65.16
7	85	$40.44	$11.50	$15.60	$0.00	$67.54
8	90	$42.82	$11.50	$15.60	$0.00	$69.92

Effective Date - 06/01/2019

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	55	$26.77	$11.50	$0.00	$0.00	$38.27
2	60	$29.21	$11.50	$15.60	$0.00	$56.31
3	65	$31.64	$11.50	$15.60	$0.00	$58.74
4	70	$34.08	$11.50	$15.60	$0.00	$61.18
5	75	$36.51	$11.50	$15.60	$0.00	$63.61
6	80	$38.94	$11.50	$15.60	$0.00	$66.04
7	85	$41.38	$11.50	$15.60	$0.00	$68.48
8	90	$43.81	$11.50	$15.60	$0.00	$70.91

Notes:

Apprentice to Journeyworker Ratio:1:6

HVAC (DUCTWORK) *SHEETMETAL WORKERS LOCAL 17 - A*	02/01/2018	$44.11	$12.20	$24.12	$2.41	$82.84
For apprentice rates see "Apprentice- SHEET METAL WORKER"						
HVAC (ELECTRICAL CONTROLS) *ELECTRICIANS LOCAL 103*	09/01/2018	$50.62	$13.00	$18.37	$0.00	$81.99
	03/01/2019	$51.10	$13.00	$18.88	$0.00	$82.98
For apprentice rates see "Apprentice- ELECTRICIAN"						
HVAC (TESTING AND BALANCING - AIR) *SHEETMETAL WORKERS LOCAL 17 - A*	02/01/2018	$44.11	$12.20	$24.12	$2.41	$82.84
For apprentice rates see "Apprentice- SHEET METAL WORKER"						
HVAC (TESTING AND BALANCING -WATER) *PIPEFITTERS LOCAL 537*	09/01/2018	$52.94	$9.95	$18.74	$0.00	$81.63
	09/01/2019	$54.44	$9.95	$18.74	$0.00	$83.13
	09/01/2020	$55.94	$9.95	$18.74	$0.00	$84.63
For apprentice rates see "Apprentice- PIPEFITTER" or "PLUMBER/PIPEFITTER"						
HVAC MECHANIC *PIPEFITTERS LOCAL 537*	09/01/2018	$52.94	$9.95	$18.74	$0.00	$81.63
	09/01/2019	$54.44	$9.95	$18.74	$0.00	$83.13
	09/01/2020	$55.94	$9.95	$18.74	$0.00	$84.63
For apprentice rates see "Apprentice- PIPEFITTER" or "PLUMBER/PIPEFITTER"						

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
HYDRAULIC DRILLS *LABORERS - ZONE 1*	12/01/2018	$39.40	$7.85	$15.35	$0.00	$62.60
	06/01/2019	$40.40	$7.85	$15.35	$0.00	$63.60
	12/01/2019	$41.40	$7.85	$15.35	$0.00	$64.60
	06/01/2020	$42.39	$7.85	$15.35	$0.00	$65.59
	12/01/2020	$43.37	$7.85	$15.35	$0.00	$66.57
	06/01/2021	$44.39	$7.85	$15.35	$0.00	$67.59
	12/01/2021	$45.40	$7.85	$15.35	$0.00	$68.60
For apprentice rates see "Apprentice- LABORER"						
INSULATOR (PIPES & TANKS) *HEAT & FROST INSULATORS LOCAL 6 (BOSTON)*	09/01/2018	$49.34	$11.75	$14.20	$0.00	$75.29
	09/01/2019	$51.84	$11.75	$14.20	$0.00	$77.79

Apprentice - *ASBESTOS INSULATOR (Pipes & Tanks) - Local 6 Boston*

Effective Date - 09/01/2018

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$24.67	$11.75	$10.45	$0.00	$46.87
2	60	$29.60	$11.75	$11.20	$0.00	$52.55
3	70	$34.54	$11.75	$11.95	$0.00	$58.24
4	80	$39.47	$11.75	$12.70	$0.00	$63.92

Effective Date - 09/01/2019

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$25.92	$11.75	$10.45	$0.00	$48.12
2	60	$31.10	$11.75	$11.20	$0.00	$54.05
3	70	$36.29	$11.75	$11.95	$0.00	$59.99
4	80	$41.47	$11.75	$12.70	$0.00	$65.92

Notes:
Steps are 1 year

Apprentice to Journeyworker Ratio:1:4

IRONWORKER/WELDER *IRONWORKERS LOCAL 7 (BOSTON AREA)*	09/16/2018	$46.07	$8.00	$22.85	$0.00	$76.92

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *IRONWORKER - Local 7 Boston*

Effective Date - 09/16/2018

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	60	$27.64	$8.00	$22.85	$0.00	$58.49
2	70	$32.25	$8.00	$22.85	$0.00	$63.10
3	75	$34.55	$8.00	$22.85	$0.00	$65.40
4	80	$36.86	$8.00	$22.85	$0.00	$67.71
5	85	$39.16	$8.00	$22.85	$0.00	$70.01
6	90	$41.46	$8.00	$22.85	$0.00	$72.31

Notes:

** Structural 1:6; Ornamental 1:4

Apprentice to Journeyworker Ratio:**

JACKHAMMER & PAVING BREAKER OPERATOR *LABORERS - ZONE 1*	12/01/2018	$38.90	$7.85	$15.35	$0.00	$62.10
	06/01/2019	$39.90	$7.85	$15.35	$0.00	$63.10
	12/01/2019	$40.90	$7.85	$15.35	$0.00	$64.10
	06/01/2020	$41.89	$7.85	$15.35	$0.00	$65.09
	12/01/2020	$42.87	$7.85	$15.35	$0.00	$66.07
	06/01/2021	$43.89	$7.85	$15.35	$0.00	$67.09
	12/01/2021	$44.90	$7.85	$15.35	$0.00	$68.10
For apprentice rates see "Apprentice- LABORER"						
LABORER *LABORERS - ZONE 1*	12/01/2018	$38.65	$7.85	$15.35	$0.00	$61.85
	06/01/2019	$39.65	$7.85	$15.35	$0.00	$62.85
	12/01/2019	$40.65	$7.85	$15.35	$0.00	$63.85
	06/01/2020	$41.64	$7.85	$15.35	$0.00	$64.84
	12/01/2020	$42.62	$7.85	$15.35	$0.00	$65.82
	06/01/2021	$43.64	$7.85	$15.35	$0.00	$66.84
	12/01/2021	$44.65	$7.85	$15.35	$0.00	$67.85

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *LABORER - Zone 1*

Effective Date - 12/01/2018

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	60	$23.19	$7.85	$15.35	$0.00	$46.39
2	70	$27.06	$7.85	$15.35	$0.00	$50.26
3	80	$30.92	$7.85	$15.35	$0.00	$54.12
4	90	$34.79	$7.85	$15.35	$0.00	$57.99

Effective Date - 06/01/2019

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	60	$23.79	$7.85	$15.35	$0.00	$46.99
2	70	$27.76	$7.85	$15.35	$0.00	$50.96
3	80	$31.72	$7.85	$15.35	$0.00	$54.92
4	90	$35.69	$7.85	$15.35	$0.00	$58.89

Notes:

Apprentice to Journeyworker Ratio:1:5

LABORER: CARPENTER TENDER *LABORERS - ZONE 1*	12/01/2018	$38.65	$7.85	$15.35	$0.00	$61.85
	06/01/2019	$39.65	$7.85	$15.35	$0.00	$62.85
	12/01/2019	$40.65	$7.85	$15.35	$0.00	$63.85
	06/01/2020	$41.64	$7.85	$15.35	$0.00	$64.84
	12/01/2020	$42.62	$7.85	$15.35	$0.00	$65.82
	06/01/2021	$43.64	$7.85	$15.35	$0.00	$66.84
	12/01/2021	$44.65	$7.85	$15.35	$0.00	$67.85
For apprentice rates see "Apprentice- LABORER"						
LABORER: CEMENT FINISHER TENDER *LABORERS - ZONE 1*	12/01/2018	$38.65	$7.85	$15.35	$0.00	$61.85
	06/01/2019	$39.65	$7.85	$15.35	$0.00	$62.85
	12/01/2019	$40.65	$7.85	$15.35	$0.00	$63.85
	06/01/2020	$41.64	$7.85	$15.35	$0.00	$64.84
	12/01/2020	$42.62	$7.85	$15.35	$0.00	$65.82
	06/01/2021	$43.64	$7.85	$15.35	$0.00	$66.84
	12/01/2021	$44.65	$7.85	$15.35	$0.00	$67.85
For apprentice rates see "Apprentice- LABORER"						
LABORER: HAZARDOUS WASTE/ASBESTOS REMOVER *LABORERS - ZONE 1*	12/01/2018	$38.80	$7.85	$15.35	$0.00	$62.00
	06/01/2019	$39.80	$7.85	$15.35	$0.00	$63.00
	12/01/2019	$40.80	$7.85	$15.35	$0.00	$64.00
For apprentice rates see "Apprentice- LABORER"						

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
LABORER: MASON TENDER *LABORERS - ZONE 1*	12/01/2018	$38.90	$7.85	$15.35	$0.00	$62.10
	06/01/2019	$39.90	$7.85	$15.35	$0.00	$63.10
	12/01/2019	$40.90	$7.85	$15.35	$0.00	$64.10
	06/01/2020	$41.89	$7.85	$15.35	$0.00	$65.09
	12/01/2020	$42.87	$7.85	$15.35	$0.00	$66.07
	06/01/2021	$43.89	$7.85	$15.35	$0.00	$67.09
	12/01/2021	$44.90	$7.85	$15.35	$0.00	$68.10
For apprentice rates see "Apprentice- LABORER"						
LABORER: MULTI-TRADE TENDER *LABORERS - ZONE 1*	12/01/2018	$38.65	$7.85	$15.35	$0.00	$61.85
	06/01/2019	$39.65	$7.85	$15.35	$0.00	$62.85
	12/01/2019	$40.65	$7.85	$15.35	$0.00	$63.85
	06/01/2020	$41.64	$7.85	$15.35	$0.00	$64.84
	12/01/2020	$42.62	$7.85	$15.35	$0.00	$65.82
	06/01/2021	$43.64	$7.85	$15.35	$0.00	$66.84
	12/01/2021	$44.65	$7.85	$15.35	$0.00	$67.85
For apprentice rates see "Apprentice- LABORER"						
LABORER: TREE REMOVER *LABORERS - ZONE 1*	12/01/2018	$38.65	$7.85	$15.35	$0.00	$61.85
	06/01/2019	$39.65	$7.85	$15.35	$0.00	$62.85
	12/01/2019	$40.65	$7.85	$15.35	$0.00	$63.85
	06/01/2020	$41.64	$7.85	$15.35	$0.00	$64.84
	12/01/2020	$42.62	$7.85	$15.35	$0.00	$65.82
	06/01/2021	$43.64	$7.85	$15.35	$0.00	$66.84
	12/01/2021	$44.65	$7.85	$15.35	$0.00	$67.85
This classification applies to all tree work associated with the removal of standing trees, and trimming and removal of branches and limbs when the work is not done for a utility company for the purpose of operation, maintenance or repair of utility company equipment. For apprentice rates see "Apprentice- LABORER"						
LASER BEAM OPERATOR *LABORERS - ZONE 1*	12/01/2018	$38.90	$7.85	$15.35	$0.00	$62.10
	06/01/2019	$39.90	$7.85	$15.35	$0.00	$63.10
	12/01/2019	$40.90	$7.85	$15.35	$0.00	$64.10
	06/01/2020	$41.89	$7.85	$15.35	$0.00	$65.09
	12/01/2020	$42.87	$7.85	$15.35	$0.00	$66.07
	06/01/2021	$43.89	$7.85	$15.35	$0.00	$67.09
	12/01/2021	$44.90	$7.85	$15.35	$0.00	$68.10
For apprentice rates see "Apprentice- LABORER"						
MARBLE & TILE FINISHERS *BRICKLAYERS LOCAL 3 - MARBLE & TILE*	08/01/2018	$40.40	$10.75	$18.97	$0.00	$70.12
	02/01/2019	$40.91	$10.75	$18.97	$0.00	$70.63
	08/01/2019	$41.99	$10.75	$19.11	$0.00	$71.85
	02/01/2020	$42.50	$10.75	$19.11	$0.00	$72.36
	08/01/2020	$43.58	$10.75	$19.26	$0.00	$73.59
	02/01/2021	$44.09	$10.75	$19.26	$0.00	$74.10
	08/01/2021	$45.21	$10.75	$19.42	$0.00	$75.38
	02/01/2022	$45.68	$10.75	$19.42	$0.00	$75.85

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *MARBLE & TILE FINISHER - Local 3 Marble & Tile*

Effective Date - 08/01/2018

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$20.20	$10.75	$18.97	$0.00	$49.92
2	60	$24.24	$10.75	$18.97	$0.00	$53.96
3	70	$28.28	$10.75	$18.97	$0.00	$58.00
4	80	$32.32	$10.75	$18.97	$0.00	$62.04
5	90	$36.36	$10.75	$18.97	$0.00	$66.08

Effective Date - 02/01/2019

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$20.46	$10.75	$18.97	$0.00	$50.18
2	60	$24.55	$10.75	$18.97	$0.00	$54.27
3	70	$28.64	$10.75	$18.97	$0.00	$58.36
4	80	$32.73	$10.75	$18.97	$0.00	$62.45
5	90	$36.82	$10.75	$18.97	$0.00	$66.54

Notes:

Apprentice to Journeyworker Ratio:1:3

MARBLE MASONS,TILELAYERS & TERRAZZO MECH *BRICKLAYERS LOCAL 3 - MARBLE & TILE*	08/01/2018	$52.95	$10.75	$20.66	$0.00	$84.36
	02/01/2019	$53.57	$10.75	$20.66	$0.00	$84.98
	08/01/2019	$54.92	$10.75	$20.80	$0.00	$86.47
	02/01/2020	$55.55	$10.75	$20.80	$0.00	$87.10
	08/01/2020	$56.90	$10.75	$20.95	$0.00	$88.60
	02/01/2021	$57.54	$10.75	$20.95	$0.00	$89.24
	08/01/2021	$58.94	$10.75	$21.11	$0.00	$90.80
	02/01/2022	$59.51	$10.75	$21.11	$0.00	$91.37

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *MARBLE-TILE-TERRAZZO MECHANIC - Local 3 Marble & Tile*

Effective Date - 08/01/2018

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$26.48	$10.75	$20.66	$0.00	$57.89
2	60	$31.77	$10.75	$20.66	$0.00	$63.18
3	70	$37.07	$10.75	$20.66	$0.00	$68.48
4	80	$42.36	$10.75	$20.66	$0.00	$73.77
5	90	$47.66	$10.75	$20.66	$0.00	$79.07

Effective Date - 02/01/2019

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$26.79	$10.75	$20.66	$0.00	$58.20
2	60	$32.14	$10.75	$20.66	$0.00	$63.55
3	70	$37.50	$10.75	$20.66	$0.00	$68.91
4	80	$42.86	$10.75	$20.66	$0.00	$74.27
5	90	$48.21	$10.75	$20.66	$0.00	$79.62

Notes:

Apprentice to Journeyworker Ratio:1:5

MECH. SWEEPER OPERATOR (ON CONST. SITES) *OPERATING ENGINEERS LOCAL 4*	12/01/2018	$47.10	$11.50	$15.60	$0.00	$74.20
	06/01/2019	$48.19	$11.50	$15.60	$0.00	$75.29
	12/01/2019	$49.33	$11.50	$15.60	$0.00	$76.43
	06/01/2020	$50.41	$11.50	$15.60	$0.00	$77.51
	12/01/2020	$51.55	$11.50	$15.60	$0.00	$78.65
	06/01/2021	$52.64	$11.50	$15.60	$0.00	$79.74
	12/01/2021	$53.78	$11.50	$15.60	$0.00	$80.88
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
MECHANICS MAINTENANCE *OPERATING ENGINEERS LOCAL 4*	12/01/2018	$47.10	$11.50	$15.60	$0.00	$74.20
	06/01/2019	$48.19	$11.50	$15.60	$0.00	$75.29
	12/01/2019	$49.33	$11.50	$15.60	$0.00	$76.43
	06/01/2020	$50.41	$11.50	$15.60	$0.00	$77.51
	12/01/2020	$51.55	$11.50	$15.60	$0.00	$78.65
	06/01/2021	$52.64	$11.50	$15.60	$0.00	$79.74
	12/01/2021	$53.78	$11.50	$15.60	$0.00	$80.88
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
MILLWRIGHT (Zone 1) *MILLWRIGHTS LOCAL 1121 - Zone 1*	10/01/2018	$41.32	$9.90	$18.50	$0.00	$69.72
	04/01/2019	$42.22	$9.90	$18.50	$0.00	$70.62

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *MILLWRIGHT - Local 1121 Zone 1*

Effective Date - 10/01/2018

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	55	$22.73	$9.90	$5.31	$0.00	$37.94
2	65	$26.86	$9.90	$15.13	$0.00	$51.89
3	75	$30.99	$9.90	$16.10	$0.00	$56.99
4	85	$35.12	$9.90	$17.06	$0.00	$62.08

Effective Date - 04/01/2019

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	55	$23.22	$9.90	$5.31	$0.00	$38.43
2	65	$27.44	$9.90	$15.13	$0.00	$52.47
3	75	$31.67	$9.90	$16.10	$0.00	$57.67
4	85	$35.89	$9.90	$17.06	$0.00	$62.85

Notes:

Steps are 2,000 hours

Apprentice to Journeyworker Ratio:1:5

MORTAR MIXER *LABORERS - ZONE 1*	12/01/2018	$38.90	$7.85	$15.35	$0.00	$62.10
	06/01/2019	$39.90	$7.85	$15.35	$0.00	$63.10
	12/01/2019	$40.90	$7.85	$15.35	$0.00	$64.10
	06/01/2020	$41.89	$7.85	$15.35	$0.00	$65.09
	12/01/2020	$42.87	$7.85	$15.35	$0.00	$66.07
	06/01/2021	$43.89	$7.85	$15.35	$0.00	$67.09
	12/01/2021	$44.90	$7.85	$15.35	$0.00	$68.10
For apprentice rates see "Apprentice- LABORER"						
OILER (OTHER THAN TRUCK CRANES,GRADALLS) *OPERATING ENGINEERS LOCAL 4*	12/01/2018	$23.06	$11.50	$15.60	$0.00	$50.16
	06/01/2019	$23.61	$11.50	$15.60	$0.00	$50.71
	12/01/2019	$24.18	$11.50	$15.60	$0.00	$51.28
	06/01/2020	$24.73	$11.50	$15.60	$0.00	$51.83
	12/01/2020	$25.30	$11.50	$15.60	$0.00	$52.40
	06/01/2021	$25.85	$11.50	$15.60	$0.00	$52.95
	12/01/2021	$26.43	$11.50	$15.60	$0.00	$53.53
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
OILER (TRUCK CRANES, GRADALLS) *OPERATING ENGINEERS LOCAL 4*	12/01/2018	$27.42	$11.50	$15.60	$0.00	$54.52
	06/01/2019	$28.07	$11.50	$15.60	$0.00	$55.17
	12/01/2019	$28.74	$11.50	$15.60	$0.00	$55.84
	06/01/2020	$29.39	$11.50	$15.60	$0.00	$56.49
	12/01/2020	$30.07	$11.50	$15.60	$0.00	$57.17
	06/01/2021	$30.71	$11.50	$15.60	$0.00	$57.81
	12/01/2021	$31.39	$11.50	$15.60	$0.00	$58.49
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
OTHER POWER DRIVEN EQUIPMENT - CLASS II *OPERATING ENGINEERS LOCAL 4*	12/01/2018	$47.10	$11.50	$15.60	$0.00	$74.20
	06/01/2019	$48.19	$11.50	$15.60	$0.00	$75.29
	12/01/2019	$49.33	$11.50	$15.60	$0.00	$76.43
	06/01/2020	$50.41	$11.50	$15.60	$0.00	$77.51
	12/01/2020	$51.55	$11.50	$15.60	$0.00	$78.65
	06/01/2021	$52.64	$11.50	$15.60	$0.00	$79.74
	12/01/2021	$53.78	$11.50	$15.60	$0.00	$80.88
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
PAINTER (BRIDGES/TANKS) *PAINTERS LOCAL 35 - ZONE 2*	01/01/2019	$50.36	$8.15	$20.85	$0.00	$79.36
	07/01/2019	$51.46	$8.15	$20.85	$0.00	$80.46
	01/01/2020	$52.56	$8.15	$20.85	$0.00	$81.56
	07/01/2020	$53.66	$8.15	$20.85	$0.00	$82.66
	01/01/2021	$54.76	$8.15	$20.85	$0.00	$83.76

Apprentice - *PAINTER Local 35 - BRIDGES/TANKS*

Effective Date - 01/01/2019

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$25.18	$8.15	$0.00	$0.00	$33.33
2	55	$27.70	$8.15	$5.64	$0.00	$41.49
3	60	$30.22	$8.15	$6.15	$0.00	$44.52
4	65	$32.73	$8.15	$6.66	$0.00	$47.54
5	70	$35.25	$8.15	$17.78	$0.00	$61.18
6	75	$37.77	$8.15	$18.29	$0.00	$64.21
7	80	$40.29	$8.15	$18.80	$0.00	$67.24
8	90	$45.32	$8.15	$19.83	$0.00	$73.30

Effective Date - 07/01/2019

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$25.73	$8.15	$0.00	$0.00	$33.88
2	55	$28.30	$8.15	$5.64	$0.00	$42.09
3	60	$30.88	$8.15	$6.15	$0.00	$45.18
4	65	$33.45	$8.15	$6.66	$0.00	$48.26
5	70	$36.02	$8.15	$17.78	$0.00	$61.95
6	75	$38.60	$8.15	$18.29	$0.00	$65.04
7	80	$41.17	$8.15	$18.80	$0.00	$68.12
8	90	$46.31	$8.15	$19.83	$0.00	$74.29

Notes:

Steps are 750 hrs.

Apprentice to Journeyworker Ratio:1:1

PAINTER (SPRAY OR SANDBLAST, NEW) * * If 30% or more of surfaces to be painted are new construction, NEW paint rate shall be used.*PAINTERS LOCAL 35 - ZONE 2*	01/01/2019	$41.26	$8.15	$20.85	$0.00	$70.26
	07/01/2019	$42.36	$8.15	$20.85	$0.00	$71.36
	01/01/2020	$43.46	$8.15	$20.85	$0.00	$72.46
	07/01/2020	$44.56	$8.15	$20.85	$0.00	$73.56
	01/01/2021	$45.66	$8.15	$20.85	$0.00	$74.66

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *PAINTER Local 35 Zone 2 - Spray/Sandblast - New*

Effective Date - 01/01/2019

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$20.63	$8.15	$0.00	$0.00	$28.78
2	55	$22.69	$8.15	$5.64	$0.00	$36.48
3	60	$24.76	$8.15	$6.15	$0.00	$39.06
4	65	$26.82	$8.15	$6.66	$0.00	$41.63
5	70	$28.88	$8.15	$17.78	$0.00	$54.81
6	75	$30.95	$8.15	$18.29	$0.00	$57.39
7	80	$33.01	$8.15	$18.80	$0.00	$59.96
8	90	$37.13	$8.15	$19.83	$0.00	$65.11

Effective Date - 07/01/2019

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$21.18	$8.15	$0.00	$0.00	$29.33
2	55	$23.30	$8.15	$5.64	$0.00	$37.09
3	60	$25.42	$8.15	$6.15	$0.00	$39.72
4	65	$27.53	$8.15	$6.66	$0.00	$42.34
5	70	$29.65	$8.15	$17.78	$0.00	$55.58
6	75	$31.77	$8.15	$18.29	$0.00	$58.21
7	80	$33.89	$8.15	$18.80	$0.00	$60.84
8	90	$38.12	$8.15	$19.83	$0.00	$66.10

Notes:

Steps are 750 hrs.

Apprentice to Journeyworker Ratio:1:1

PAINTER (SPRAY OR SANDBLAST, REPAINT) *PAINTERS LOCAL 35 - ZONE 2*	01/01/2019	$39.32	$8.15	$20.85	$0.00	$68.32
	07/01/2019	$40.42	$8.15	$20.85	$0.00	$69.42
	01/01/2020	$41.52	$8.15	$20.85	$0.00	$70.52
	07/01/2020	$42.62	$8.15	$20.85	$0.00	$71.62
	01/01/2021	$43.72	$8.15	$20.85	$0.00	$72.72

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *PAINTER Local 35 Zone 2 - Spray/Sandblast - Repaint*

Effective Date - 01/01/2019

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$19.66	$8.15	$0.00	$0.00	$27.81
2	55	$21.63	$8.15	$5.64	$0.00	$35.42
3	60	$23.59	$8.15	$6.15	$0.00	$37.89
4	65	$25.56	$8.15	$6.66	$0.00	$40.37
5	70	$27.52	$8.15	$17.78	$0.00	$53.45
6	75	$29.49	$8.15	$18.29	$0.00	$55.93
7	80	$31.46	$8.15	$18.80	$0.00	$58.41
8	90	$35.39	$8.15	$19.83	$0.00	$63.37

Effective Date - 07/01/2019

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$20.21	$8.15	$0.00	$0.00	$28.36
2	55	$22.23	$8.15	$5.64	$0.00	$36.02
3	60	$24.25	$8.15	$6.15	$0.00	$38.55
4	65	$26.27	$8.15	$6.66	$0.00	$41.08
5	70	$28.29	$8.15	$17.78	$0.00	$54.22
6	75	$30.32	$8.15	$18.29	$0.00	$56.76
7	80	$32.34	$8.15	$18.80	$0.00	$59.29
8	90	$36.38	$8.15	$19.83	$0.00	$64.36

Notes:
Steps are 750 hrs.

Apprentice to Journeyworker Ratio:1:1

PAINTER (TRAFFIC MARKINGS) *LABORERS - ZONE 1*	12/01/2018	$38.65	$7.85	$15.35	$0.00	$61.85
	06/01/2019	$39.65	$7.85	$15.35	$0.00	$62.85
	12/01/2019	$40.65	$7.85	$15.35	$0.00	$63.85
	06/01/2020	$41.64	$7.85	$15.35	$0.00	$64.84
	12/01/2020	$42.62	$7.85	$15.35	$0.00	$65.82
	06/01/2021	$43.64	$7.85	$15.35	$0.00	$66.84
	12/01/2021	$44.65	$7.85	$15.35	$0.00	$67.85
For Apprentice rates see "Apprentice- LABORER"						
PAINTER / TAPER (BRUSH, NEW) * * If 30% or more of surfaces to be painted are new construction, NEW paint rate shall be used.*PAINTERS LOCAL 35 - ZONE 2*	01/01/2019	$39.86	$8.15	$20.85	$0.00	$68.86
	07/01/2019	$40.96	$8.15	$20.85	$0.00	$69.96
	01/01/2020	$42.06	$8.15	$20.85	$0.00	$71.06
	07/01/2020	$43.16	$8.15	$20.85	$0.00	$72.16
	01/01/2021	$44.25	$8.15	$20.85	$0.00	$73.25

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *PAINTER - Local 35 Zone 2 - BRUSH NEW*

Effective Date - 01/01/2019

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$19.93	$8.15	$0.00	$0.00	$28.08
2	55	$21.92	$8.15	$5.64	$0.00	$35.71
3	60	$23.92	$8.15	$6.15	$0.00	$38.22
4	65	$25.91	$8.15	$6.66	$0.00	$40.72
5	70	$27.90	$8.15	$17.78	$0.00	$53.83
6	75	$29.90	$8.15	$18.29	$0.00	$56.34
7	80	$31.89	$8.15	$18.80	$0.00	$58.84
8	90	$35.87	$8.15	$19.83	$0.00	$63.85

Effective Date - 07/01/2019

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$20.48	$8.15	$0.00	$0.00	$28.63
2	55	$22.53	$8.15	$5.64	$0.00	$36.32
3	60	$24.58	$8.15	$6.15	$0.00	$38.88
4	65	$26.62	$8.15	$6.66	$0.00	$41.43
5	70	$28.67	$8.15	$17.78	$0.00	$54.60
6	75	$30.72	$8.15	$18.29	$0.00	$57.16
7	80	$32.77	$8.15	$18.80	$0.00	$59.72
8	90	$36.86	$8.15	$19.83	$0.00	$64.84

Notes:
Steps are 750 hrs.

Apprentice to Journeyworker Ratio:1:1

PAINTER / TAPER (BRUSH, REPAINT) *PAINTERS LOCAL 35 - ZONE 2*	01/01/2019	$37.92	$8.15	$20.85	$0.00	$66.92
	07/01/2019	$39.02	$8.15	$20.85	$0.00	$68.02
	01/01/2020	$40.12	$8.15	$20.85	$0.00	$69.12
	07/01/2020	$41.22	$8.15	$20.85	$0.00	$70.22
	01/01/2021	$42.32	$8.15	$20.85	$0.00	$71.32

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *PAINTER Local 35 Zone 2 - BRUSH REPAINT*

Effective Date - 01/01/2019

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$18.96	$8.15	$0.00	$0.00	$27.11
2	55	$20.86	$8.15	$5.64	$0.00	$34.65
3	60	$22.75	$8.15	$6.15	$0.00	$37.05
4	65	$24.65	$8.15	$6.66	$0.00	$39.46
5	70	$26.54	$8.15	$17.78	$0.00	$52.47
6	75	$28.44	$8.15	$18.29	$0.00	$54.88
7	80	$30.34	$8.15	$18.80	$0.00	$57.29
8	90	$34.13	$8.15	$19.83	$0.00	$62.11

Effective Date - 07/01/2019

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$19.51	$8.15	$0.00	$0.00	$27.66
2	55	$21.46	$8.15	$5.64	$0.00	$35.25
3	60	$23.41	$8.15	$6.15	$0.00	$37.71
4	65	$25.36	$8.15	$6.66	$0.00	$40.17
5	70	$27.31	$8.15	$17.78	$0.00	$53.24
6	75	$29.27	$8.15	$18.29	$0.00	$55.71
7	80	$31.22	$8.15	$18.80	$0.00	$58.17
8	90	$35.12	$8.15	$19.83	$0.00	$63.10

Notes:
Steps are 750 hrs.

Apprentice to Journeyworker Ratio:1:1

PANEL & PICKUP TRUCKS DRIVER *TEAMSTERS JOINT COUNCIL NO. 10 ZONE A*	12/01/2018	$34.18	$11.91	$12.70	$0.00	$58.79
	06/01/2019	$35.18	$11.91	$12.70	$0.00	$59.79
	08/01/2019	$35.18	$12.41	$12.70	$0.00	$60.29
	12/01/2019	$35.18	$12.41	$13.72	$0.00	$61.31
	06/01/2020	$36.08	$12.41	$13.72	$0.00	$62.21
	08/01/2020	$36.08	$12.91	$13.72	$0.00	$62.71
	12/01/2020	$36.08	$12.91	$14.82	$0.00	$63.81
	06/01/2021	$36.88	$12.91	$14.82	$0.00	$64.61
	08/01/2021	$36.88	$13.41	$14.82	$0.00	$65.11
	12/01/2021	$36.88	$13.41	$16.01	$0.00	$66.30
PIER AND DOCK CONSTRUCTOR (UNDERPINNING AND DECK) *PILE DRIVER LOCAL 56 (ZONE 1)* For apprentice rates see "Apprentice- PILE DRIVER"	08/01/2018	$46.57	$9.90	$21.15	$0.00	$77.62
	08/01/2019	$48.94	$9.90	$21.15	$0.00	$79.99
PILE DRIVER *PILE DRIVER LOCAL 56 (ZONE 1)*	08/01/2018	$46.57	$9.90	$21.15	$0.00	$77.62
	08/01/2019	$48.94	$9.90	$21.15	$0.00	$79.99

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *PILE DRIVER - Local 56 Zone 1*

Effective Date - 08/01/2018

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$23.29	$9.90	$21.15	$0.00	$54.34
2	60	$27.94	$9.90	$21.15	$0.00	$58.99
3	70	$32.60	$9.90	$21.15	$0.00	$63.65
4	75	$34.93	$9.90	$21.15	$0.00	$65.98
5	80	$37.26	$9.90	$21.15	$0.00	$68.31
6	80	$37.26	$9.90	$21.15	$0.00	$68.31
7	90	$41.91	$9.90	$21.15	$0.00	$72.96
8	90	$41.91	$9.90	$21.15	$0.00	$72.96

Effective Date - 08/01/2019

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$24.47	$9.90	$21.15	$0.00	$55.52
2	60	$29.36	$9.90	$21.15	$0.00	$60.41
3	70	$34.26	$9.90	$21.15	$0.00	$65.31
4	75	$36.71	$9.90	$21.15	$0.00	$67.76
5	80	$39.15	$9.90	$21.15	$0.00	$70.20
6	80	$39.15	$9.90	$21.15	$0.00	$70.20
7	90	$44.05	$9.90	$21.15	$0.00	$75.10
8	90	$44.05	$9.90	$21.15	$0.00	$75.10

Notes:

Apprentice to Journeyworker Ratio:1:5

PIPEFITTER & STEAMFITTER *PIPEFITTERS LOCAL 537*	09/01/2018	$52.94	$9.95	$18.74	$0.00	$81.63
	09/01/2019	$54.44	$9.95	$18.74	$0.00	$83.13
	09/01/2020	$55.94	$9.95	$18.74	$0.00	$84.63

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *PIPEFITTER - Local 537*

Effective Date - 09/01/2018

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	40	$21.18	$9.95	$7.75	$0.00	$38.88
2	45	$23.82	$9.95	$18.74	$0.00	$52.51
3	60	$31.76	$9.95	$18.74	$0.00	$60.45
4	70	$37.06	$9.95	$18.74	$0.00	$65.75
5	80	$42.35	$9.95	$18.74	$0.00	$71.04

Effective Date - 09/01/2019

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	40	$21.78	$9.95	$7.75	$0.00	$39.48
2	45	$24.50	$9.95	$18.74	$0.00	$53.19
3	60	$32.66	$9.95	$18.74	$0.00	$61.35
4	70	$38.11	$9.95	$18.74	$0.00	$66.80
5	80	$43.55	$9.95	$18.74	$0.00	$72.24

Notes:

** 1:3; 3:15; 1:10 thereafter / Steps are 1 yr.

Refrig/AC Mechanic **1:1;1:2;2:4;3:6;4:8;5:10;6:12;7:14;8:17;9:20;10:23(Max)

Apprentice to Journeyworker Ratio:**

PIPELAYER *LABORERS - ZONE 1*	12/01/2018	$38.90	$7.85	$15.35	$0.00	$62.10
	06/01/2019	$39.90	$7.85	$15.35	$0.00	$63.10
	12/01/2019	$40.90	$7.85	$15.35	$0.00	$64.10
	06/01/2020	$41.89	$7.85	$15.35	$0.00	$65.09
	12/01/2020	$42.87	$7.85	$15.35	$0.00	$66.07
	06/01/2021	$43.89	$7.85	$15.35	$0.00	$67.09
	12/01/2021	$44.90	$7.85	$15.35	$0.00	$68.10
For apprentice rates see "Apprentice- LABORER"						
PLUMBERS & GASFITTERS *PLUMBERS & GASFITTERS LOCAL 12*	09/01/2018	$55.69	$11.82	$16.01	$0.00	$83.52
	03/01/2019	$57.19	$11.82	$16.01	$0.00	$85.02
	09/01/2019	$58.69	$11.82	$16.01	$0.00	$86.52
	03/01/2020	$60.19	$11.82	$16.01	$0.00	$88.02
	09/01/2020	$61.69	$11.82	$16.01	$0.00	$89.52
	03/01/2021	$63.19	$11.82	$16.01	$0.00	$91.02

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *PLUMBER/GASFITTER - Local 12*

Effective Date - 09/01/2018

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	35	$19.49	$11.82	$5.81	$0.00	$37.12
2	40	$22.28	$11.82	$6.59	$0.00	$40.69
3	55	$30.63	$11.82	$8.98	$0.00	$51.43
4	65	$36.20	$11.82	$10.53	$0.00	$58.55
5	75	$41.77	$11.82	$12.13	$0.00	$65.72

Effective Date - 03/01/2019

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	35	$20.02	$11.82	$5.81	$0.00	$37.65
2	40	$22.88	$11.82	$6.59	$0.00	$41.29
3	55	$31.45	$11.82	$8.98	$0.00	$52.25
4	65	$37.17	$11.82	$10.53	$0.00	$59.52
5	75	$42.89	$11.82	$12.13	$0.00	$66.84

Notes:

** 1:2; 2:6; 3:10; 4:14; 5:19/Steps are 1 yr
Step4 with lic$62.12, Step5 with lic$69.27

Apprentice to Journeyworker Ratio:**

PNEUMATIC CONTROLS (TEMP.) *PIPEFITTERS LOCAL 537*	09/01/2018	$52.94	$9.95	$18.74	$0.00	$81.63
	09/01/2019	$54.44	$9.95	$18.74	$0.00	$83.13
	09/01/2020	$55.94	$9.95	$18.74	$0.00	$84.63
For apprentice rates see "Apprentice- PIPEFITTER" or "PLUMBER/PIPEFITTER"						
PNEUMATIC DRILL/TOOL OPERATOR *LABORERS - ZONE 1*	12/01/2018	$38.90	$7.85	$15.35	$0.00	$62.10
	06/01/2019	$39.90	$7.85	$15.35	$0.00	$63.10
	12/01/2019	$40.90	$7.85	$15.35	$0.00	$64.10
	06/01/2020	$41.89	$7.85	$15.35	$0.00	$65.09
	12/01/2020	$42.87	$7.85	$15.35	$0.00	$66.07
	06/01/2021	$43.89	$7.85	$15.35	$0.00	$67.09
	12/01/2021	$44.90	$7.85	$15.35	$0.00	$68.10
For apprentice rates see "Apprentice- LABORER"						
POWDERMAN & BLASTER *LABORERS - ZONE 1*	12/01/2018	$39.65	$7.85	$15.35	$0.00	$62.85
	06/01/2019	$40.65	$7.85	$15.35	$0.00	$63.85
	12/01/2019	$41.65	$7.85	$15.35	$0.00	$64.85
	06/01/2020	$42.64	$7.85	$15.35	$0.00	$65.84
	12/01/2020	$43.62	$7.85	$15.35	$0.00	$66.82
	06/01/2021	$44.64	$7.85	$15.35	$0.00	$67.84
	12/01/2021	$45.65	$7.85	$15.35	$0.00	$68.85
For apprentice rates see "Apprentice- LABORER"						

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
POWER SHOVEL/DERRICK/TRENCHING MACHINE *OPERATING ENGINEERS LOCAL 4*	12/01/2018	$47.58	$11.50	$15.60	$0.00	$74.68
	06/01/2019	$48.68	$11.50	$15.60	$0.00	$75.78
	12/01/2019	$49.83	$11.50	$15.60	$0.00	$76.93
	06/01/2020	$50.93	$11.50	$15.60	$0.00	$78.03
	12/01/2020	$52.08	$11.50	$15.60	$0.00	$79.18
	06/01/2021	$53.18	$11.50	$15.60	$0.00	$80.28
	12/01/2021	$54.33	$11.50	$15.60	$0.00	$81.43
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
PUMP OPERATOR (CONCRETE) *OPERATING ENGINEERS LOCAL 4*	12/01/2018	$47.58	$11.50	$15.60	$0.00	$74.68
	06/01/2019	$48.68	$11.50	$15.60	$0.00	$75.78
	12/01/2019	$49.83	$11.50	$15.60	$0.00	$76.93
	06/01/2020	$50.93	$11.50	$15.60	$0.00	$78.03
	12/01/2020	$52.08	$11.50	$15.60	$0.00	$79.18
	06/01/2021	$53.18	$11.50	$15.60	$0.00	$80.28
	12/01/2021	$54.33	$11.50	$15.60	$0.00	$81.43
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
PUMP OPERATOR (DEWATERING, OTHER) *OPERATING ENGINEERS LOCAL 4*	12/01/2018	$32.03	$11.50	$15.60	$0.00	$59.13
	06/01/2019	$32.78	$11.50	$15.60	$0.00	$59.88
	12/01/2019	$33.57	$11.50	$15.60	$0.00	$60.67
	06/01/2020	$34.32	$11.50	$15.60	$0.00	$61.42
	12/01/2020	$35.10	$11.50	$15.60	$0.00	$62.20
	06/01/2021	$35.85	$11.50	$15.60	$0.00	$62.95
	12/01/2021	$36.64	$11.50	$15.60	$0.00	$63.74
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
READY MIX CONCRETE DRIVERS after 4/30/10 (Drivers Hired After 4/30/2010)*TEAMSTERS LOCAL 25c*	07/01/2017	$28.18	$8.48	$9.72	$0.00	$46.38
READY-MIX CONCRETE DRIVER *TEAMSTERS LOCAL 25c*	07/01/2017	$29.48	$8.48	$9.72	$0.00	$47.68
RECLAIMERS *OPERATING ENGINEERS LOCAL 4*	12/01/2018	$47.10	$11.50	$15.60	$0.00	$74.20
	06/01/2019	$48.19	$11.50	$15.60	$0.00	$75.29
	12/01/2019	$49.33	$11.50	$15.60	$0.00	$76.43
	06/01/2020	$50.41	$11.50	$15.60	$0.00	$77.51
	12/01/2020	$51.55	$11.50	$15.60	$0.00	$78.65
	06/01/2021	$52.64	$11.50	$15.60	$0.00	$79.74
	12/01/2021	$53.78	$11.50	$15.60	$0.00	$80.88
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
RIDE-ON MOTORIZED BUGGY OPERATOR *LABORERS - ZONE 1*	12/01/2018	$38.90	$7.85	$15.35	$0.00	$62.10
	06/01/2019	$39.90	$7.85	$15.35	$0.00	$63.10
	12/01/2019	$40.90	$7.85	$15.35	$0.00	$64.10
	06/01/2020	$41.89	$7.85	$15.35	$0.00	$65.09
	12/01/2020	$42.87	$7.85	$15.35	$0.00	$66.07
	06/01/2021	$43.89	$7.85	$15.35	$0.00	$67.09
	12/01/2021	$44.90	$7.85	$15.35	$0.00	$68.10
For apprentice rates see "Apprentice- LABORER"						

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
ROLLER/SPREADER/MULCHING MACHINE *OPERATING ENGINEERS LOCAL 4*	12/01/2018	$47.10	$11.50	$15.60	$0.00	$74.20
	06/01/2019	$48.19	$11.50	$15.60	$0.00	$75.29
	12/01/2019	$49.33	$11.50	$15.60	$0.00	$76.43
	06/01/2020	$50.41	$11.50	$15.60	$0.00	$77.51
	12/01/2020	$51.55	$11.50	$15.60	$0.00	$78.65
	06/01/2021	$52.64	$11.50	$15.60	$0.00	$79.74
	12/01/2021	$53.78	$11.50	$15.60	$0.00	$80.88
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
ROOFER (Inc.Roofer Waterproofng &Roofer Damproofg) *ROOFERS LOCAL 33*	08/01/2018	$42.36	$11.35	$15.90	$0.00	$69.61
	02/01/2019	$43.51	$11.35	$15.90	$0.00	$70.76

Apprentice - *ROOFER - Local 33*

Effective Date - 08/01/2018

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$21.18	$11.35	$3.69	$0.00	$36.22
2	60	$25.42	$11.35	$15.90	$0.00	$52.67
3	65	$27.53	$11.35	$15.90	$0.00	$54.78
4	75	$31.77	$11.35	$15.90	$0.00	$59.02
5	85	$36.01	$11.35	$15.90	$0.00	$63.26

Effective Date - 02/01/2019

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$21.76	$11.35	$3.69	$0.00	$36.80
2	60	$26.11	$11.35	$15.90	$0.00	$53.36
3	65	$28.28	$11.35	$15.90	$0.00	$55.53
4	75	$32.63	$11.35	$15.90	$0.00	$59.88
5	85	$36.98	$11.35	$15.90	$0.00	$64.23

Notes: ** 1:5, 2:6-10, the 1:10; Reroofing: 1:4, then 1:1
Step 1 is 2000 hrs.; Steps 2-5 are 1000 hrs.
(Hot Pitch Mechanics' receive $1.00 hr. above ROOFER)

Apprentice to Journeyworker Ratio:**

ROOFER SLATE / TILE / PRECAST CONCRETE *ROOFERS LOCAL 33*	08/01/2018	$42.61	$11.35	$15.90	$0.00	$69.86
	02/01/2019	$43.76	$11.35	$15.90	$0.00	$71.01
For apprentice rates see "Apprentice- ROOFER"						
SHEETMETAL WORKER *SHEETMETAL WORKERS LOCAL 17 - A*	02/01/2018	$44.11	$12.20	$24.12	$2.41	$82.84

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *SHEET METAL WORKER - Local 17-A*

Effective Date - 02/01/2018

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	40	$17.64	$12.20	$5.61	$0.00	$35.45
2	40	$17.64	$12.20	$5.61	$0.00	$35.45
3	45	$19.85	$12.20	$10.85	$1.29	$44.19
4	45	$19.85	$12.20	$10.85	$1.29	$44.19
5	50	$22.06	$12.20	$11.80	$1.38	$47.44
6	50	$22.06	$12.20	$12.05	$1.39	$47.70
7	60	$26.47	$12.20	$13.70	$1.57	$53.94
8	65	$28.67	$12.20	$14.65	$1.67	$57.19
9	75	$33.08	$12.20	$16.56	$1.86	$63.70
10	85	$37.49	$12.20	$17.96	$2.03	$69.68

Notes:
Steps are 6 mos.

Apprentice to Journeyworker Ratio:1:4

SIGN ERECTOR *PAINTERS LOCAL 35 - ZONE 2*	06/01/2013	$25.81	$7.07	$7.05	$0.00	$39.93

Apprentice - *SIGN ERECTOR - Local 35 Zone 2*

Effective Date - 06/01/2013

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$12.91	$7.07	$0.00	$0.00	$19.98
2	55	$14.20	$7.07	$2.45	$0.00	$23.72
3	60	$15.49	$7.07	$2.45	$0.00	$25.01
4	65	$16.78	$7.07	$2.45	$0.00	$26.30
5	70	$18.07	$7.07	$7.05	$0.00	$32.19
6	75	$19.36	$7.07	$7.05	$0.00	$33.48
7	80	$20.65	$7.07	$7.05	$0.00	$34.77
8	85	$21.94	$7.07	$7.05	$0.00	$36.06
9	90	$23.23	$7.07	$7.05	$0.00	$37.35

Notes:
Steps are 4 mos.

Apprentice to Journeyworker Ratio:1:1

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
SPECIALIZED EARTH MOVING EQUIP < 35 TONS *TEAMSTERS JOINT COUNCIL NO. 10 ZONE A*	12/01/2018	$34.64	$11.91	$12.70	$0.00	$59.25
	06/01/2019	$35.64	$11.91	$12.70	$0.00	$60.25
	08/01/2019	$35.64	$12.41	$12.70	$0.00	$60.75
	12/01/2019	$35.64	$12.41	$13.72	$0.00	$61.77
	06/01/2020	$36.54	$12.41	$13.72	$0.00	$62.67
	08/01/2020	$36.54	$12.91	$13.72	$0.00	$63.17
	12/01/2020	$36.54	$12.91	$14.82	$0.00	$64.27
	06/01/2021	$37.34	$12.91	$14.82	$0.00	$65.07
	08/01/2021	$37.34	$13.41	$14.82	$0.00	$65.57
	12/01/2021	$37.34	$13.41	$16.01	$0.00	$66.76
SPECIALIZED EARTH MOVING EQUIP > 35 TONS *TEAMSTERS JOINT COUNCIL NO. 10 ZONE A*	12/01/2018	$34.93	$11.91	$12.70	$0.00	$59.54
	06/01/2019	$35.93	$11.91	$12.70	$0.00	$60.54
	08/01/2019	$35.93	$12.41	$12.70	$0.00	$61.04
	12/01/2019	$35.93	$12.41	$13.72	$0.00	$62.06
	06/01/2020	$36.83	$12.41	$13.72	$0.00	$62.96
	08/01/2020	$36.83	$12.91	$13.72	$0.00	$63.46
	12/01/2020	$36.83	$12.91	$14.82	$0.00	$64.56
	06/01/2021	$37.63	$12.91	$14.82	$0.00	$65.36
	08/01/2021	$37.63	$13.41	$14.82	$0.00	$65.86
	12/01/2021	$37.63	$13.41	$16.01	$0.00	$67.05
SPRINKLER FITTER *SPRINKLER FITTERS LOCAL 550 - (Section A) Zone 1*	01/01/2019	$57.98	$9.47	$19.10	$0.00	$86.55
	03/01/2019	$59.48	$9.47	$19.10	$0.00	$88.05
	10/01/2019	$60.98	$9.47	$19.10	$0.00	$89.55
	03/01/2020	$62.48	$9.47	$19.10	$0.00	$91.05
	10/01/2020	$63.98	$9.47	$19.10	$0.00	$92.55
	03/01/2021	$65.48	$9.47	$19.10	$0.00	$94.05

Apprentice - *SPRINKLER FITTER - Local 550 (Section A) Zone 1*

Effective Date - 01/01/2019

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	35	$20.29	$9.47	$9.10	$0.00	$38.86
2	40	$23.19	$9.47	$9.10	$0.00	$41.76
3	45	$26.09	$9.47	$9.10	$0.00	$44.66
4	50	$28.99	$9.47	$9.10	$0.00	$47.56
5	55	$31.89	$9.47	$9.10	$0.00	$50.46
6	60	$34.79	$9.47	$10.60	$0.00	$54.86
7	65	$37.69	$9.47	$10.60	$0.00	$57.76
8	70	$40.59	$9.47	$10.60	$0.00	$60.66
9	75	$43.49	$9.47	$10.60	$0.00	$63.56
10	80	$46.38	$9.47	$10.60	$0.00	$66.45

Notes: Apprentice entered prior 9/30/10:
40/45/50/55/60/65/70/75/80/85
Steps are 850 hours

Apprentice to Journeyworker Ratio:1:3

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
STEAM BOILER OPERATOR *OPERATING ENGINEERS LOCAL 4*	12/01/2018	$47.10	$11.50	$15.60	$0.00	$74.20
	06/01/2019	$48.19	$11.50	$15.60	$0.00	$75.29
	12/01/2019	$49.33	$11.50	$15.60	$0.00	$76.43
	06/01/2020	$50.41	$11.50	$15.60	$0.00	$77.51
	12/01/2020	$51.55	$11.50	$15.60	$0.00	$78.65
	06/01/2021	$52.64	$11.50	$15.60	$0.00	$79.74
	12/01/2021	$53.78	$11.50	$15.60	$0.00	$80.88
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
TAMPERS, SELF-PROPELLED OR TRACTOR DRAWN *OPERATING ENGINEERS LOCAL 4*	12/01/2018	$47.10	$11.50	$15.60	$0.00	$74.20
	06/01/2019	$48.19	$11.50	$15.60	$0.00	$75.29
	12/01/2019	$49.33	$11.50	$15.60	$0.00	$76.43
	06/01/2020	$50.41	$11.50	$15.60	$0.00	$77.51
	12/01/2020	$51.55	$11.50	$15.60	$0.00	$78.65
	06/01/2021	$52.64	$11.50	$15.60	$0.00	$79.74
	12/01/2021	$53.78	$11.50	$15.60	$0.00	$80.88
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
TELECOMMUNICATION TECHNICIAN *ELECTRICIANS LOCAL 103*	09/01/2018	$37.97	$13.00	$16.35	$0.00	$67.32
	03/01/2019	$38.33	$13.00	$16.82	$0.00	$68.15

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *TELECOMMUNICATION TECHNICIAN - Local 103*

Effective Date - 09/01/2018

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	40	$15.19	$13.00	$0.46	$0.00	$28.65
2	40	$15.19	$13.00	$0.46	$0.00	$28.65
3	45	$17.09	$13.00	$13.06	$0.00	$43.15
4	45	$17.09	$13.00	$13.06	$0.00	$43.15
5	50	$18.99	$13.00	$13.37	$0.00	$45.36
6	55	$20.88	$13.00	$13.67	$0.00	$47.55
7	60	$22.78	$13.00	$13.96	$0.00	$49.74
8	65	$24.68	$13.00	$14.26	$0.00	$51.94
9	70	$26.58	$13.00	$14.56	$0.00	$54.14
10	75	$28.48	$13.00	$14.85	$0.00	$56.33

Effective Date - 03/01/2019

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	40	$15.33	$13.00	$0.46	$0.00	$28.79
2	40	$15.33	$13.00	$0.46	$0.00	$28.79
3	45	$17.25	$13.00	$13.42	$0.00	$43.67
4	45	$17.25	$13.00	$13.42	$0.00	$43.67
5	50	$19.17	$13.00	$13.73	$0.00	$45.90
6	55	$21.08	$13.00	$14.03	$0.00	$48.11
7	60	$23.00	$13.00	$14.34	$0.00	$50.34
8	65	$24.91	$13.00	$14.66	$0.00	$52.57
9	70	$26.83	$13.00	$14.96	$0.00	$54.79
10	75	$28.75	$13.00	$15.27	$0.00	$57.02

Notes:

Apprentice to Journeyworker Ratio:1:1

TERRAZZO FINISHERS *BRICKLAYERS LOCAL 3 - MARBLE & TILE*	08/01/2018	$51.85	$10.75	$20.66	$0.00	$83.26
	02/01/2019	$52.49	$10.75	$20.66	$0.00	$83.90
	08/01/2019	$53.84	$10.75	$20.80	$0.00	$85.39
	02/01/2020	$54.48	$10.75	$20.80	$0.00	$86.03
	08/01/2020	$55.83	$10.75	$20.95	$0.00	$87.53
	02/01/2021	$56.47	$10.75	$20.95	$0.00	$88.17
	08/01/2021	$57.87	$10.75	$21.11	$0.00	$89.73
	02/01/2022	$58.46	$10.75	$21.11	$0.00	$90.32

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *TERRAZZO FINISHER - Local 3 Marble & Tile*

Effective Date - 08/01/2018

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$25.93	$10.75	$20.03	$0.00	$56.71
2	60	$31.11	$10.75	$20.03	$0.00	$61.89
3	70	$36.30	$10.75	$20.03	$0.00	$67.08
4	80	$41.48	$10.75	$20.03	$0.00	$72.26
5	90	$46.67	$10.75	$20.03	$0.00	$77.45

Effective Date - 02/01/2019

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$26.25	$10.75	$20.03	$0.00	$57.03
2	60	$31.49	$10.75	$20.03	$0.00	$62.27
3	70	$36.74	$10.75	$20.03	$0.00	$67.52
4	80	$41.99	$10.75	$20.03	$0.00	$72.77
5	90	$47.24	$10.75	$20.03	$0.00	$78.02

Notes:

Apprentice to Journeyworker Ratio:1:3

TEST BORING DRILLER *LABORERS - FOUNDATION AND MARINE*	12/01/2018	$40.00	$7.85	$15.55	$0.00	$63.40
	06/01/2019	$41.00	$7.85	$15.55	$0.00	$64.40
	12/01/2019	$42.00	$7.85	$15.55	$0.00	$65.40
	06/01/2020	$42.99	$7.85	$15.55	$0.00	$66.39
	12/01/2020	$43.97	$7.85	$15.55	$0.00	$67.37
	06/01/2021	$44.99	$7.85	$15.55	$0.00	$68.39
	12/01/2021	$46.00	$7.85	$15.55	$0.00	$69.40
For apprentice rates see "Apprentice- LABORER"						
TEST BORING DRILLER HELPER *LABORERS - FOUNDATION AND MARINE*	12/01/2018	$38.72	$7.85	$15.55	$0.00	$62.12
	06/01/2019	$39.72	$7.85	$15.55	$0.00	$63.12
	12/01/2019	$40.72	$7.85	$15.55	$0.00	$64.12
	06/01/2020	$41.71	$7.85	$15.55	$0.00	$65.11
	12/01/2020	$42.69	$7.85	$15.55	$0.00	$66.09
	06/01/2021	$43.71	$7.85	$15.55	$0.00	$67.11
	12/01/2021	$44.72	$7.85	$15.55	$0.00	$68.12
For apprentice rates see "Apprentice- LABORER"						
TEST BORING LABORER *LABORERS - FOUNDATION AND MARINE*	12/01/2018	$38.60	$7.85	$15.55	$0.00	$62.00
	06/01/2019	$39.60	$7.85	$15.55	$0.00	$63.00
	12/01/2019	$40.60	$7.85	$15.55	$0.00	$64.00
	06/01/2020	$41.59	$7.85	$15.55	$0.00	$64.99
	12/01/2020	$42.57	$7.85	$15.55	$0.00	$65.97
	06/01/2021	$43.59	$7.85	$15.55	$0.00	$66.99
	12/01/2021	$44.60	$7.85	$15.55	$0.00	$68.00
For apprentice rates see "Apprentice- LABORER"						

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
TRACTORS/PORTABLE STEAM GENERATORS *OPERATING ENGINEERS LOCAL 4*	12/01/2018	$47.10	$11.50	$15.60	$0.00	$74.20
	06/01/2019	$48.19	$11.50	$15.60	$0.00	$75.29
	12/01/2019	$49.33	$11.50	$15.60	$0.00	$76.43
	06/01/2020	$50.41	$11.50	$15.60	$0.00	$77.51
	12/01/2020	$51.55	$11.50	$15.60	$0.00	$78.65
	06/01/2021	$52.64	$11.50	$15.60	$0.00	$79.74
	12/01/2021	$53.78	$11.50	$15.60	$0.00	$80.88
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
TRAILERS FOR EARTH MOVING EQUIPMENT *TEAMSTERS JOINT COUNCIL NO. 10 ZONE A*	12/01/2018	$35.22	$11.91	$12.70	$0.00	$59.83
	06/01/2019	$36.22	$11.91	$12.70	$0.00	$60.83
	08/01/2019	$36.22	$12.41	$12.70	$0.00	$61.33
	12/01/2019	$36.22	$12.41	$13.72	$0.00	$62.35
	06/01/2020	$37.12	$12.41	$13.72	$0.00	$63.25
	08/01/2020	$37.12	$12.91	$13.72	$0.00	$63.75
	12/01/2020	$37.12	$12.91	$14.82	$0.00	$64.85
	06/01/2021	$37.92	$12.91	$14.82	$0.00	$65.65
	08/01/2021	$37.92	$13.41	$14.82	$0.00	$66.15
	12/01/2021	$37.92	$13.41	$16.01	$0.00	$67.34
TUNNEL WORK - COMPRESSED AIR *LABORERS (COMPRESSED AIR)*	12/01/2018	$50.88	$7.85	$15.95	$0.00	$74.68
	06/01/2019	$51.88	$7.85	$15.95	$0.00	$75.68
	12/01/2019	$52.88	$7.85	$15.95	$0.00	$76.68
	06/01/2020	$53.87	$7.85	$15.95	$0.00	$77.67
	12/01/2020	$54.85	$7.85	$15.95	$0.00	$78.65
	06/01/2021	$55.87	$7.85	$15.95	$0.00	$79.67
	12/01/2021	$56.88	$7.85	$15.95	$0.00	$80.68
For apprentice rates see "Apprentice- LABORER"						
TUNNEL WORK - COMPRESSED AIR (HAZ. WASTE) *LABORERS (COMPRESSED AIR)*	12/01/2018	$52.88	$7.85	$15.95	$0.00	$76.68
	06/01/2019	$53.88	$7.85	$15.95	$0.00	$77.68
	12/01/2019	$54.88	$7.85	$15.95	$0.00	$78.68
	06/01/2020	$55.87	$7.85	$15.95	$0.00	$79.67
	12/01/2020	$56.85	$7.85	$15.95	$0.00	$80.65
	06/01/2021	$57.87	$7.85	$15.95	$0.00	$81.67
	12/01/2021	$58.88	$7.85	$15.95	$0.00	$82.68
For apprentice rates see "Apprentice- LABORER"						
TUNNEL WORK - FREE AIR *LABORERS (FREE AIR TUNNEL)*	12/01/2018	$42.95	$7.85	$15.95	$0.00	$66.75
	06/01/2019	$43.95	$7.85	$15.95	$0.00	$67.75
	12/01/2019	$44.95	$7.85	$15.95	$0.00	$68.75
	06/01/2020	$45.94	$7.85	$15.95	$0.00	$69.74
	12/01/2020	$46.92	$7.85	$15.95	$0.00	$70.72
	06/01/2021	$47.94	$7.85	$15.95	$0.00	$71.74
	12/01/2021	$48.95	$7.85	$15.95	$0.00	$72.75
For apprentice rates see "Apprentice- LABORER"						

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
TUNNEL WORK - FREE AIR (HAZ. WASTE) *LABORERS (FREE AIR TUNNEL)*	12/01/2018	$44.95	$7.85	$15.95	$0.00	$68.75
	06/01/2019	$45.95	$7.85	$15.95	$0.00	$69.75
	12/01/2019	$46.95	$7.85	$15.95	$0.00	$70.75
	06/01/2020	$47.94	$7.85	$15.95	$0.00	$71.74
	12/01/2020	$48.92	$7.85	$15.95	$0.00	$72.72
	06/01/2021	$49.94	$7.85	$15.95	$0.00	$73.74
	12/01/2021	$50.95	$7.85	$15.95	$0.00	$74.75
For apprentice rates see "Apprentice- LABORER"						
VAC-HAUL *TEAMSTERS JOINT COUNCIL NO. 10 ZONE A*	12/01/2018	$34.64	$11.91	$12.70	$0.00	$59.25
	06/01/2019	$35.64	$11.91	$12.70	$0.00	$60.25
	08/01/2019	$35.64	$12.41	$12.70	$0.00	$60.75
	12/01/2019	$35.64	$12.41	$13.72	$0.00	$61.77
	06/01/2020	$36.54	$12.41	$13.72	$0.00	$62.67
	08/01/2020	$36.54	$12.91	$13.72	$0.00	$63.17
	12/01/2020	$36.54	$12.91	$14.82	$0.00	$64.27
	06/01/2021	$37.34	$12.91	$14.82	$0.00	$65.07
	08/01/2021	$37.34	$13.41	$14.82	$0.00	$65.57
	12/01/2021	$37.34	$13.41	$16.01	$0.00	$66.76
WAGON DRILL OPERATOR *LABORERS - ZONE 1*	12/01/2018	$38.90	$7.85	$15.35	$0.00	$62.10
	06/01/2019	$39.90	$7.85	$15.35	$0.00	$63.10
	12/01/2019	$40.90	$7.85	$15.35	$0.00	$64.10
	06/01/2020	$41.89	$7.85	$15.35	$0.00	$65.09
	12/01/2020	$42.87	$7.85	$15.35	$0.00	$66.07
	06/01/2021	$43.89	$7.85	$15.35	$0.00	$67.09
	12/01/2021	$44.90	$7.85	$15.35	$0.00	$68.10
For apprentice rates see "Apprentice- LABORER"						
WASTE WATER PUMP OPERATOR *OPERATING ENGINEERS LOCAL 4*	12/01/2018	$47.58	$11.50	$15.60	$0.00	$74.68
	06/01/2019	$48.68	$11.50	$15.60	$0.00	$75.78
	12/01/2019	$49.83	$11.50	$15.60	$0.00	$76.93
	06/01/2020	$50.93	$11.50	$15.60	$0.00	$78.03
	12/01/2020	$52.08	$11.50	$15.60	$0.00	$79.18
	06/01/2021	$53.18	$11.50	$15.60	$0.00	$80.28
	12/01/2021	$54.33	$11.50	$15.60	$0.00	$81.43
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
WATER METER INSTALLER *PLUMBERS & GASFITTERS LOCAL 12*	09/01/2018	$55.69	$11.82	$16.01	$0.00	$83.52
	03/01/2019	$57.19	$11.82	$16.01	$0.00	$85.02
	09/01/2019	$58.69	$11.82	$16.01	$0.00	$86.52
	03/01/2020	$60.19	$11.82	$16.01	$0.00	$88.02
	09/01/2020	$61.69	$11.82	$16.01	$0.00	$89.52
	03/01/2021	$63.19	$11.82	$16.01	$0.00	$91.02
For apprentice rates see "Apprentice- PLUMBER/PIPEFITTER" or "PLUMBER/GASFITTER"						
Outside Electrical - East						
CABLE TECHNICIAN (Power Zone) *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104*	09/03/2017	$27.14	$7.75	$1.81	$0.00	$36.70
For apprentice rates see "Apprentice- LINEMAN"						
CABLEMAN (Underground Ducts & Cables) *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104*	09/03/2017	$38.45	$7.75	$9.53	$0.00	$55.73

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
For apprentice rates see "Apprentice- LINEMAN"						
DRIVER / GROUNDMAN CDL *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104*	09/03/2017	$31.66	$7.75	$9.44	$0.00	$48.85
For apprentice rates see "Apprentice- LINEMAN"						
DRIVER / GROUNDMAN -Inexperienced (<2000 Hrs) *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104*	09/03/2017	$24.88	$7.75	$1.75	$0.00	$34.38
For apprentice rates see "Apprentice- LINEMAN"						
EQUIPMENT OPERATOR (Class A CDL) *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104*	09/03/2017	$38.45	$7.75	$13.61	$0.00	$59.81
For apprentice rates see "Apprentice- LINEMAN"						
EQUIPMENT OPERATOR (Class B CDL) *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104*	09/03/2017	$33.92	$7.75	$10.21	$0.00	$51.88
For apprentice rates see "Apprentice- LINEMAN"						
GROUNDMAN *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104*	09/03/2017	$24.88	$7.75	$1.75	$0.00	$34.38
For apprentice rates see "Apprentice- LINEMAN"						
GROUNDMAN -Inexperienced (<2000 Hrs.) *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104*	09/03/2017	$20.35	$7.75	$1.61	$0.00	$29.71
For apprentice rates see "Apprentice- LINEMAN"						
JOURNEYMAN LINEMAN *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104*	09/03/2017	$45.23	$7.75	$16.61	$0.00	$69.59

Apprentice - *LINEMAN (Outside Electrical) - East Local 104*

Effective Date - 09/03/2017

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	60	$27.14	$7.75	$3.31	$0.00	$38.20
2	65	$29.40	$7.75	$3.38	$0.00	$40.53
3	70	$31.66	$7.75	$3.45	$0.00	$42.86
4	75	$33.92	$7.75	$5.02	$0.00	$46.69
5	80	$36.18	$7.75	$5.09	$0.00	$49.02
6	85	$38.45	$7.75	$5.15	$0.00	$51.35
7	90	$40.71	$7.75	$7.22	$0.00	$55.68

Notes:

Apprentice to Journeyworker Ratio:1:2

TELEDATA CABLE SPLICER *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104*	02/05/2018	$29.98	$4.70	$3.15	$0.00	$37.83
	02/04/2019	$30.73	$4.70	$3.17	$0.00	$38.60
TELEDATA LINEMAN/EQUIPMENT OPERATOR *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104*	02/05/2018	$28.22	$4.70	$3.10	$0.00	$36.02
	02/04/2019	$28.93	$4.70	$3.14	$0.00	$36.77
TELEDATA WIREMAN/INSTALLER/TECHNICIAN *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104*	02/05/2018	$28.22	$4.70	$3.10	$0.00	$36.02
	02/04/2019	$28.93	$4.70	$3.14	$0.00	$36.77
TREE TRIMMER *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104*	01/31/2016	$18.51	$3.55	$0.00	$0.00	$22.06

This classification applies only to tree work done: (a) for a utility company, R.E.A. cooperative, or railroad or coal mining company, and (b) for the purpose of operating, maintaining, or repairing the utility company's equipment, and (c) by a person who is using hand or mechanical cutting methods and is not on the ground. This classification does not apply to wholesale tree removal.

TREE TRIMMER GROUNDMAN *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104*	01/31/2016	$16.32	$3.55	$0.00	$0.00	$19.87

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

This classification applies only to tree work done: (a) for a utility company, R.E.A. cooperative, or railroad or coal mining company, and (b) for the purpose of operating, maintaining, or repairing the utility company's equipment, and (c) by a person who is using hand or mechanical cutting methods and is on the ground. This classification does not apply to wholesale tree removal.

Additional Apprentice Information:

Minimum wage rates for apprentices employed on public works projects are listed above as a percentage of the pre-determined hourly wage rate established by the Commissioner under the provisions of the M.G.L. c. 149, ss. 26-27D. Apprentice ratios are established by the Division of Apprenticeship Training pursuant to M.G.L. c. 23, ss. 11E-11L.

All apprentices must be registered with the Division of Apprenticeship Training in accordance with M.G.L. c. 23, ss. 11E-11L.

All steps are six months (1000 hours.)
Ratios are expressed in allowable number of apprentices to journeymen or fraction thereof, unless otherwise specified.

** Multiple ratios are listed in the comment field.
*** APP to JM; 1:1, 2:2, 2:3, 3:4, 4:4, 4:5, 4:6, 5:7, 6:7, 6:8, 6:9, 7:10, 8:10, 8:11, 8:12, 9:13, 10:13, 10:14, etc.
**** APP to JM; 1:1, 1:2, 2:3, 2:4, 3:5, 4:6, 4:7, 5:8, 6:9, 6:10, 7:11, 8:12, 8:13, 9:14, 10:15, 10:16, etc.

BY-LAWS OF THE TOWN OF ARLINGTON
TITLE I
ARTICLE 16

CONSTRUCTION PROJECTS

Section 1. Women Work Force Participation
Any Town board or official in charge of a construction or reconstruction project is required to include in the contract documents the following:

A. Contractor shall maintain as a goal on this project a not less than five percent ratio of women work force to total project hours in both the general contract and each individual filed sub-bid contract, if applicable. The preceding sentence shall be included in all construction contracts whether entered into by the Town pursuant to the provisions of M.G.L. c. 149 or M.G. L. c 30, §39M et. seq. provided however, that if entered into under Chapter 30 same shall not be deemed to apply where the projected bid price as determined by the Director of Public Works is not likely to exceed $200,000.

B. A Labor Scheduling Table which will be used as a tool for achieving a range of women work force participation for the entire project in both the general contract and each individual filed sub-bid contract.

Section 2. Equal Opportunity Goal Compliance
Any Town board or official in charge of a construction or reconstruction project is required to include in the contract documents the following:

A. Before starting work, the contractors (includes the general contractor, for itself and its subcontractors, as well as all filed sub-bid contractors, if applicable) will submit plans for achievement of the equal opportunity goals of the contract. All contractors will be required to make a good faith effort to achieve these goals. The plan will indicate if the contractors expect to achieve the requirements during the first quarter. If there are reasons why the contractors do not expect to achieve the requirements during the first quarter year of the contract construction phase, then the contractors shall provide a plan calculated to address, to the extent reasonably possibly, these obstacles to a good faith effort to achieve such goals.

B. Not more than ten days following the end of each work quarter, the contractors will report on the achievement of the goals, detailing the good faith efforts that have been made and will continue to be made and any other appropriate efforts not yet undertaken.

C. All reports will be signed by an officer or principal of the company who has the authority to contractually obligate the company.

Section 3. Recruitment and Training
Any board, officer, committee, or other agency of the Town, which acts on behalf of the Town in making or supervising any contract, in an amount exceeding the sum of $100,000 for the purchase of goods or services or for the construction, renovation, or repair of buildings or other improvement of real estate, may make arrangements with contractors and other interested agencies for special programs of recruitment and training in connection with the work to be performed on such contract, with the objective of promoting equal employment opportunity for members of minority groups protected by the fair employment laws of the Commonwealth and the United States. Any board, officer, committee or other Town agency may expend Town funds in carrying them out provided that appropriations specifically designed for such purposes have been voted by the Town Meeting.

TOWN OF ARLINGTON
EQUAL OPPORTUNITY ADVISORY COMMITTEE
730 MASSACHUSETTS AVENUE, ARLINGTON, MA 02476
PHONE (781) 316-3120 FAX: (781) 316-3129

TRICIA O'DONOGHUE, CHAIR
BARBARA BOLTZ
AUGUSTA HAYDOCK
JACK JONES

CARYN COVE MALLOY
EQUAL OPPORTUNITY OFFICER

CONTRACTOR CERTIFICATION

During the performance of the Contract, the Contractor and all subcontractors (hereafter collectively referred to as "the Contractor") for a town construction contract or town assisted construction contract, for him/herself, his/her assignees and successors in interest, agree to comply with all applicable equal employment opportunity, non-discrimination and affirmative action requirements, including but not limited to the following:

The Contractor shall comply with the provisions of Town of Arlington Bylaws, Anti-Discrimination policies and Chapter 151B of the Massachusetts General Laws, as amended, and all other applicable anti-discrimination and equal opportunity laws, all of which are herein incorporated by reference and made a part of this contract.

In connection with the performance of work under this contract, the Contractor shall undertake, in good faith, affirmative action measures to eliminate any discriminatory barrier in the terms and conditions of employment on the grounds of race, color, religious creed, national origin, sex, gender identity, sexual orientation, age, genetic information, ancestry, children, marital status, veteran status or membership in the armed service, the receiving of public assistance, and handicap. Such affirmative action measures shall entail a list of positive and aggressive measures which shall include but not be limited to, advertising employment opportunities in minority and other community news media; notifying minority women and other community-based organizations of employment opportunities; maintaining a file of names and addresses of each worker referred to the Contractor and what action was taken concerning such worker; and notifying this Committee in writing when a union with whom the Contractor has a collective bargaining agreement has failed to refer a minority or woman worker.

The Contractor shall submit to the Equal Opportunity Advisory Committee, through the Purchasing Director Domenic Lanzillotti, the following Contractor's Certification with all attachments. The Contractor's Certification will be reviewed by the Committee and will inform the Contractor of any deficiencies to be corrected.

CONTRACTOR CERTIFICATION

_____ certifies that they:

(Contractor Name)

1. Will not discriminate in their employment practices.

2. Intend to use, if General Contractor, the following listed construction trades in the work under the contract:

   _____

   _____

   _____

3. If Trade Subcontractor, will provide the following work under the contract:

   _____

   _____

   _____

4. Will make good faith efforts to comply with the minority employee and women employee workforce participation ratio goals of the Town of Arlington and the Commonwealth of Massachusetts and specific affirmative steps contained herein; and to provide evidence of its good faith efforts. Attached hereto, please find:

A. Employment Opportunities advertised in:

   _____

   _____

   _____

B. Notification to Minority/Women/Community based Organizations such as:

   _____

   _____

   _____

C. List of workers referred to Contractor and note on what action was taken:

_____

_____

_____

D. Written notification that Union/Local No. _____ failed to refer a Minority or Female worker during the week of: _____

_____

Signature of Officer Date

_____

Printed Name of Officer and Title

STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

Prepared by

ENGINEERS JOINT CONTRACT DOCUMENTS COMMITTEE

and

Issued and Published Jointly By

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

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AMERICAN CONSULTING ENGINEERS COUNCIL

———————————

AMERICAN SOCIETY OF CIVIL ENGINEERS

This document has been approved and endorsed by

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1420 King Street, Alexandria, VA 22314

American Consulting Engineers Council
1015 15th Street N.W., Washington, DC 20005

American Society of Civil Engineers
345 East 47th Street, New York, NY 10017

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GENERAL CONDITIONS

ARTICLE 1 - DEFINITIONS AND TERMINOLOGY

1.01 *Defined Terms*

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

32. *PCBs*--Polychlorinated biphenyls.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

1.02 *Terminology*

A. *Intent of Certain Terms or Adjectives*

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

B. *Day*

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

C. *Defective*

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

D. *Furnish, Install, Perform, Provide*

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

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

3. The words "perform" or "provide," when used in connection with services, materials, or equipment, shall mean to furnish and install said services, materials, or equipment complete and ready for intended use.

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

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

ARTICLE 2 - PRELIMINARY MATTERS

2.01 *Delivery of Bonds*

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

2.02* *Copies of Documents*

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

2.03 *Commencement of Contract Times; Notice to Proceed*

A. The Contract Times will commence to run on the thirtieth day after the Effective Date of the Agreement or, if a Notice to Proceed is given, on the day indicated in the Notice to Proceed. A Notice to Proceed may be given at any time within 30 days after the Effective Date of the Agreement. In no event will the Contract Times com-

mence to run later than the sixtieth day after the day of Bid opening or the thirtieth day after the Effective Date of the Agreement, whichever date is earlier.

2.04 *Starting the Work*

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

*See Supplementary Conditions

2.05* *Before Starting Construction*

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

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

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

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

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

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

2.06 *Preconstruction Conference*

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

2.07 *Initial Acceptance of Schedules*

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

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

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

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

*See Supplementary Conditions

ARTICLE 3 - CONTRACT DOCUMENTS: INTENT, AMENDING, REUSE

3.01* *Intent*

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

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

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

3.02 *Reference Standards*

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

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

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

3.03 *Reporting and Resolving Discrepancies*

A. *Reporting Discrepancies*

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

B. *Resolving Discrepancies*

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

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

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

3.04 *Amending and Supplementing Contract Documents*

A. The Contract Documents may be amended to provide for additions, deletions, and revisions in the Work or to modify the terms and conditions thereof in one or

*See Supplementary Conditions

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

3.05 *Reuse of Documents*

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

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

4.01 *Availability of Lands*

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

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

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

4.02* *Subsurface and Physical Conditions*

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

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

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

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

1. the completeness of such reports and drawings for CONTRACTOR's purposes, includ-

ing, but not limited to, any aspects of the means, methods, techniques, sequences, and procedures of construction to be employed by CONTRACTOR, and safety precautions and programs incident thereto; or

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

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

*See Supplementary Conditions

4.03 *Differing Subsurface or Physical Conditions*

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

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

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

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

4. is of an unusual nature, and differs materially from conditions ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract Documents; then CONTRACTOR shall, promptly after becoming aware thereof and before further disturbing the subsurface or physical conditions or performing any Work in connection therewith (except in an emergency as required by paragraph 6.16.A), notify OWNER and ENGINEER in writing about such condition. CONTRACTOR shall not further disturb such condition or perform any Work in connection therewith (except as aforesaid) until receipt of written order to do so.

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

C. *Possible Price and Times Adjustments*

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

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

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

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

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

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

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

3. If OWNER and CONTRACTOR are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Contract Times, or both, a Claim may be

made therefor as provided in paragraph 10.05. However, OWNER, ENGINEER, and ENGINEER's Consultants shall not be liable to CONTRACTOR for any claims, costs, losses, or damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) sustained by CONTRACTOR on or in connection with any other project or anticipated project.

4.04 *Underground Facilities*

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

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

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

a. reviewing and checking all such information and data,

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

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

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

B. *Not Shown or Indicated*

1. If an Underground Facility is uncovered or revealed at or contiguous to the Site which was not shown or indicated, or not shown or indicated with reasonable accuracy in the Contract Documents, CONTRACTOR shall, promptly after becoming aware thereof and before further disturbing conditions affected thereby or performing any Work in connection therewith (except in an emergency as required by paragraph 6.16.A), identify the owner of such Underground Facility and give written notice to that owner and to OWNER and ENGINEER. ENGINEER will promptly review the Underground Facility and determine the extent, if any, to which a change is required in the Contract Documents to reflect and document the consequences of the existence or location of the Underground Facility. During such time, CONTRACTOR shall be responsible for the safety and protection of such Underground Facility.

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

4.05* *Reference Points*

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

4.06 *Hazardous Environmental Condition at Site*

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

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

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

*See Supplementary Conditions

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

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

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

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

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

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

G. To the fullest extent permitted by Laws and Regulations, OWNER shall indemnify and hold harmless CONTRACTOR, Subcontractors, ENGINEER, ENGINEER's Consultants and the officers, directors, partners, employees, agents, other consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to a Hazardous Environmental Condition, provided that such Hazardous Environmental Condition: (i) was not shown or indicated in the Drawings or

Specifications or identified in the Contract Documents to be included within the scope of the Work, and (ii) was not created by CONTRACTOR or by anyone for whom CONTRACTOR is responsible. Nothing in this paragraph 4.06.E shall obligate OWNER to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.

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

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

*See Supplementary Conditions

ARTICLE 5 - BONDS AND INSURANCE

5.01* *Performance, Payment, and Other Bonds*

A. CONTRACTOR shall furnish performance and payment Bonds, each in an amount at least equal to the Contract Price as security for the faithful performance and payment of all CONTRACTOR's obligations under the Contract Documents. These Bonds shall remain in effect at least until one year after the date when final payment becomes due, except as provided otherwise by Laws or Regulations or by the Contract Documents. CONTRACTOR shall also furnish such other Bonds as are required by the Contract Documents.

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

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

5.02 *Licensed Sureties and Insurers*

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

5.03 *Certificates of Insurance*

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

5.04* *CONTRACTOR's Liability Insurance*

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

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

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

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

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

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

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

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

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

*See Supplementary Conditions

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

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

3. include completed operations insurance;

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

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

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

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

5.05 *OWNER's Liability Insurance*

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

5.06* *Property Insurance*

A. Unless otherwise provided in the Supplementary Conditions, OWNER shall purchase and maintain property

insurance upon the Work at the Site in the amount of the full replacement cost thereof (subject to such deductible amounts as may be provided in the Supplementary Conditions or required by Laws and Regulations). This insurance shall:

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

2. be written on a Builder's Risk "all-risk" or open peril or special causes of loss policy form that shall at least include insurance for physical loss or damage to the Work, temporary buildings, false work, and materials and equipment in transit, and shall insure against at least the following perils or causes of loss: fire, lightning, extended coverage, theft, vandalism and malicious mischief, earthquake, collapse, debris removal, demolition occasioned by enforcement of Laws and Regulations, water damage, and such other perils or causes of loss as may be specifically required by the Supplementary Conditions;

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

*See Supplementary Conditions

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

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

6. include testing and startup; and

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

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

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

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

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

5.07 *Waiver of Rights*

A.* OWNER and CONTRACTOR intend that all policies purchased in accordance with paragraph 5.06 will protect OWNER, CONTRACTOR, Subcontractors, ENGINEER, ENGINEER's Consultants, and all other

individuals or entities identified in the Supplementary Conditions to be listed as insureds or additional insureds (and the officers, directors, partners, employees, agents, and other consultants and subcontractors of each and any of them) in such policies and will provide primary coverage for all losses and damages caused by the perils or causes of loss covered thereby. All such policies shall contain provisions to the effect that in the event of payment of any loss or damage the insurers will have no rights of recovery against any of the insureds or additional insureds thereunder. OWNER and CONTRACTOR waive all rights against each other and their respective officers, directors, partners, employees, agents, and other consultants and subcontractors of each and any of them for all losses and damages caused by, arising out of or resulting from any of the perils or causes of loss covered by such policies and any other property insurance applicable to the Work; and, in addition, waive all such rights against Subcontractors, ENGINEER, ENGINEER's Consultants, and all other individuals or entities identified in the Supplementary Conditions to be listed as insureds or additional insureds (and the officers, directors, partners, employees, agents, and other consultants and subcontractors of each and any of them) under such policies for losses and damages so caused.

None of the above waivers shall extend to the rights that any party making such waiver may have to the proceeds of insurance held by OWNER as trustee or otherwise payable under any policy so issued.

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

*See Supplementary Conditions

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

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

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

5.08* *Receipt and Application of Insurance Proceeds*

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

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

5.09* *Acceptance of Bonds and Insurance; Option to Replace*

A.* If either OWNER or CONTRACTOR has any objection to the coverage afforded by or other provisions of the Bonds or insurance required to be purchased and maintained by the other party in accordance with Article 5 on the basis of non-conformance with the Contract Documents, the objecting party shall so notify the other party in writing within 10 days after receipt of the

certificates (or other evidence requested) required by paragraph 2.05.C. OWNER and CONTRACTOR shall each provide to the other such additional information in respect of insurance provided as the other may reasonably request. If either party does not purchase or maintain all of the Bonds and insurance required of such party by the Contract Documents, such party shall notify the other party in writing of such failure to purchase prior to the start of the Work, or of such failure to maintain prior to any change in the required coverage. Without prejudice to any other right or remedy, the other party may elect to obtain equivalent Bonds or insurance to protect such other party's interests at the expense of the party who was required to provide such coverage, and a Change Order shall be issued to adjust the Contract Price accordingly.

5.10 *Partial Utilization, Acknowledgment of Property Insurer*

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

ARTICLE 6 - CONTRACTOR'S RESPONSIBILITIES

6.01 *Supervision and Superintendence*

A. CONTRACTOR shall supervise, inspect, and direct the Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform the Work in accordance with

*See Supplementary Conditions

the Contract Documents. CONTRACTOR shall be solely responsible for the means, methods, techniques, sequences,
and procedures of construction, but CONTRACTOR shall not be responsible for the negligence of OWNER or ENGINEER in the design or specification of a specific means, method, technique, sequence, or procedure of construction which is shown or indicated in and expressly required by the Contract Documents. CONTRACTOR shall be responsible to see that the completed Work complies accurately with the Contract Documents.

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

6.02 *Labor; Working Hours*

A. CONTRACTOR shall provide competent, suitably qualified personnel to survey, lay out, and construct the

Work as required by the Contract Documents. CONTRACTOR shall at all times maintain good discipline and order at the Site.

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

6.03 *Services, Materials, and Equipment*

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

B. All materials and equipment incorporated into the Work shall be as specified or, if not specified, shall be of good quality and new, except as otherwise provided in the Contract Documents. All warranties and guarantees specifically called for by the Specifications shall expressly

run to the benefit of OWNER. If required by ENGINEER, CONTRACTOR shall furnish satisfactory evidence (including reports of required tests) as to the source, kind, and quality of materials and equipment. All materials and equipment shall be stored, applied, installed, connected, erected, protected, used, cleaned, and conditioned in accordance with instructions of the applicable Supplier, except as otherwise may be provided in the Contract Documents.

6.04 *Progress Schedule*

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

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

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

6.05 *Substitutes and "Or-Equals"*

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

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

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

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

2. Substitute Items

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

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

c. The procedure for review by ENGINEER will be as set forth in paragraph 6.05.A.2.d, as supplemented in the General Requirements and as ENGINEER may decide is appropriate under the circumstances.

d. CONTRACTOR shall first make written application to ENGINEER for review of a proposed substitute item of material or equipment that CONTRACTOR seeks to furnish or use. The application shall certify

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

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

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

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

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

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

6.06 *Concerning Subcontractors, Suppliers, and Others*

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

B. If the Supplementary Conditions require the identity of certain Subcontractors, Suppliers, or other individuals or entities to be submitted to OWNER in advance for acceptance by OWNER by a specified date prior to the Effective Date of the Agreement, and if CONTRACTOR has submitted a list thereof in accordance with the Supplementary Conditions, OWNER's acceptance (either in writing or by failing to make written objection thereto by the date indicated for acceptance or objection in the Bidding Documents or the Contract Documents) of any such Subcontractor, Supplier, or other individual or entity so identified may be revoked on the basis of reasonable objection after due investigation. CONTRACTOR shall submit an acceptable replacement

for the rejected Subcontractor, Supplier, or other individual or entity, and the Contract Price will be adjusted by the difference in the cost occasioned by such replacement, and an appropriate Change Order will be issued or Written Amendment signed. No acceptance by OWNER of any such Subcontractor, Supplier, or other individual or entity, whether initially or as a replacement, shall constitute a waiver of any right of OWNER or ENGINEER to reject defective Work.

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

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

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

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

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

6.07 *Patent Fees and Royalties*

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

6.08 *Permits*

A. Unless otherwise provided in the Supplementary Conditions, CONTRACTOR shall obtain and pay for all construction permits and licenses. OWNER shall assist CONTRACTOR, when necessary, in obtaining such permits and licenses. CONTRACTOR shall pay all governmental charges and inspection fees necessary for

the prosecution of the Work which are applicable at the time of opening of Bids, or, if there are no Bids, on the Effective Date of the Agreement. CONTRACTOR shall pay all charges of utility owners for connections to the Work, and OWNER shall pay all charges of such utility owners for capital costs related thereto, such as plant investment fees.

6.09 *Laws and Regulations*

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

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

C. Changes in Laws or Regulations not known at the time of opening of Bids (or, on the Effective Date of the Agreement if there were no Bids) having an effect on the cost or time of performance of the Work may be the subject of an adjustment in Contract Price or Contract Times. If OWNER and CONTRACTOR are unable to agree on entitlement to or on the amount or extent, if any, of any such adjustment, a Claim may be made therefor as provided in paragraph 10.05.

6.10* *Taxes*

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

6.11* *Use of Site and Other Areas*

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

1. CONTRACTOR shall confine construction equipment, the storage of materials and equipment, and the operations of workers to the Site and other areas permitted by Laws and Regulations,

*See Supplementary Conditions

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

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

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

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

C. *Cleaning:* Prior to Substantial Completion of the Work CONTRACTOR shall clean the Site and make it ready for utilization by OWNER. At the completion of the Work CONTRACTOR shall remove from the Site all tools, appliances, construction equipment and machinery, and surplus materials and shall restore to original condition all property not designated for alteration by the Contract Documents.

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

6.12 *Record Documents*

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

6.13 *Safety and Protection*

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

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

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

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

B. CONTRACTOR shall comply with all applicable Laws and Regulations relating to the safety of persons or property, or to the protection of persons or property from damage, injury, or loss; and shall erect and maintain all necessary safeguards for such safety and protection. CONTRACTOR shall notify owners of adjacent property and of Underground Facilities and other utility owners when prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation, and replacement of their property. All damage, injury, or loss to any property referred to in paragraph 6.13.A.2 or 6.13.A.3 caused, directly or indirectly, in whole or in part, by CONTRACTOR, any Subcontractor, Supplier, or any other individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, shall be remedied by CONTRACTOR (except damage or loss attributable to the fault of Drawings or Specifications or to the acts or omissions of OWNER or ENGINEER or ENGINEER's Consultant, or anyone employed by any of them, or anyone for whose acts any of them may be liable, and not attributable, directly or indirectly, in whole or in part, to the fault or negligence of CONTRACTOR or any Subcontractor, Supplier, or other individual or entity directly or indirectly employed by any of them). CONTRACTOR's duties and responsibilities for safety and for protection of the Work shall continue until such time as all the Work is completed and ENGINEER has issued a notice to OWNER and CONTRACTOR in accordance with paragraph 14.07.B that the Work is acceptable (except as otherwise expressly provided in connection with Substantial Completion).

6.14 *Safety Representative*

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

6.15 *Hazard Communication Programs*

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

6.16 *Emergencies*

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

6.17* *Shop Drawings and Samples*

A.* CONTRACTOR shall submit Shop Drawings to ENGINEER for review and approval in accordance with the acceptable schedule of Shop Drawings and Sample submittals. All submittals will be identified as ENGINEER may require and in the number of copies specified in the General Requirements. The data shown on the Shop Drawings will be complete with respect to quantities, dimensions, specified performance and design criteria, materials, and similar data to show ENGINEER the services, materials, and equipment CONTRACTOR proposes to provide and to enable ENGINEER to review the information for the limited purposes required by paragraph 6.17.E.

B.* CONTRACTOR shall also submit six (6) Samples to ENGINEER for review and approval in accordance with the acceptable schedule of Shop Drawings and Sample submittals. Each Sample will be identified clearly as to material, Supplier, pertinent data such as catalog numbers, and the use for which intended and otherwise as ENGINEER may require to enable ENGINEER to review the submittal for the limited purposes required by paragraph 6.17.E. The numbers of each Sample to be submitted will be as specified in the Specifications.

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

D. *Submittal Procedures*

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

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

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

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

d. CONTRACTOR shall also have reviewed and coordinated each Shop Drawing or

*See Supplementary Conditions

Sample with other Shop Drawings and Samples and with the requirements of the Work and the Contract Documents.

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

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

E. *ENGINEER's Review*

1. ENGINEER will timely review and approve Shop Drawings and Samples in accordance with the schedule of Shop Drawings and Sample submittals acceptable to ENGINEER. ENGINEER's review and approval will be only to determine if the items covered by the submittals

will, after installation or incorporation in the Work, conform to the information given in the Contract Documents and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents.

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

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

F. *Resubmittal Procedures*

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

6.18 *Continuing the Work*

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

6.19 *CONTRACTOR's General Warranty and Guarantee*

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

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

2. normal wear and tear under normal usage.

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

1. observations by ENGINEER;

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

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

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

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

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

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

8. any correction of defective Work by OWNER.

6.20 *Indemnification*

A. To the fullest extent permitted by Laws and Regulations, CONTRACTOR shall indemnify and hold harmless OWNER, ENGINEER, ENGINEER's Consultants, and the officers, directors, partners, employees, agents, and other consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to the performance of the Work, provided that any such claim, cost, loss, or damage:

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

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

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

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

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

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

ARTICLE 7 - OTHER WORK

7.01 *Related Work at Site*

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

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

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

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

such utility owners and other contractors to the extent that there are comparable provisions for the benefit of CONTRACTOR in said direct contracts between OWNER and such utility owners and other contractors.

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

7.02 *Coordination*

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

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

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

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

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

ARTICLE 8 - OWNER'S RESPONSIBILITIES

8.01 *Communications to Contractor*

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

8.02 *Replacement of ENGINEER*

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

8.03 *Furnish Data*

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

8.04 *Pay Promptly When Due*

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

8.05 *Lands and Easements; Reports and Tests*

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

*See Supplementary Conditions

8.06* *Insurance*

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

8.07 *Change Orders*

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

8.08 *Inspections, Tests, and Approvals*

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

8.09 *Limitations on OWNER's Responsibilities*

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

8.10 *Undisclosed Hazardous Environmental Condition*

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

8.11 *Evidence of Financial Arrangements*

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

ARTICLE 9 - ENGINEER'S STATUS DURING CONSTRUCTION

9.01 *OWNER'S Representative*

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

9.02 *Visits to Site*

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

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

9.03* *Project Representative*

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

*See Supplementary Conditions

the responsibilities and authority and limitations thereon of such other individual or entity will be as provided in the Supplementary Conditions.

9.04 *Clarifications and Interpretations*

A. ENGINEER will issue with reasonable promptness such written clarifications or interpretations of the requirements of the Contract Documents as ENGINEER may determine necessary, which shall be consistent with the intent of and reasonably inferable from the Contract Docu-

ments. Such written clarifications and interpretations will be binding on OWNER and CONTRACTOR. If OWNER and CONTRACTOR are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Contract Times, or both, that should be allowed as a result of a written clarification or interpretation, a Claim may be made therefor as provided in paragraph 10.05.

9.05 *Authorized Variations in Work*

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

9.06 *Rejecting Defective Work*

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

9.07 *Shop Drawings, Change Orders and Payments*

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

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

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

9.08 *Determinations for Unit Price Work*

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

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

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

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

*See Supplementary Conditions

9.10 *Limitations on ENGINEER's Authority and Responsibilities*

A. Neither ENGINEER's authority or responsibility under this Article 9 or under any other provision of the Contract Documents nor any decision made by ENGINEER in good faith either to exercise or not exercise such

authority or responsibility or the undertaking, exercise, or performance of any authority or responsibility by ENGINEER shall create, impose, or give rise to any duty in contract, tort, or otherwise owed by ENGINEER to CONTRACTOR, any Subcontractor, any Supplier, any other individual or entity, or to any surety for or employee or agent of any of them.

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

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

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

E. The limitations upon authority and responsibility set forth in this paragraph 9.10 shall also apply to ENGINEER's Consultants, Resident Project Representative, and assistants. See Article 18.

ARTICLE 10 - CHANGES IN THE WORK; CLAIMS

10.01 *Authorized Changes in the Work*

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

B. If OWNER and CONTRACTOR are unable to agree on entitlement to, or on the amount or extent, if any, of an adjustment in the Contract Price or Contract Times, or both, that should be allowed as a result of a Work Change Directive, a Claim may be made therefor as provided in paragraph 10.05.

10.02 *Unauthorized Changes in the Work*

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

10.03 *Execution of Change Orders*

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

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

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

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

10.04 *Notification to Surety*

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

10.05 *Claims and Disputes*

A. *Notice:* Written notice stating the general nature of each Claim, dispute, or other matter shall be delivered by the claimant to ENGINEER and the other party to the Contract promptly (but in no event later than 30 days) after the start of the event giving rise thereto. Notice of the amount or extent of the Claim, dispute, or other matter with supporting data shall be delivered to the ENGINEER and the other party to the Contract within 60 days after the start of such event (unless ENGINEER allows additional time for claimant to submit additional or more accurate data in support of such Claim, dispute, or other matter). A Claim for an adjustment in Contract Price shall be prepared in accordance with the provisions of paragraph 12.01.B. A Claim for an adjustment in Contract Time shall be prepared in accordance with the provisions of paragraph 12.02.B. Each Claim shall be accompanied by claimant's written statement that the adjustment claimed is the entire adjustment to which the claimant believes it is entitled as a result of said event. The opposing party shall submit any response to ENGINEER and the claimant within 30 days after receipt of the claimant's last submittal (unless ENGINEER allows additional time).

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

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

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

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

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

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

11.01 *Cost of the Work*

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

1. Payroll costs for employees in the direct employ of CONTRACTOR in the performance of the Work under schedules of job classifications agreed upon by OWNER and CONTRACTOR. Such employees shall include without limitation superintendents, foremen, and other personnel employed full time at the Site. Payroll costs for employees not employed full time on the Work

shall be apportioned on the basis of their time spent on the Work. Payroll costs shall include, but not be limited to, salaries and wages plus the cost of fringe benefits, which shall include social security contributions, unemployment, excise, and payroll taxes, workers' compensation, health and retirement benefits, bonuses, sick leave, vacation and holiday pay applicable thereto. The expenses of performing Work outside of regular working hours, on Saturday, Sunday, or legal holidays, shall be included in the above to the extent authorized by OWNER.

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

3. Payments made by CONTRACTOR to Subcontractors for Work performed by Subcontractors. If required by OWNER, CONTRACTOR shall obtain competitive bids from subcontractors acceptable to OWNER and CONTRACTOR and shall deliver such bids to OWNER, who will then determine, with the advice of ENGINEER, which bids, if any, will be acceptable. If any subcontract provides that the Subcontractor is to be paid on the basis of Cost of the Work plus a fee, the Subcontractor's Cost of the Work and fee shall be determined in the same manner as CONTRACTOR's Cost of the Work and fee as provided in this paragraph 11.01.

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

5. Supplemental costs including the following:

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

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

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

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

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

f. Losses and damages (and related expenses) caused by damage to the Work, not compensated by insurance or otherwise, sustained by CONTRACTOR in connection with the performance of the Work (except losses and damages within the deductible amounts of property insurance established in accordance with paragraph 5.06.D), provided such losses and damages have resulted from causes other than the negligence of CONTRACTOR, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable. Such losses shall include settlements made with the written consent and approval of OWNER. No such losses, damages, and expenses shall be included in the Cost of the Work for the purpose of determining CONTRACTOR's fee.

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

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

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

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

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

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

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

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

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

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

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

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

11.02 *Cash Allowances*

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

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

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

B. Prior to final payment, an appropriate Change Order will be issued as recommended by ENGINEER to reflect actual amounts due CONTRACTOR on account of

Work covered by allowances, and the Contract Price shall be correspondingly adjusted.

11.03 *Unit Price Work*

A. Where the Contract Documents provide that all or part of the Work is to be Unit Price Work, initially the Contract Price will be deemed to include for all Unit Price Work an amount equal to the sum of the unit price for each separately identified item of Unit Price Work times the estimated quantity of each item as indicated in the Agreement. The estimated quantities of items of Unit Price Work are not guaranteed and are solely for the purpose of comparison of Bids and determining an initial Contract Price. Determinations of the actual quantities and classifications of Unit Price Work performed by CONTRACTOR will be made by ENGINEER subject to the provisions of paragraph 9.08.

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

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

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

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

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

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

12.01* *Change of Contract Price*

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

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

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

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

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

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

1. a mutually acceptable fixed fee; or

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

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

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

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

*See Supplementary Conditions

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

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

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

12.02 *Change of Contract Times*

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

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

12.03 *Delays Beyond CONTRACTOR's Control*

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

12.04 *Delays Within CONTRACTOR's Control*

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

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

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

12.06 *Delay Damages*

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

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

2. delays beyond the control of both OWNER and CONTRACTOR including but not limited to fires, floods, epidemics, abnormal weather conditions, acts of God, or acts or neglect by utility

owners or other contractors performing other work as contemplated by Article 7.

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

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

13.01 *Notice of Defects*

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

13.02* *Access to Work*

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

13.03* *Tests and Inspections*

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

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

1. for inspections, tests, or approvals covered by paragraphs 13.03.C and 13.03.D below;

2. that costs incurred in connection with tests or inspections conducted pursuant to paragraph 13.04.B shall be paid as provided in said paragraph 13.04.B; and

3. as otherwise specifically provided in the Contract Documents.

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

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

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

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

13.04 *Uncovering Work*

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

B. If ENGINEER considers it necessary or advisable that covered Work be observed by ENGINEER or inspected or tested by others, CONTRACTOR, at ENGINEER's request, shall uncover, expose, or otherwise make available for observation, inspection, or testing as ENGINEER may require, that portion of the Work in

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

*See Supplementary Conditions

13.05 *OWNER May Stop the Work*

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

13.06 *Correction or Removal of Defective Work*

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

13.07 *Correction Period*

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

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

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

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

13.08 *Acceptance of Defective Work*

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

13.09 *OWNER May Correct Defective Work*

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

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

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

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

ARTICLE 14 - PAYMENTS TO CONTRACTOR AND COMPLETION

14.01 *Schedule of Values*

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

14.02 *Progress Payments*

A.* *Applications for Payments*

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

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

3. The amount of retainage with respect to pro-gress payments will be as stipulated in the Agreement.

*See Supplementary Conditions

B. *Review of Applications*

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

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

a. the Work has progressed to the point indicated;

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

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

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

that might entitle CONTRACTOR to be paid additionally by OWNER or entitle OWNER to withhold payment to CONTRACTOR.

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

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

a. the Work is defective, or completed Work has been damaged, requiring correction or replacement;

b. the Contract Price has been reduced by Written Amendment or Change Orders;

c. OWNER has been required to correct defective Work or complete Work in accordance with paragraph 13.09; or

d. ENGINEER has actual knowledge of the occurrence of any of the events enumerated in paragraph 15.02.A.

C. *Payment Becomes Due*

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

D. *Reduction in Payment*

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

a. claims have been made against OWNER on account of CONTRACTOR's performance or furnishing of the Work;

b. Liens have been filed in connection with the Work, except where CONTRACTOR has delivered a specific Bond satisfactory to OWNER to secure the satisfaction and discharge of such Liens;

c. there are other items entitling OWNER to a set-off against the amount recommended; or

d. OWNER has actual knowledge of the occurrence of any of the events enumerated in paragraphs 14.02.B.5.a through 14.02.B.5.c or paragraph 15.02.A.

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

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

14.03 *CONTRACTOR's Warranty of Title*

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

14.04 *Substantial Completion*

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

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

14.05 *Partial Utilization*

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

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

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

14.06 *Final Inspection*

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

14.07 *Final Payment*

A. *Application for Payment*

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

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

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

B. *Review of Application and Acceptance*

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

C. *Payment Becomes Due*

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

14.08 *Final Completion Delayed*

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

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

14.09 *Waiver of Claims*

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

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

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

ARTICLE 15 - SUSPENSION OF WORK AND TERMINATION

15.01 OWNER May Suspend Work

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

15.02 *OWNER May Terminate for Cause*

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

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

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

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

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

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

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

15.03 *OWNER May Terminate For Convenience*

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

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

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

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

4. for reasonable expenses directly attributable to termination.

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

15.04 *CONTRACTOR May Stop Work or Terminate*

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

ARTICLE 16 - DISPUTE RESOLUTION*

16.01 *Methods and Procedures*

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

ARTICLE 17 - MISCELLANEOUS*

17.01 *Giving Notice*

A. Whenever any provision of the Contract Documents requires the giving of written notice, it will be deemed to have been validly given if delivered in person to the individual or to a member of the firm or to an officer of the corporation for whom it is intended, or if delivered at or sent by registered or certified mail, postage prepaid, to the last business address known to the giver of the notice.

17.02 *Computation of Times*

A. When any period of time is referred to in the Contract Documents by days, it will be computed to

exclude the first and include the last day of such period. If the last day of any such period falls on a Saturday or Sunday or on a day made a legal holiday by the law of the applicable jurisdiction, such day will be omitted from the computation.

17.03 *Cumulative Remedies*

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

17.04 *Survival of Obligations*

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

17.05 *Controlling Law*

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

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SUPPLEMENTARY CONDITIONS

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SUPPLEMENTARY CONDITIONS

AMENDMENTS TO GENERAL CONDITIONS

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

ARTICLE I. DEFINITIONS AND TERMINOLOGY

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

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

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

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

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

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

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

ARTICLE 2. PRELIMINARY MATTERS

SC-2.05

Delete paragraph 2.0SC of the General Conditions in its entirety and insert the following in its place:

"C. Evidence of Insurance: CONTRACTOR shall deliver to OWNER, with a copy to the ENGINEER, Certificates of Insurance within 1O days after receipt of the notice of the acceptance of bid (and other evidence requested by OWNER) which CONTRACTOR is required to purchase and maintain in accordance with the requirements of Article 5."

ARTICLE 3. CONTRACT DOCUMENTS: INTENT, AMENDI NG, REUSE
SC-3.0

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

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

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

SC-4.02

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

SC-4.04

Change "of' to "or" on line 6 of paragraph 4.04 B.2 of the General Conditions. Delete the following words from lines 8 and 9 of paragraph 4.04 82 of the General Conditions:

"...Or not shown or indicated with reasonable accuracy..."

SC-4.05

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

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

SC-4.06

Delete the term Supplementary Conditions in paragraph 4.06A of the General Conditions and replace it with "Contract Documents".

ARTICLE 5. BOND AND INSURANCE

NOTICE TO CONTRACTOR:

1. Proof of Insurance coverage shall be furnished to the OWNER in accordance with the schedule for submittal of Bonds and Agreements.

2. Additionally refer to Article 2. PRELIMINARY MATTERS, Paragraph SC-2.05.C

SC-5.01

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

SC-5.03

Delete the second sentence following SC-5.03.A: of the General Conditions, which beings "OWNER shall deliver to..."

SC-5.04

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

5.4 A.1 and 5.04 A.2 Worker's Compensation

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

5.04 A.3, 5.04 A.4, and 5.04 A.5 Commercial General Liability Limits shall include Coverage for... independent Contractors, Personal Injury, Owners and Contractors Protective Liability, Explosion, Underground and Collapse, Broad Form Property Damage, Blanket Contractual Liability per locations/project endorsement.

Commercial General Liability	$1,000,000/$2,000,000
Products/completed Operations	$2,000,000 Aggregate

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

(1) Bodily injury:	$1,000,000/$1,000,000	Each person
	$1,000,000/$1,000,000	Each accident
(2) Property damage	$1,000,000	Each occurrence

The following indemnity agreement: shall be made part of this contract:

1.To the fullest extent permitted by law, Contractor(s) hereby acknowledges and agrees that it shall indemnify, hold harmless and defend the Engineer, the Owner, the Engineer and any of their officers, directors, employees, agents, affiliates, subsidiaries and partners from and against all-claims, damages, losses and expenses, including but not limited to, attorney's fees, arising out of or resulting from the performance of the contractor's work under this contract, provided that any such claim, damage, loss or expense (1) is attributable to bodily injury to or destruction of tangible property (other than to the work itself) including loss of use resulting therefrom, and (2) is (CAUSED) in whole or in part by any

negligent acts omissions of the contractor, its employees, agents or contractors or anyone directly or indirectly employed by any of them, or anyone whose acts any of them may be liable.

2. The Contractor hereby acknowledges its obligation under the foregoing paragraph to indemnify the Engineer and Owner against judgments suffered because of the contractor's work and to assume the cost of defending the Engineer and Owner against claims as described in the foregoing paragraph.

A. Engineer and Owner shall be named as Additional Insured on contractors General Liability and Umbrella Liability Contractors.

The Contractual Liability required by paragraph s.04n.4 of the General Conditions shall provide coverage for not less than the following amounts:

(1) Bodily injury:	$1,000,000 Each occurrence $1,000,000 Annual aggregate
(2).Property damage, including explosion, collapse and underground coverage:	$1,000,000 Each occurrence $1,000,000 Annual aggregate

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

"C. The CONTRACTOR shall also provide:

1. CONTRACTOR shall, as a minimum, purchase and maintain excess liability insurance in the umbrella form with a combined single limit of not less than $5,000,000 per claim and in the aggregate. Evidence of such excess liability shall be delivered to OWNER in accordance with paragraph 2.0SC in the form of a certificate indicating the policy numbers and limits of liability of all underlying insurance.

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

2. If the aggregate limits of liability indicated in CONTRACTOR' insurance provided in accordance with paragraphs 5.03 and 5.04 are not sufficient to cover all claims for damages arising from his operations under this Contract and from any other work performed by him or if policies of insurance do not provide that the aggregate limits of liability for bodily injury and property damage apply to each contract or project separately, CONTRACTOR shall have such policies amended so that the aggregate limits of liability required by this Contract will be available to cover all claims for damages due to operations under this Contract."

SC-5.05

Delete paragraph 5 .05 of the General Conditions in its entirety.

SC-5.06

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

"A. CONTRACTOR shall purchase and maintain, until final payment, property insurance upon the Work at the site in an amount equal to the total bid price for the completed construction. This insurance shall include the interests of OWNER, CONTRACTOR, Subcontractors, ENGINEER and ENGINEERS consultants in the Work, shall insure against the perils of fire and extended coverage, shall include "all risk" insurance for physical loss and damage including theft, vandalism and malicious mischief, collapse and water damage, and shall include damages, losses and expenses rising out of or resulting from any insured loss or incurred in the repair or replacement of any insured property (including but not limited to fees and charges of engineers, architects, attorneys and other professionals). This insurance shall be provided on the completed value form.' If not covered under the "all risk" insurance or otherwise provided in these Supplementary Conditions, CONTRACTOR shall purchase and maintain similar property insurance on portions of the Work stored on and off the site or in transit when such portions of the Work are to be included in an Application for Payment." A $20,000 deductible shall be acceptable. Any other deductible amount shall be approved in advance by the OWNER and any deductible amount shall be borne by the CONTRACTOR.

Delete paragraph 5.068 of the General Conditions in its entirety.

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

"C. All the policies of insurance (or the certificates or other evidence thereof) required to be purchased and maintained by CONTRACTOR in accordance with paragraphs 5.06 will contain a provision or endorsement that the coverage afforded will not be canceled or materially changed or renewal refused until at least thirty days' prior written notice has been given to OWNER by certified mail and will contain waiver provisions in accordance with paragraph 5.078. The words **"Endeavor** to" shall be struck from the Certificate Of Insurance in the Cancellation Statement"

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

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

SC-5.07

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

SC-5.08

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

Delete paragraph 5.0813 of the General Conditions in its entirety.

SC-5.09

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

"A. If OWNER has any objection Ito the coverage afforded by or other provisions of the insurance required to be purchased and maintained by CONTRACTOR in accordance with this Article 5 on the basis of its not complying with the Contract Documents, OWNER will notify CONTRACTOR in writing thereof within thirty days of the date of delivery of such certificates to OWNER in accordance with paragraph 2.0SC. CONTRACTOR will provide such additional information in respect of insurance provided by him as OWNER may reasonably request."

ARTICLE 6. CONTRACTOR'S RESPONSIBILTIES

SC-6.01

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

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

SC-6.04

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

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

SC-6.17

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

SC-6.20

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

"A. To the fullest extent permitted by law, the CONTRACTOR shall indemnify and hold harmless the OWNER, the ENGINEER, ENGINEER'S consultants, and their agents and employees from and against all claims, damages, losses and expenses, including but not limited to attorneys fees, arising out of or resulting from the performance of the Work, provided that such claim, damage, loss or expense is attributable to bodily injury, sickness,

disease or death, or to injury to or destruction of tangible property (other than the Work itself) including loss of use resulting therefrom, but only to the extent caused in whole or in part by acts or omissions of the CONTRACTOR, a subcontractor, anyone directly or indirectly employed by them or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss or expense is caused in part by a party indemnified hereunder. Such obligation shall apply to any such claims, damages, losses and expenses which arise and/or are incurred by any person or entity either during the performance of the Work and/or alter completion of construction. Nothing in this paragraph shall be construed to negate, abridge, or reduce other rights or obligations of indemnity or contribution which would otherwise exist as to a party or person indemnified hereunder. CONTRACTOR hereby assumes the responsibility and liability for injury to or death of any and all persons, including the. CONTRACTOR's employees, and for any and all damage to property caused by, resulting from, or arising out of any act, omission or neglect on the part of the CONTRACTOR, or of any Subcontractor or of anyone directly or indirectly employed by any of them or of anyone for whose acts, any of them may be liable."

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

ARTICLE 8. OWNER'S RESPONSIBILITIES

SC-8.06

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

ARTICLE 9. ENGINEER'S STATUS DURING CONSTRUCTION

SC-9.01

Add a new paragraph 9.0113 after paragraph 9.01A of the General Conditions, which is to read as follows:

"B. Nothing contained in the Contract Documents shall be construed to create a contractual relationship of any kind (1) between the ENGINEER and CONTRACTOR, (2) between the OWNER and a Subcontractor or Subcontractors, or (3) between any person or entities other than the OWNER and CONTRACTOR. The ENGINEER shall, however, be entitled to performance and enforcement of obligations under the CONTRACT DOCUMENTS intended to facilitate performance of the ENGINEERS duties."

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

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

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

(1) If the total extended bid price [Estimated Quantity times the Bid Unit Price] of a particular item of Unit Price Work amounts to 5 percent or more of the Original Contract Price and the variation in the quantity of the particular item of Unit Price Work performed by CONTRACTOR differs by more than 15 percent from the estimated quantity of such item indicated in the Agreement;
and

(2) If there is no corresponding adjustment with respect to any other item of work; and

(3) If CONTRACTOR believes that CONTRACTOR has incurred additional expense as a result thereof, CONTRACTOR may make a claim for an adjustment in the Contract Price in .accordance with Article 11- if the parties am unable to agree as to the effect of any such variations in the quantity of Unit Price Work performed. If OWNER believes that the quantity variation entitles OWNER to an adjustment in the unit price, OWNER shall be entitled to an adjustment in the unit price in an amount determined by the ENGINEER. ENGINEER shall not be liable in connection with any determination relating to adjustments which is rendered in good faith."

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

SC-12.06

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

"12.07 Liquidated Damages:

A. If the CONTRACTOR shall neglect, fail or refuse to complete the work within the time herein specified, or any proper extension thereof granted by the OWNER, then the CONTRACTOR does hereby agree, as a part consideration for the awarding of this Contract, to pay to the OWNER the amount specified in the Contract, not as a penalty but as liquidated damages for such breach of contract as hereinafter set forth, for each and every calendar day that the Contract shall be in default after the time stipulated in the Contract for completing the work. Such damages may be retained from time to time by the OWNER from progress payments or any amounts owing to the CONTRACTOR, or otherwise collected.

B. The said amount is fixed and agreed upon by and between the CONTRACTOR and the OWNER because of the impracticability and extreme difficulty of fixing and ascertaining the actual damages the OWNER would in such event sustain, and said amount is agreed to be the amount of damages which the OWNER would sustain and said amount shall be retained from time to time by the OWNER from current periodical estimates.

C. It is further agreed that time is of the essence of each and every portion of this Contract and of the specifications wherein as definite and certain length of times iffixed for the performance of any act whatsoever; and where under the Contract an additional time is allowed for the completion of any work, the new time limit fixed by such extension shall be of the essence of this Contract. Provided that the CONTRACTOR shall not be charged with liquidated damages of any excess cost when the OWNER determines that the CONTRACTOR is without fault and the CONTRACTOR'S reasons for the time extension are acceptable to the OWNER; Provided, further, that the CONTRACTOR shall not be charged with liquidated damages or any excess cost when the delay in completion of the work is due:

1) to any preference, priority or allocation order duly issued by the Government;

2) to unforeseeable cause beyond the control and without the fault or negligence of the CONTRACTOR, including, but not restricted to, acts of God, or of the public enemy, acts of the OWNER, acts of another CONTRACTOR in the performance of a contract with the OWNER, fires, floods, epidemics, quarantine restrictions, strikes, freight embargoes, and severe weather; and

3) to any delays of subcontractors or suppliers occasioned by any of the causes specified in subsections C(I) and C(2) above;

D. Provided, further, that the CONTRACTOR shall, within ten (10) days from the beginning of such delay, unless the OWNER shall grant a further period of time prior to the date of final settlement of the Contract, notify the OWNER, in writing, of the causes of the delay, who shall ascertain the facts and extent of the delay and notify the CONTRACTOR within a reasonable time of its decision in the matter."

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

SC-13.07

Delete paragraph 3.07A of the General Conditions and insert the following in its place:

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

SC-13.09

Revise paragraph 13.09A of the General Conditions

A. Delete the word "seven" and replace it with the word "ten" so that it reads "alter ten days written notice to CONTRACTOR."

ARTICLE 14. PAYMENTS TO CONTRACTOR AND COMPLETION

SC-14.02

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

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

Add Paragraph 4. to read as follows:

"4. The CONTRACTOR shall submit Weekly Payroll Records Report and Statement of

Compliance verifying compliance with the Minimum Prevailing Wage Law, MGL ch. 149, Sections 26-27H. "These Statements of Compliance shall be submitted as a condition of payment for work performed during the period the reports apply."

SC-14.03

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

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

ARTICLE 15. SUSPENSION OF WORK AND TERMINATION

SC-15.02

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

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

ARTICLE 17. MISCELLANEOUS

SC-17.06, 17.07, 17.08, 17.09

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

"17.06 Assignment:

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

17.7 Liability

1t is understood and agreed that members of the OWNER or the ENGINEER' or any agent or employees of the OWNER signing this Agreement shall not be personally liable hereunder for any action incurred in connection with this Agreement.

17.8 State Statutes and Regulations

See Superseding Changes To General & Supplementary Conditions 12/29/04 for further modifications of the General Conditions due to state statutes and regulations.

17.9 Severability

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

END OF SECTION

STATE STATUTES AND REGULATIONS
COMMONWEALTH OF MASSACHUSETTS

A. REVISIONS TO GENERAL CONDITIONS

1. Definitions

2. Subsurface Conditions Found Different

3. Subcontracting

4. Permits

5. Contractor Records

6. Massachusetts Sales and Use Tax I

7. Clarifications and Interpretations

8. Change of Contract Price

9. Payments

10. Suspension of Work and Termination

11. Labor Classification and Minimum Wage Rates

B. OTHER REGULATORY REQUIREMENTS

1. Working Hours

2. DEP Community Sound Level Criteria

ATTACHMENT A – Wage Rates

ATTACHMENT B

Excerpts from Chapter 149 and Chapter 30 of the Massachusetts General Law

ATTACHMENT C - (not used on this project)

Special Provisions for Minority/Women Business Enterprises and the Commonwealth of Massachusetts Supplemental Equal Employment Opportunity Anti-Discrimination and Affirmative Action Program.

ATTACHMENT D--

Change Orders

A. REVISIONS TO GENERAL CONDITIONS:

1. Definitions

The term "AWARDING AUTHORITY," as used herein, shall be considered to be synonymous with the term "OWNER," described in definition 1.01 A.30.

Delete definition 1.01 A.43 entitled "Substantial Completion" in the General Conditions in its entirety and insert the following in its place:

"Substantial Completion shall be interpreted in accordance with Massachusetts General Law Chapter 30, Section 39G or -39K as appropriate."

2. Subsurface Conditions Found Different

Add the following sentence to the end of paragraph 4.03A of the General Conditions:

"...to do so. Adjustments resulting from subsurface or latent physical conditions will be in accordance with Massachusetts General Law Chapter 30, Section 39N."

3. Subcontracting

Add the following language at the end of paragraph 6.06F of the General Conditions:

"Except as required otherwise by Massachusetts General Law Chapter 149, Section 44F, for Work governed by Chapter 149, sections 44A through 44H."

4. Permits

Delete paragraph 6.08A of the General Conditions in its entirety and insert the following in its place:

"A. The AWARDING AUTHORITY shall be responsible for identifying and obtaining all federal, state, and local permits required by the nature and location of construction, including but not limited to railroad permits, building construction permits, and permits for street and highway cuts and openings. CONTRACTOR shall be responsible for obtaining all permits required of his equipment, work force, or particular operations (such as blasting) in the performance of the Work and not otherwise specified to be obtained by the AWARDING AUTHORITY. These permit fees shall be paid by CONTRACTOR. CONTRACTOR shall pay all governmental charges and inspection fees necessary for the prosecution of the Work, which are applicable at the time of opening of bids, or, if there are no Bids, on the Effective Date of the Agreement."

5. Contractor Records

Add a new paragraph immediately after paragraph 6.09C of the General Conditions, which is to read as follows:

"D. The CONTRACTOR shall comply with all applicable provisions Chapter 30, Section 39R of the Massachusetts General Laws Regarding, CONTRACTOR'S records."

6. Massachusetts Sales and Use Tax

Add the following paragraph after paragraph 6.1OA of the General Conditions:

"B. The material and supplies to be used by the CONTRACTOR in the Work of this Contract are exempt from the Sales and Use Tax of the Commonwealth of Massachusetts. The AWARDING AUTHORITY tax exemption certificate number will be furnished to the CONTRACTOR."

7. Clarifications and Interpretations

Add the following language at the end of paragraph 9.04A of the General Conditions:

"The ENGINEER'S interpretation will be made in accordance with the requirements of Massachusetts General Law Chapter 30, Section 39P."

8. Change of Contract Price

Delete paragraphs 11.01,11.02, and 12.01 of the General Conditions, having to do with Change of Contract Price. Changes in contract price will be governed by the section called "Change Orders" in Attachment D, Section XXX and Article 11 in the Supplementary Conditions.

9. Payments

Delete paragraph 12.028.1 of the General Conditions, in its entirety and insert the following in its place:

"1. Progress Payments will be made in accordance with the Massachusetts General Law Chapter 30, Section 39G or 39K, as applicable."

Add the following new paragraph following paragraph 14.02C.1 of the General Conditions:

"2. The CONTRACTOR shall make payments to Subcontractors in accordance with the requirements of Massachusetts General Law Chapter 30, Section 39F."

Delete paragraph 14.07B of the General Conditions in its entirety and insert the following in its place:

"1. If, on the basis of the ENGINEER's observation of the Work during construction and final inspection and, upon the ENGINEER's review of the final Application for Payment and accompanying documentation, the ENGINEER is satisfied that the Work has been completed and that the CONTRACTOR's other obligations under the Contract Documents have been fulfilled, the ENGINEER will indicate in writing his recommendation of payment and present the Application to the AWARDI NG AUTHORITY for payment. Thereupon the ENGINEER will give written notice to the AWARDING AUTHORITY and the CONTRACTOR that the Work is acceptable subject to the provisions of paragraph 14.15. Otherwise, the ENGINEER will return the Application to CONTRACTOR, indicating in writing the reasons for refusing to recommend final payment. In such case the CONTRACTOR shall make the

necessary corrections and resubmit the Application. If the Application and accompanying documentation are appropriate as to form and substance, the AWARDING AUTHORITY shall in accordance with the applicable Massachusetts General Law, pay the CONTRACTOR the amount recommended by the ENGINEER."

10. Suspension of Work and Termination

Delete paragraph 15.01A of the General Conditions in its entirety and insert the following in its place:

"A. The AWARDING AUTHORITY may order, at any time and without cause, the CONTRACTOR to suspend or delay the Work in accordance with Massachusetts General Law Chapter 30, Section 39-0."

11. Labor Classifications and Minimum Wage Rates

Add the following paragraphs under the heading "Wage Rates" after paragraph 17.10 of the Supplementary Conditions:

"17.11 Wage Rates

A. Minimum wage rates as determined by the Commissioner of the Department of Labor and Industries under the provisions of Massachusetts General Laws Chapter 149, Sections 26-270 apply to this project. A copy of the wage schedule is included in the front end of the specifications under Federal Minimum Wage Rates. If, after the Notice of Award, it becomes necessary to employ any person in a trade or occupation not classified in the wage determinations, such person shall be paid at not less than such rates as shall be determined by the Commissioner. Such approved minimum rate shall be retro- active to the time of the initial employment of such person in such trade or occupation. The CONTRACTOR shall notify the AWARDING AUTHORITY of its intention to employ persons in trades or occupations not classified in the wage determinations as soon as possible in order to allow sufficient time for the AWARDING AUTHORITY to obtain approved rates for such trades or occupations.

B. The schedule of wages referred to above are minimum rates only, and the AWARDING AUTHORITY will not consider any claims for additional compensation made by CONTRACTOR because of payment by the CONTRACTOR of any wage rate in excess of the applicable rate contained in the Contract.

C. The said schedule of wages shall continue to be the minimum rates to be paid during the life of this Agreement and a legible copy of said schedule shall be kept posted in a conspicuous place at the site of the Work.

D. CONTRACTOR and subcontractors shall submit a copy of weekly payroll records to the AWARDING AUTHORITY and the AWARDING AUTHORITY shall retain the records of a minimum of three years."

B. OTHER REGULATORY REQUIREMENTS:

1. Working Hours

No laborer, workman, mechanic, foreman, or inspector, working within the Commonwealth, in the employ of the CONTRACTOR, subcontractor, or other person doing or contracting to do the whole or a part of the work contemplated by this contract, shall be required or permitted to work more than eight hours in any one day or more than forty-eight hours in any one week, or more than six days in any one week, except in cases of emergency.

2. DEP Community sound Level Criteria

The Community Sound Level Criteria as established by the Commonwealth of Massachusetts Department of Environmental Protection (DEP) must be conformed to prior to the AWARDING AUTHORITY's acceptance of the structure. The following sound level criteria must be met at the construction site:

A. The increase in the broad band noise level shall not be in excess often (10) dB(A) above ambient at the station boundary. The ambient level is defined as the A-weighted noise level that is exceeded ninety (90) percent of the time measured during the period in question.

B. The primary noise source(s) shall not produce a puretone condition. Puretone is any given octave band center frequency that exceeds the two adjacent center frequencies by three (3) or more decibels.

END OF SECTION

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SUPERSEDING CHANGES TO
GENERAL AND SUPPLEMENTARY CONDITIONS

1. GENERAL CONDITIONS

2.06A - insert at end: Said conference shall be scheduled and arranged by the Contractor. I

4.01B - delete

4.06G - delete

5.07B - delete

6.17E - restore the word "timely" in the first line. Delete the word "only" from the 5"' line. Where "only" has been deleted, insert "to determine their general conformance with the contract documents, in accordance with good and accepted engineering practices, and".

8.02A - delete "to whom contractor makes no reasonable objection'.

9.02A - Insert, after "Work" in the 6"' line, "While construction is active at the project, said visits and inspections will take place at least once per week."

12.06 - delete subparts A and B, and replace with the following: "The Contractor hereby agrees that the Contractor shall have no claim for damages of any kind against the Owner or the Engineer on account of any delay in the commencement of the Work and/or any delay in, or suspension of any portion of the Work, whether such delay is caused by the Owner, the Engineer, or otherwise. The Contractor acknowledges that the Contractor's sole remedy for any such delay and/or suspension will be an extension of time as provided in these general conditions.

No claims shall be allowed on account of the failure of the Engineer to furnish Drawings, specifications or instructions or to return Shop Drawings or Samples until the expiration of the applicable time period referenced in Mass. Gen. L. c. 30, §39P, and not then unless such claim be reasonable.

No extension of time shall be granted because of seasonable or abnormal variations in temperature, humidity or precipitation, which conditions shall be wholly at the risk of the Contract, whether occurring within the time originally scheduled for completion, or within any period of extension granted. There shall be no increase in the Contract Sum on account of any additional costs or operations or conditions resulting therefrom.

14.02C - change 'Ten" to "Twenty-One"

14.07A(3) - delete the first three lines through the word "Owner,". In the third line, after Contractor, substitute "shall" for "may". In the fourth line, after the word "full" insert "on behalf of both Contractor and all of its Subcontractors,".

14.09A(1) - delete -

15.03B - add after "termination" ", with respect to this project or any other project of the Contractor."

Add "15.03C. If this Contract is terminated by Owner with or without cause, and regardless of whether said termination is rightful or wrongful, in no event shall the Contractor be paid a sum which, together with prior payments to Contractor, exceeds the sum payable to Contractor under the Agreement (Section 00520), as adjusted by any agreed change orders.

II. SUPPLEMENTARY CONDITIONS

Article V - Bonds and Insurance

Employer's liability coverage must be $2 million per accident, $2 million disease limits, and $2 million per employee disease limits.

General liability insurance limits must be $5 million aggregate, $2 million dollars' products/completed operations aggregate; $2 million personal injury and advertising; and $2 million per occurrence.

The contractual liability insurance coverage must have limits corresponding to the foregoing. At 5.04A.6, the following changes should be made to paragraph I of the indemnity clause: four lines from the bottom, the parenthesis should be removed from the word "CAUSED" and the word "CAUSED" should be changed to lower-case (caused). Also, in the last line of said clause, insert the word "for" after the word "anyone."

At SC-5.04C 1 - insert the following sentence at the end: "The Contractor's excess liability insurance coverage must follow from with its underlying liability coverages."

SC-6.20A - insert the word "defend" after the word "shall" in the first line.

SC-14.02A.3 - insert the following sentence at the end: "Retainage for the entire project will be withheld until substantial completion of the entire project, at which time retainage shall be accounted for, subject to all of the other terms and conditions of payment at the time of substantial completion.

Add the following Article SC-18.

SC-I 8 Arbitration - J

18.1 Controversies and Claims Subject to Arbitration. Any Claim arising out of or related to the Contract, or the breach thereof, except claims relating to aesthetic effect, shall be settled by arbitration, subject to the provisions of Subparagraph 18.7. Arbitration will be conducted in accordance with the Construction Industry Arbitration Rules of the American Arbitration Association and judgment upon the award rendered by the Arbitrator or Arbitrators may be entered in any Court having jurisdiction thereof. In any such arbitration in which the amount stated in the demand is $100,000 or less, a single arbitrator shall be appointed in accordance with the procedures set forth in the American Arbitration Association Construction Industry Arbitration Rules. In any such arbitration in which the amount stated in the demand is in excess of $100,000, a panel of three arbitrators shall be appointed in accordance with the procedures set forth in the American Arbitration

Association Construction Industry Arbitration Rules. The patties may agree to use any arbitration service. In the absence of such agreement, the American Arbitration Association shall be utilized.

18.2 Rules For Arbitration. If the neutral arbitrator is appointed by the American Arbitration Association, the said Association shall administer the arbitration and its Construction Industry Arbitration Rules shall govern all aspects of the proceeding including the enforcement of any award. If the neutral arbitrator is not appointed by the American Arbitration Association, then the panel of arbitrators shall act as the administrator of the arbitration but the Construction Industry Arbitration Rules of the Association shall nonetheless govern all aspects of the proceeding, including the enforcement of any award. The arbitration .panel shall have all the powers and duties conferred on the Association pursuant to said rules.

In addition, the following rules shall govern the selection of arbitrators and the proceedings:

18.2.1 Neither party may appoint as arbitrator an employee or an owner of that party, nor the parent, spouse or child of an employee or owner of that party.

18.2.2 Alter the neutral arbitrator has been appointed, neither party may engage in ex parte communication with the arbitrator appointed by that party.

18.2.3 Contract Performance During Arbitration. During arbitration proceedings, the Owner and Contractor shall otherwise continue their performances hereunder.

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18.3 When a written decision of the Engineer states that the decision is final, any demand for arbitration of the matter covered by such decision must be made within two months after substantial completion of the project, as determined by the Engineer in accordance with the provisions hereof. The failure to demand arbitration within said two month period will result in the Engineer's decision becoming final and binding upon the Owner and the Contractor.

18.4 A Demand for arbitration shall be made with the time limits specified in Subparagraph 18.3, and in no event shall be made after the date when the institution of legal or equitable proceedings based on such Claim would be barred by the applicable statute of limitations.

18.5 Claims and Timely Assertion of Claims. A party who files a notice of demand for arbitration must assert in the demand all Claims then known to that party on which arbitration is permitted to be demanded. When a party fails to include a claim through oversight, inadvertence or excusable neglect, or when a Claim has matured or been acquired subsequently, the arbitrator or arbitrators may permit amendment.

18.6 Judgment on Final Award. The award rendered by the arbitrator or arbitrators shall be final, and the judgment maybe entered upon it in accordance with applicable law in any court having jurisdiction thereof.

18.7 Notwithstanding any provision contained in this Paragraph 18 or elsewhere in the Contract Documents, the Owner reserves the following right in connection with claims and disputes between the Owner and Contractor:

1. the right to institute the legal action against the Contractor in any court of competent jurisdiction in-lieu of demanding arbitration pursuant to this paragraph 18, in which case the dispute or disputes which are the subject of such action shall be decided by such court, and not by arbitration.

2. the right to obtain from any court of competent jurisdiction a stay of any arbitration instituted by the Contractor, provided that the application for such stay is made before the appointment of the neutral arbitrator in such arbitration, in which case the dispute or disputes which are the subject of such arbitration shall be decided by such court, and not by arbitration;

3. the right to require the Contractor to join as a party in any arbitration between the Owner and Architect relating to the Project in which case the Contractor agrees to be bound by that decision of the arbitrator arbitrators in such arbitration.

In case the Owner elects to proceed in accordance with 18.7.1 or 18.7.2 above, the word "litigation", shall be deemed to replace the word "arbitration" wherever the latter word appears in the Contract Documents.

SC-19 MBE and WBE participation

The Contractor shall comply with the provision of G.L.c. 7 40N, and any associated regulations effective during the time of the project, relative to the participation of minority and women-owned businesses in connection with the project. At present, the current participation goals are 7.4% MBE and 4% WBE.

END OF SECTION

EQUAL OPPORTUNITY REQUIREMENTS

1. EQUAL EMPLOYMENT OPPORTUNITY

A. Equal Employment Plan: The Contractor and each Subcontractor shall implement an effective affirmative action plan to assure equal employment opportunity throughout the performance of work on this project. Do not discriminate against any employee or applicant tor employment because of race, color, sex, religion, age, or national origin. Affirmative action plan shall include, but not be limited to, the following:

1. Employment, upgrading, demotion, or transfer.
2. Recruitment or recruitment advertising.
3. Layoff or termination.
4. Rates of pay or other forms of compensation.
5. Selection for training, including apprenticeship.

B. Rules and Regulations: The Contractor and each Subcontractor shall comply with all applicable local, state and federal laws and regulations regarding equal employment opportunity and with the provisions of the following:

1.. Governors "Executive Order No. 74", dated July 20. 1970. entitled the "Governor's Code of Fair Practices", as amended by the Governor's Executive Order No. 116, dated May 1, 1975.

2. The Fair Employment Practices Law of the Commonwealth, Chapter 1518 of the General Laws of Massachusetts, as amended.

3. The rules and regulations of the Massachusetts Commission Against Discrimination as in force at the dale of the Contract.

4. The rules, regulations and relevant orders of the United States Secretary of Labor, the Commonwealth of Massachusetts Department of Labor and Industries, and other authorities having jurisdiction as in force at the date of the Contract.

5. Governor's 'Executive Order No. 237'.

C. Employment Advertisements: State in all solicitations or advertisements for employees that all qualified applicants will receive consideration tor employment without regard to race, color, sex, religion, age, or national origin.

D. Referral Notices: Direct special effort toward the recruitment of minority workers through the unions and through referral agencies representing the minority community.

E. Advising Labor Unions: Send to each labor union or representative of workers with which the Contractor has a collective bargaining agreement or other contract or understanding, a notice advising the labor union or workers' representative of the Contractors equal employment opportunity commitment and post copies of these notices in conspicuous places available to employees and applicants for employment.

F. Posting: Post copies of equal opportunity employment notices in conspicuous places available to employees and applicants for employment and post notices setting forth the provisions oi this non-discrimination equal employment opportunity clause.

G. Manning Table: Assume and be responsible for the affirmative duty of achieving the range of minority employment and women work force participation set forth in a manning table tor the entire project. Submit a manning table at the request of the Owner and obtain Owners approval prior to the Award of Contract.

H. Percentage Participation: Both Contractor and Sub-contractor shall comply with requirements of Minority and Women Business percentage of Contract percentage participation requirements specified in the Minority and Women Business Enterprise Set Aside Requirements Section.

END OF SECTION

MINORITY AND WOMEN BUSINESS
ENTERPRISE SET ASIDE REQUIREMENTS

1. GENERAL

A. All provisions of the Contract Documents shall be subject to all applicable provisions of law, including, without limitation, Federal. State, and Local statutes and ordinances regarding setting aside a portion of the Contract tor qualified Minority and Women Business Enterprises. The Contractor shall recognize that other duties and obligations are required by laws, statutes, and ordinances which may not be provided herein, but must be considered and made a part of this Contract. In case of a conflict between the Contract Documents and applicable laws, statutes, and ordinances, the provisions of law, statutes, and ordinances shall *govern.*

2. MINORITY AND WOMEN OWNED BUSINESS ENTERPRISE SET ASIDE REQUIREMENTS

A. Requirements For minority and women business enterprise set aside requirements, provided to the Architect by the Awarding Authority Follow. The Architect does not warrant or guarantee the completeness or accuracy of this information, and *every* bidder and contractor shall be responsible tor ascertaining the MWBE set aside requirements in the area where the work will be performed.

1. Bidders shall agree to contract with minority and women owned businesses as certified by the State Office of Minority and Women Business Assistance [SOMWBA]. "the amount of participation which shall be reserved for such enterprises shall not be less than fifteen percent [t5%] of the total contract amount including accepted alternates, of which at least ten percent [10%] shall be reserved tor minority business enterprises and five percent [5%] shall be reserved tor womenowned business enterprises.

2. The Contractor and each Subcontractor shall furnish to the Awarding Authority, within fifteen days alter completion of its portion of the work, a certified 'Statement of Compliance" certifying compliance with minority and women business enterprise set aside requirements. Submit the 'Statement of Compliance' in a form acceptable lo the Awarding Authority.

3. See Massachusetts Executive Order 237 as amended.

END OF SECTION

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INSURANCE REQUIREMENTS

1. GENERAL

A. This section specifies the Owner's requirements for insurance and relates to the General Conditions of the Contract for Construction and Supplementary Conditions of the Contract for Construction.

B. Provisions of the General Conditions of the Contract for Construction and Supplementary General Conditions of the Contract for Construction, which are not modified by the following insurance Requirements, remain in full effect.

2. INSURANCE REQUIREMENTS

A. Insurance Limits: The insurance required should be written for not less than the limits of liability required by law or the following limits, whichever is greater: State and federal Workmen's Compensation Statutory Benefits required by union contract as required.

GENERAL LIABILITY*	
General Liability- Bodily Injury and Property Damage Each Occurrence	$1,000,000.00
General Liability — Bodily Injury and Property Damage Aggregate	$2,000,000.00

General Liability shall include coverage for the following:

Comprehensive form
Premise/Operations Liability
Explosion, Collapse and Underground (XCU). Products/Completed Operations (aggregate limit $2,000,000.00) Contractual Liability
Independent Contractors Broad
Form Property Damage
Personal Injury Including Libel and Slander Coverage Broad
Form CGL Endorsement

AUTOMOBILE LIABILITY**	
Comp. Automobile Liability** Bodily Injury and Property Damage Per Accident	$1,000,000.00

**Provide coverage for All Owned, Non-Owned, and Hired vehicles.

EXCESS LIABILITY – Umbrella Form	
Each occurrence	$5,000,000.00
Aggregate	$5,000,000.00

B. Exclusions: The Owner's property insurance shall not cover tools, equipment, shoring, staging, forms, temporary buildings or other equipment owned or rented by the Contractor, its Subcontractors, or any Worker.

C. Named Insured: Each Insurance policy certificate of insurance provided by the Contractor shall name the Town of Arlington as an additional insured. Each insurance policy and certificate of insurance provided by the Contractor shall contain a provision that the Owner shall be notified of cancellation or restrictive amendment at least thirty (30) days prior to the effective date of such cancellation or amendment.

D. Insurance Certificates: Submit insurance certificates for the Owner's review and approval prior to commencement of the work. The Contractor and all subcontractors who are required to provide insurance under the Contract shall provide accurate and bona fide "Certificates of insurance "issued by a responsible agent of the insurance company.

1. Certificate Content: Such "Certificates of Insurance" shall clearly indicate the insurance coverage. Each "Certificate of Insurance" shall be accompanied by a sworn and duly notarized statement from the responsible agent of the insurance company issuing the certificate clearly stating that all insurance specified and required by the Contract Documents is provided and in force, and also a clear statement of all exceptions and deviations, if any, from the Contract Document issuance requirements.

2. Responsibility: The insurance agent issuing and authorizing the "Certificate of Insurance" shall be responsible and liable for the accuracy and validity of the "Certificate of Insurance". Each insured party shall certify by sworn and duly notarized statement that the "Certificate of Insurance" issued for them are bona fide.

3. Disclaimers Prohibited: "Certificates of Insurance" shall not contain any disclaimers such as: "This Certificate is issued as a matter of information only and confers no right upon the certificate holder. This Certificate does not amend, extend, or alter the coverage afforded by the policies listed below." Disclaimers are not acceptable.

4. Certificates of Insurance Can Be Relied Upon: Parties receiving "Certificates of insurance" shall be entitled to rely upon the "Certificates of insurance" and shall have the right to claim the benefits and protection provided by the insurance as it applies to them.

5. Alternate to "Certificates of Insurance": Instead of providing the "Certificates of lnsurance" and the sworn statements required above, the insured may provide bona fide and accurate copies of all insurance policies and riders accompanied by a sworn and duly notarized statement from the insured that the policies, riders, and documents submitted are bona fide and valid, and that parties receiving the insurance documents may rely on the documents as satisfaction of the Contract insurance requirements.

E. The Contractor shall provide "builder's risk" insurance as described in the General Conditions of the Contract for Construction and with limits equal to the full insurable completed value of the building under construction. The "Builder's Risk" insurance shall include "all risk" insurance for physical loss and damage including theft, vandalism, and malicious mischief. The "Builder's Risk" insurance shall be amended to delete any and all endorsements relating to cancellation of the policy due to partial occupancy by the Owner.

1. Builder's Risk Deductible Amount: $1,000,000.00

END OF SECTION

SECTION 01 11 00

CONTROL OF WORK AND MATERIALS

PART 1 – GENERAL

Not Used.

PART 2 – PRODUCTS

Not Used

PART 3 - EXECUTION

3.01 HAULING, HANDLING AND STORAGE OF MATERIALS:

A. The Contractor shall, at its own expense, handle and haul all materials furnished by it and shall remove any of its surplus materials at the completion of the work.

B. The Contractor shall provide suitable and adequate storage for equipment and materials furnished by it that are liable to injury and shall be responsible for any loss of or damage to any equipment or materials by theft, breakage, or otherwise.

C. All excavated materials and equipment to be incorporated in the Work shall be placed so as not to injure any part of the Work or existing facilities and so that free access can be had at all times to all parts of the Work and to all public utility installations in the vicinity of the work. Materials and equipment shall be kept neatly piled and compactly stored in such location as will cause a minimum of inconvenience to public travel and adjoining owners, tenants and occupants.

D. The Contractor shall be responsible for all damages to the work under construction during its progress and until final completion and acceptance even though partial payments have been made under the Contract.

3.02 OPEN EXCAVATIONS:

A. All open excavations shall be adequately safeguarded by providing temporary barricades, caution signs, lights and other means to prevent accidents to persons, and damage to property. The Contractor shall, at its own expense, provide suitable and safe means for completely covering all open excavations and for accommodating travel when work is not in progress.

B. Bridges provided for access to private property during construction shall be removed when no longer required.

C. The length of open trench will be controlled by the particular surrounding conditions but shall always be confined to the limits prescribed by the Engineer.

D. If the excavation becomes a hazard, or if it excessively restricts traffic at any point, then special construction procedures shall be taken, such as limiting the length of trench and prohibiting stocking excavated material in the street.

E. All street excavations shall be completely closed at the end of each work day. Backfilling or use of steel plates of adequate strength to carry traffic shall be used.

3.03 MAINTENANCE OF TRAFFIC:

A. Unless permission to close the street is received in writing from the proper authority, all excavated materials and equipment shall be placed so that vehicular and pedestrian traffic may be safely maintained at all times.

B. Should the Chief of Police deem it necessary, uniformed officers will be assigned to direct traffic. The Contractor shall make all arrangements in obtaining uniformed officers required.

C. The Contractor shall at its own expense, as directed by the Police Traffic Control/Safety Officer, provide and erect acceptable barricades, barrier fences, traffic signs, and all other traffic devices not specifically covered in a bid item, to protect the work from traffic, pedestrians, and animals. The Contractor shall provide sufficient police details, temporary lighting such as lanterns/flashers (electric battery operated) or other approved illuminated traffic signs and devices to afford adequate protection to the traveling public, at no additional cost to the Owner.

D. The Contractor shall furnish all construction signs that are deemed necessary by and in accordance with Part VI of the Manual on Uniform Traffic Control Devices as published by the U.S. Department of Transportation. In addition, the Contractor may be required to furnish up to 128 square feet of additional special construction warning signs. Size and exact wording of signs shall be determined by the Engineer during construction.

E. The intent of policing is to ensure public safety by direction of traffic. Police officers are not to serve as watchmen to protect the Contractor's equipment and materials.

F. Nothing contained herein shall be construed as relieving the Contractor of any of its responsibilities for protection of persons and property under the terms of the Contract.

G. As this is a public park and public space. Contractor shall provide signage directing the public for a safe detour route through the park.

3.04 CARE AND PROTECTION OF PROPERTY:

A. The Contractor shall be responsible for the preservation of all public and private property, and shall use every precaution necessary to prevent damage thereto. If any direct or indirect damage is done to public or private property by or on account of any act, omission, neglect, or misconduct in the execution of the work on the part of the Contractor, such property shall be promptly restored by the Contractor, at its expense, to a condition similar or equal to that existing before the damage was done, to the satisfaction of the Engineer.

B. Contractor shall use all means necessary to protect and preserve the materials to be removed, store, and reinstalled in this project. All artifacts are of a delicate nature. Any damage to existing or reinstalled items and features in this project shall be at the expense of the contractor, and will not be accepted until historical commission is satisfied.

3.05 PROTECTION AND RELOCATION OF EXISTING STRUCTURES AND UTILITIES:

A. All existing buildings, utilities, pipes, poles, wires fences, curbing, property line markers and other structures which the Engineer decides must be preserved in place without being temporarily or permanently relocated, shall be carefully supported and protected from damage by the contractor. Should such property be damaged, it shall be restored by the Contractor, at no additional cost to the Owner.

B. The Contractor shall determine the location of all underground structures and utilities (including existing water services, drain lines, electrical lines, and sewers). Services to buildings shall be maintained, and all costs or charges resulting from damage thereto shall be paid by Contractor.

C. On paved surfaces the Contractor shall not use or operate tractors, bulldozers, or other power-operated equipment with treads or wheels which are shaped so as to cut or otherwise damage such surfaces.

D. All property damaged by the Contractor's operations shall be restored to a condition at least equal to that in which it was found immediately before work was begun. Suitable materials and methods shall be used for such restoration.

E. Restoration of existing property and structures shall be carried out as promptly as practicable and shall not be left until the end of the construction period.

3.06 MAINTENANCE OF FLOW:

A. The Contractor shall at its own cost, provide for the flow of sewers and drains interrupted during the progress of the work, and shall immediately cart away and dispose of all offensive matter. The entire procedure of maintaining existing flow shall be fully discussed with the Engineer well in advance of the interruption of any flow.

B. All existing drainage facilities including, but not limited to; brooks, streams, canals, channels, ditches, culverts, catch basins and drainage piping shall be adequately safeguarded so as not to impede drainage or to cause siltation of downstream areas in any manner whatsoever. If the Contractor damages or impairs any of the aforesaid drainage facilities, it shall repair the same within the same day.

C. At the conclusion of the work, the Contractor shall remove all silt in drainage structures caused by its operations as described in Section 01 74 13, CLEANING UP.

3.07 REJECTED MATERIALS AND DEFECTIVE WORK:

A. Materials furnished by the Contractor and condemned by the Engineer as unsuitable or not in conformity with the specifications shall forthwith be removed from the work by the Contractor, and shall not be made use of elsewhere in the work.

B. Any errors, defects or omissions in the execution of the work or in the materials furnished by the Contractor, even though they may have been passed or overlooked or have appeared after the completion of the work, discovered at any time before the final payment is made hereunder, shall be forthwith rectified and made good by and at the expense of the Contractor and in a manner satisfactory to the Engineer.

C. The Contractor shall reimburse the Owner for any expense, losses or damages incurred in consequence of any defect, error, omission or act of the Contractor or his employees, as determined by the Engineer, occurring previous to the final payment.

3.08 SANITARY REGULATIONS:

Sanitary conveniences for the use of all persons employed on the work, properly screened from public observation, shall be provided in sufficient numbers in such manner and at such locations as may be approved. The contents shall be removed and disposed of in a satisfactory manner as the occasion requires. The Contractor shall rigorously prohibit the committing of nuisances within, on or about the work. Any employees found violating these provisions shall be discharged and not again employed on the work without the written consent of the Engineer. The sanitary conveniences specified above shall be the obligation and responsibility of the Contractor.

3.09 SAFETY AND HEALTH REGULATIONS:

This project is subject to the Safety and Health regulations of the U.S. Department of Labor set forth in 29 CFR, Part 1926., and to the Massachusetts Department of Labor and Industries, Division of Industrial Safety "Rules and Regulations for the Prevention of Accidents in Construction Operations (454 CMR 10.0 et. seq.)." The Contractor shall be familiar with the requirements of these regulations.

3.10 SITE INVESTIGATION:

The Contractor acknowledges that it has satisfied itself as to the conditions existing at the site of the work, the type of equipment required to perform this work, the quality and quantity of the materials furnished insofar as this information is reasonably ascertainable from an inspection of the site, as well as from information presented by the drawings and specifications made a part of this contract. Any failure of the Contractor to acquaint itself with available information will not relieve it from the responsibility for estimating properly the difficulty or cost of successfully performing the work. The Owner assumes no responsibility for any conclusion or interpretation made by the Contractor on the basis of the information made available by the Owner.

3.11 HANGERS, PADS, AND SUPPORTS:

A. Unless otherwise indicated, hangers and supports shall be by the trade providing the supported item.

B. Except where detailed or specified, design of hangers and supports shall be the responsibility of the Contractor. All parts of such hangers or supports shall be designed in accordance with accepted engineering practice, using a factor of safety of at least 2½.

C. When proprietary hangers, etc., are supplied, satisfactory evidence of the strength of such items shall be furnished.

D. Hangers for items hung from steel and concrete shall be centered on the vertical center of gravity of the beam.

E. Locations and sizes of openings, sleeves, concrete pads, steel frames, and other equipment supports are indicated on the drawings for bidding purposes only. Final sizes and locations of such items shall be obtained from the shop drawings.

3.12 SLEEVES, HOLES, HANGERS, INSERTS, ETC.:

A. Except where holes and openings are dimensioned, and hangers, inserts, and supports are fully called for on the architectural and structural drawings (or reference is made thereon to drawings containing such information) to accommodate mechanical or electrical items, they shall be by the mechanical or electrical trade concerned.

B. Sleeves, inserts, anchors, etc., supplied under the mechanical and electrical contracts in sufficient time to so permit, shall be set in concrete, masonry, etc., or fastened to steel deck, etc., by the respective architectural or structural trade. Where not supplied in sufficient time, installation of such items shall be the responsibility of the mechanical or electrical trade involved.

C. Nothing shall be suspended from the steel roof deck and no fastenings made to it, except with the prior permission of the Engineer. Request for permission shall be accompanied by full details of the hanger or fastener, including the weight of the item to be suspended.

D. Nailers and other wood members attached to steel or masonry, for which fasteners are not indicated on the design drawings or in the specification, shall be fastened with the equivalent of ½-inch diameter bolts at 3 feet o.c.

E. Openings for mechanical and electrical items in finished areas of the building shall be closed off with near escutcheon plates or similar closures. These closures shall be by the mechanical or electrical trade involved.

3.13 WEATHER PROTECTION:

A. In conformance with Sections 44F and 44G of Chapter 149 of the General Laws of Massachusetts, the General Contractor shall install weather protection and shall furnish adequate heat in the area so protected during the months of November through March. Standards for such specifications shall be established by the Director of Building Construction in the Executive Office for Administration and Finance.

3.14 ELECTRIC SERVICE:

A. The Contractor shall make all necessary applications and arrangements and pay for all fees and charges for electrical energy for power and light necessary for the proper completion of this contract during its entire progress. The Contractor shall provide and pay for all temporary wiring, switches, connections, and meters.

B. There shall be sufficient electric lighting so that all work may be done in a workmanlike manner where there is not sufficient daylight.

END OF SECTION

SECTION 01 12 16

SCOPE AND SEQUENCE OF WORK

PART 1 – GENERAL

1.01 WORK INCLUDED:

A. Scope of work includes but is not limited to:

- Removing and disposing of existing piping, backwash pit, valve vault and mechanical equipment found inside the building.
- Furnish and installing new main drains, inlets, and recirculation systems.
- Furnish and installing filtration and chemical treatment equipment, including fittings, piping, and valves.
- Furnish and installing a new backwash pit and pump system.
- Furnish and install new corrugated metal roof on steel purlins.
- Furnish and install new slab under metal roof assembly
- Remove and install new roofing system, fans, and vents.
- Remove and install all existing electrical and service, install new service and new electrical devices.
- Remove and remediation of any hazardous materials.

B. No work can commence, or mobilization can occur till Notice of Proceed from Town of Arlington.

1.02 RELATED WORK:

A. SECTION 01 11 00 – CONTROL OF WORK AND MATERIALS

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.01 GENERAL:

A. The Contractor shall be responsible for scheduling its activities and the activities of any subcontractors involved, to meet the completion date, or milestones, established for the contract. Scheduling of the work shall be coordinated with the Owner and Engineer.

B. The Construction Sequence Requirements shall be used by the Contractor to form a complete schedule for the project, which shall be coordinated with the Owner and Engineer. Prior to performing any work at the site, the Contractor shall submit a detailed plan to the Engineer for review. The plan shall describe the proposed sequence, methods, and timing of the work.

END OF SECTION

SECTION 01 14 00

SPECIAL PROVISIONS

PART 1 - GENERAL

Not used

PART 2 - PRODUCTS

Not used

PART 3 - EXECUTION

3.01 WATER FOR CONSTRUCTION PURPOSES:

A. In locations where water is in sufficient supply, the Contractor may be allowed to use water without charge for jetting backfill and other construction purposes. The express approval of the Owner shall be obtained before water is used. Waste of water by the Contractor shall be sufficient cause for withdrawing the privilege of unrestricted use.

B. If no water is available, the Contractor shall supply water at no additional cost to the Owner.

3.02 PIPE LOCATION:

Pipe shall be located substantially as indicated on drawings. The Owner reserves the right, acting through the Engineer, to make such modifications as may be deemed desirable to avoid interference with existing structures or for other reasons.

3.03 DIMENSIONS OF EXISTING STRUCTURES:

Where the dimensions and locations of existing structures are of critical importance in the installation or connections of new work, the Contractor shall verify such dimensions and locations in the field before the fabrication of any material or equipment that is dependent on the correctness of such information.

3.04 OCCUPYING PRIVATE PROPERTY:

The Contractor shall not enter upon nor occupy with men, equipment or materials any property outside of Owner's property, except with the written consent of the property owner or property owner's agent.

3.05 EXISTING UTILITY LOCATIONS – CONTRACTOR'S RESPONSIBILITY:

A. The location of existing underground services and utilities shown on the drawings is based on available records. It is not warranted that all existing utilities and services are shown, or that shown locations are correct. The Contractor shall be responsible for having the utility companies locate their respective utilities on the ground prior to excavating.

B. The Contractor shall, at least 72 hours, exclusive of Saturdays, Sundays and holidays, prior to excavation in the proximity of telephone, gas, cable television and electric utilities, notify the utilities concerned by calling "DIG SAFE" at telephone number: 1-888-344-7233.

C. The Contractor shall coordinate all work involving utilities and shall satisfy itself as to the existing conditions of the areas in which it is to perform his work. It shall conduct and arrange its work so as not to impede or interfere with the work of other contractors working in the same or adjacent areas.

3.06 COORDINATION OF WORK:

The General Contractor shall be responsible for coordinating its own work as well as that of any subcontractors. It shall be responsible for notification of the Engineer when each phase of work is expected to begin and the approximate completion date.

3.07 TIME FOR COMPLETION OF CONTRACT:

The time for completion of this contract is stipulated in the Form of/for General Bid. The Bidder shall base his bid on completing the proposed work by the completion date stipulated in the contract documents.

3.08 MAINTENANCE OF TRENCH SURFACE:

After backfilling and compacting the trench, the Contractor shall be responsible for keeping the ground surface dry and passable at all times until the surface has been restored to original conditions.

3.09 DESIGN OF EQUIPMENT:

Attention is directed to the fact that the layout of certain equipment is based on that of one manufacturer. If other equipment is submitted for approval, the Contractor shall prepare and submit for approval at its expense, detailed structural, mechanical and electrical drawings, equipment lists, maintenance requirements, and any other data required by the Engineer, showing all necessary changes and embodying all special features of the equipment he proposes to furnish. Such changes, if approved, shall be made at the expense of the Contractor.

3.10 SERVICES OF MANUFACTURER'S REPRESENTATIVE:

A. The Contractor shall arrange for a qualified service representative, at a time suitable to the Engineer, from the company manufacturing or supplying certain equipment as indicated on the detailed specifications, to perform the duties described herein.

B. After installation of the listed equipment has been completed and the equipment is presumably ready for operation, but before others operate it the representative shall inspect, operate, test, and adjust the equipment. The inspection shall include, but shall not be limited to, the following points as applicable:

1. Soundness (without cracks or otherwise damaged parts); completeness in all details, as specified; correctness in setting, alignment, and relative arrangement of various parts; adequacy and correctness of packing, sealing and lubricants.

2. The operation, testing, and adjustment shall be as required to prove that the equipment is left in proper condition for satisfactory operation under the conditions specified. Where called for in the specifications, vibration readings shall be made and the equipment balanced accordingly.

3. On completion of its work, the Contractor shall submit in triplicate to the Engineer the manufacturer's or supplier representative's complete signed report of the results of its inspection, operation, adjustments, and test. The report shall include detailed descriptions of the points inspected, tests and adjustments made, quantitative results obtained if such are specified, and suggestions for precautions to be taken to ensure proper maintenance. The report shall also include a certificate that the equipment conforms to the requirements of the contract and is ready for permanent operation and that nothing in the installation will render the manufacturer's warranty null and void.

4. After the Engineer has reviewed the reports from the manufacturer's representative, the Contractor shall make arrangements to have the manufacturer's representative present when the field acceptance tests are made.

3.11 COMPLIANCE WITH PERMITS:

A. The Contractor shall perform all work in conformance with requirements of the Permits, which appear in Section 00 31 43 – PERMITS.

3.12 CUTTING, FITTING AND PATCHING:

A. The Contractor shall do all cutting, fitting, or patching of its work that may be required to make its several parts come together properly and fit it to receive or be received by work of other Contractors, as shown upon or reasonably implied by the drawings and the specifications for the completed structure, including all existing work.

B. The Contractor shall not endanger any work by cutting, digging, or otherwise and shall not cut or alter the work of any other Contractor, save with the consent of the Engineer.

C. All holes or openings required to be made in new or existing work, particularly at pipe, conduit, or other penetrations not covered by escutcheons or plates shall be neatly patched. All such holes shall be made completely watertight as approved by the Engineer.

D. Size and locations of holes required in steel, concrete, or other structural or finish materials for piping, wiring, ducts, etc., which have not been located and detailed on the drawings shall be approved by the Engineer prior to layout and cutting thereof. All holes shall be suitably reinforced as required by the Engineer.

E. Workmanship and materials of patching and repair work shall match the adjacent similar work and shall conform to the applicable sections of the specification. Patches and joints with existing work shall provide, as applicable in each case, visual, structural, and waterproofing continuity.

3.13 CONTRACTOR'S REPRESENTATIVE:

The Contractor shall designate a representative who will be available to respond to emergency calls by the Owner at any time day and night and on weekends and holidays should such a situation arise. This representative shall be on site at all times during construction activities.

3.14 VISUAL RECORDING:

Before beginning construction, the Contractor shall make a color DVD recording along the entire work length. One complete recording, for the entire project length, shall be furnished to the Engineer prior to the start of the work. The visual recording shall be identified by street name, as applicable, and station.

3.15 OPERATOR TRAINING:

A trained representative of the manufacturer of all equipment shall instruct the plant operating personnel on the operation and maintenance of the equipment. The Contractor shall videotape all training sessions and turned over to the Owner / Engineer at the conclusion of the project.

3.16 HOURS OF CONSTRUCTION ACTIVITY:

A. The Contractor shall conduct all construction activity between 7:00 a.m. and 5:00 p.m., Monday through Friday, with noise sensitive activity between 8:00 am and 3:00 pm. No construction work shall be allowed on Saturdays, Sundays or Holidays without written authorization from the Owner.

3.17 CONSTRUCTION CREWS:

The Contractor shall not increase the number of construction crews assigned to the work without providing one-week advance notice to the Engineer.

3.18 MASSACHUSETTS DATA SECURITY REGULATIONS:

In an effort to safeguard personal information of Massachusetts residents contained in paper or electronic records the Contractor shall not submit to the Engineer or Owner documents in paper or electronic form that contain personal information (person's name combined with one or more of the following – Social Security Number, driver's license number or state-issued identification card number, financial institution account number, or credit or debit card number). Any document submitted to the Engineer that violates this provision shall be returned to the Contractor and the Contractor shall remove personal information from the document prior to resubmitting it to the Engineer. The Contractor shall require each Subcontractor to also comply with the MA data security regulations insofar as they involve submittal of personal information to the Engineer and Owner.

3.19 CONTRACTOR EXPERIENCE

The contractor/subcontractor shall have at least 5 years' experience in construction in similar scope. Contractor/subcontractor should provide a resume with examples of at least three projects similar in scope and importance. Instructions on documenting this experience are included in the "Statement of Bidders Qualifications" bid form in the Contract.

END OF SECTION

SECTION 01 31 19.23

CONSTRUCTION MEETINGS

PART 1 - GENERAL

1.01 DESCRIPTION:

A. This Section specifies requirements for project meetings including but not limited to Pre-Construction Conference and Progress Meetings.

B. It shall be the responsibility of the Contractor to coordinate work between all subcontractors, sections, and trades required for the proper completion of the Work.

C. It shall be the responsibility of the Engineer to provide construction meeting notes following the pre-construction conference and each construction meeting.

1.02 PRE-CONSTRUCTION CONFERENCE:

A. After the bids have been opened but prior to the start of the construction there will be a pre-construction conference to discuss the phasing and scheduling of the Project. The specific time and place of the conference shall be arranged by the Engineer after the Contract has been awarded.

B. This pre-construction conference is intended to establish lines of communication between the parties involved, review responsibilities and personnel assignments, establish project schedules, discuss proposed performance methods, and coordinate Work to be performed by subcontractors.

C. Authorized representatives of the Owner, Engineer and their consultants, the Contractor, its Superintendent and Site Foreman, and all others invited by the Contractor, shall attend the pre-construction conference. All participants at the conference shall be familiar with the Project and authorized to conclude matters relating to the Work.

D. Discuss items of significance at the pre-construction conference that could affect progress including at least the following:

1. Tentative construction schedule
2. Critical Work sequencing
3. Designation of responsible personnel
4. Procedures for processing field decisions and Change Orders
5. Procedures for processing Applications for Payment
6. Review of Davis Bacon and other federal requirements

7. Distribution of Contract Documents
8. Submittal of Shop Drawings, Product Data and Samples
9. Preparation of record documents
10. Use of the premises
11. Office, work and storage, and laydown areas
12. Equipment deliveries
13. Construction safety procedures
14. Environmental health and safety procedures
15. First aid
16. Security
17. Housekeeping
18. Working hours
19. Traffic Control
20. Emergency Vehicle Access to and around work site
21. Environmental protection measures for construction site

1.03 PROGRESS MEETINGS:

A. During the course of the Project, the Contractor shall attend weekly progress meetings as scheduled by the Owner. The Owner, based on work progress and activities, may adjust the progress meetings to biweekly or other. The attendance of subcontractors may be required during the progress of the Work. The Contractor's delegate to the meeting shall be prepared and authorized to discuss the following items:

1. Progress of Work/Critical Work Sequencing in relation to Contract Schedule.
2. Proposed Work activities for forthcoming period.
3. Resources committed to Contract.
4. Coordination of Work with others.
5. Status of procurement of equipment and materials.
6. Status of Submittals.
7. Outstanding actions, decisions, or approvals that affect Work activities.
8. Site access and/or security issues
9. Hazards and risks
10. Housekeeping
11. Quality issues
12. Potential Claims
13. Change Orders
14. Costs, budget, and payment requests

B. The Contractor shall revise the construction schedule after each progress meeting where revisions to the schedule have been made or recognized and the revised schedule shall be submitted to the Engineer and Owner.

PART 2 - PRODUCTS

Not used.

PART 3 – EXECUTION

Not used.

END OF SECTION

SECTION 01 32 16

CONSTRUCTION SCHEDULING

PART 1- GENERAL

1.01 PROGRAM DESCRIPTION

A. A Critical Path Method (CPM) construction schedule shall be used to control the work of this Contract and to provide a definitive basis for determining job progress. The Contractor shall prepare the construction schedule. All work shall be done in accordance with the established CPM schedule and the Contractor and his subcontractors shall be responsible for cooperating fully with the Engineer and the Owner in effectively utilizing the CPM schedule.

B. The CPM schedule to be prepared and submitted by the Contractor shall consist of a CPM network (diagram of activities) and a computer-generated schedule (print-out) as specified herein. The format shall be the activity-on-node precedence network.

C. The Contractor shall develop his own outline of the work and prepare his proposed CPM schedule. The computer-based schedule shall be the product of a recognized commercial computer software producer and shall meet all of the requirements defined herein.

1.02 QUALIFICATIONS

A. The Contractor shall have the capability of preparing and utilizing the specified CPM scheduling technique. A statement of CPM capability shall be submitted by the Contractor in writing to the Engineer within 10 days after the issuance of the Notice to Proceed to verify that either the Contractor's organization has in-house capability qualified to use the technique or that the Contractor employs a consultant who is so qualified. Capability shall be verified by description of the construction projects to which the Contractor or his consultant has successfully applied the CPM scheduling technique and which were controlled throughout the duration of the project by means of systematic use and updating of a computer-based CPM schedule. The submittal shall include the name of the individual on the Contractor's staff who will be responsible for the CPM schedule and for providing the required updating information.

1.03 NETWORK REQUIREMENTS

A. The network shall show the order and inter-dependence of activities and the sequence in which the work is to be accomplished as planned by the Contractor. The **basic concept of a network analysis diagram** shall be followed to show how the start of a given activity is dependent on the completion of preceding activities and its completion restricts the start of following activities.

B. Detailed network activities shall include: construction activities, the submittal and approval of shop drawings, the procurement of materials and equipment, fabrication of materials and equipment and their delivery, installation and testing, start-up and training. The Contractor shall break the work into activities with durations no longer than twenty working days each, except as to non-construction activities (such as procurement of materials and delivery of equipment) and any other activities for which the Engineer may approve the showing of longer duration. To the extent feasible, **activities related** to a specific physical area of the work should be grouped on the network for ease of understanding and simplification.

C. Separate activities shall be provided for each significant identifiable function in each trade area in each facility. Activities shall be so identified that there will be no reasonable doubt as to how much work remains on each. Specific activities which shall be included are: all subcontract work, all interface work between subcontractors and between the Contractor and subcontractors, leakage tests of pipelines, electrical connections to each item of equipment, supplier and manufacturer technical assistance, mechanical connections to each item of equipment, all tests, concrete finishing, each item of site work, (including restraints on other activities) and all utilities, fuels and chemicals.

D. Each activity on the network shall have the following indicated on the NODE representing it.

1. A single duration (i.e., the single best estimate of elapsed time considering the scope of the work involved in the activity and the resources planned for accomplishing the activity) expressed in working days.

2. A five character (or less) code indicative of the party responsible for accomplishing the activity.

3. A cost estimate for each activity which, when accumulated with the cost of all activities, equals the total contract cost. Estimated overhead and profit shall be prorated throughout all activities. Materials costs shall be assigned to delivery activities.

4. A brief description of the activity.

E. The selection and number of activities shall be subject to the Engineer's approval. The detailed network need not be time scaled but shall be drafted to show a continuous flow from left to right with no flow from right to left. In addition to the brief description, the Contractor shall submit a separate list of all activities containing a detailed narrative of the scope of each activity, including the trades, subcontractors involved, and number of man-hours estimated.

F. To the extent that the network or any revision thereof shows anything not jointly agreed upon or fails to show anything jointly agreed upon, it shall not be deemed to have been approved by the Engineer. Failure to include on a network any element of work required for the performance of this Contract shall not excuse the Contractor from completing all work required within any applicable completion date, notwithstanding the review of the network by the Engineer.

G. Except where earlier completions are specified, CPM schedules, which show completion of all work prior to the contract completion date, may be approved by the Engineer but in no event shall they be acceptable as a basis for claim for delay against the Owner by the Contractor.

1.04 COMPUTER-GENERATED SCHEDULE REQUIREMENTS

A. Each computer-generated schedule submittal from the CPM activity network shall include the following tabulations: a list of activities in numerical order, a list of activity precedence's, a schedule sequenced by Early Start Date and a schedule sequenced by Total Float. Each schedule shall include the following minimum items:

1. Activity numbers

2. Estimated duration

3. Activity description

4. Early start date (calendar dated)

5. Early finish date (calendar dated)

6. Latest allowable start date (calendar dated)

7. Latest allowable finish date (calendar dated)

8. Status (whether critical)

9. Estimated cost of the activity

10. Total float and free float

B. In addition, each schedule shall be prefaced with the following summary data:

1. Contract name and number

2. Contractor's Name

3. Contract duration

4. Contract schedule

5. The effective or starting date of the schedule.

C. The workday to calendar date correlation shall be based on an 8-hour day and 40-hour week with adequate allowance for holidays, adverse weather and all other special requirements of the work.

1.05 SUBMITTALS

A. Within 10 days following the issuance of the Notice to Proceed, the Contractor shall submit 4 copies of the CPM Schedule to the Engineer for review and acceptance. The Contractor shall submit to the Engineer a preliminary network defining the planned operations during the first 60 calendar days after the issuance of the Notice to Proceed. The Contractor's general approach for the balance of the project shall be indicated. Cost of activities expected to be completed or partially completed before submission and approval of the complete network shall be included.

1.06 APPROVED CPM SCHEDULE

A. Following review by the Engineer, the Contractor shall incorporate the Engineer's comments into the network and submit five prints and two reproducibles of the revised network and two copies of the computer-generated schedule. This final submittal shall be delivered to the Engineer within 60 days after the issuance of the Notice to Proceed.

B. CPM schedules, which contain activities showing negative, float or which extend beyond the contract completion date in the computer-generated schedule will not be approved.

C. The approved network shall then be the approved CPM schedule to be used by the Contractor for planning, organizing and directing the work, and reporting progress.

D. Approval of the CPM activity network by the Engineer is advisory only and shall not relieve the Contractor of responsibility for accomplishing the work within the contract completion date. Omissions and errors in the approved CPM schedule shall not excuse performance less than that required by the Contract. Approval by the Engineer in no way makes the Engineer an insurer of the CPM schedule's success or liable for time or cost overruns flowing from its shortcomings. The Owner hereby disclaims any obligation or liability by reason of approval by its agent, the Engineer, of the CPM schedule.

E. The CPM activity network shall be submitted on sheets 24-in by 36-in and may be divided into as many separate sheets as required. An electronic file in PDF format shall be submitted concurrent with the hard copy schedule.

1.07 PROGRESS REPORTING

A. Progress under the approved CPM schedule shall be evaluated monthly by the Contractor. Not less than seven days prior to each monthly progress meeting, The Contractor shall evaluate the status of each activity on which work has started or is due to start, based on the preceding CPM schedule; to **show actual progress,** to identify those activities started and those completed during the previous period, to show the estimated time required to complete or the percent complete of each activity started but not yet completed and to reflect any changes indicated for the network. Activities shall not be considered complete until they are, in fact, 100 percent complete.

B. At each progress meeting the Contractor shall submit a narrative report based on the CPM schedule evaluation described above, in a format agreed upon by the Contractor and the Engineer. The report shall include a description of the progress during the previous period in terms of completed activities, an explanation of each activity which is showing a delay, a description of problem areas, current and anticipated delaying factors and their estimated impact on performance of other activities and completion dates and an explanation of corrective action taken or proposed. This report, as well as the CPM Status Report, will be discussed at each progress meeting.

1.08 RESPONSIBILITY FOR SCHEDULE COMPLIANCE

A. Whenever it becomes apparent from the current CPM schedule and narrative report that delays to the critical path have resulted and the contract completion date will not be met, the Contractor shall take some or all of the following actions at no additional cost to the Owner. He shall submit to the Engineer for approval, a written statement of the steps he intends to take to remove or arrest the delay to the critical path in the approved schedule.

1.09 ADJUSTMENT OF CONTRACT SCHEDULE AND COMPLETION TIME

A. If the Contractor desires to make changes in his method of operating which affect the approved CPM schedule, he shall notify the Engineer in writing stating what changes are proposed and the reason for the change. If the Engineer approves these changes, the Contractor shall revise and submit for approval, without additional cost to the Owner, all of the affected portions of the CPM network. The Contractor shall adjust the CPM schedule only after prior approval of his proposed changes by the Engineer.

B. If the completion of any activity, whether or not critical, falls more than 100 percent behind its approved duration, the Contractor shall submit for approval a schedule adjustment showing each such activity divided into two activities reflecting completed versus uncompleted work.

C. Shop drawings which are not approved on the first submittal or within the schedule time and equipment which do not pass the specified tests shall be immediately rescheduled.

D. The contract time will be adjusted only for causes specified in this Contract. In the event the Contractor requests an extension of any contract completion date, he shall furnish such justification and supporting evidence as the Engineer may deem necessary to determine whether the Contractor is entitled to an extension of time under the provisions of this Contract. The Engineer will, after receipt of such justification and supporting evidence, make findings of fact and will advise the Contractor in writing thereof. If the Engineer finds that the Contractor is entitled to any extension of any contract completion date, the Engineer's determination as to the total number of day's extension shall be based upon the currently approved CPM schedule and on all data relevant to the extension. Such data shall be included in the next updating of the schedule. Actual delays in activities, which, according to the CPM schedule, do not affect any contract completion date shown by the critical path in the network, will not be the basis for a change therein.

E. Each request for change in any contract completion date shall be submitted by the Contractor to the Engineer within 30 days after the beginning of the delay for which a time extension is requested but before the date of final payment under this Contract. No time extension will be granted for requests, which are not submitted within the foregoing time limit.

1.10 COORDINATING SCHEDULES WITH OTHER CONTRACT SCHEDULES

A. Where work is to be performed under this Contract concurrently with or contingent upon work performed on the same facilities or area under other contracts, the Contractor's CPM Schedule shall be coordinated with the schedules of the other contracts. The Contractor shall obtain the schedules of the other appropriate contracts from the Owner for the preparation and updating of his CPM schedule and shall make the required changes in his schedule when indicated by changes in corresponding schedules.

B. In case of interference between the operations of different contractors, the Owner will determine the work priority of each Contractor and the sequence of work necessary to expedite the completion of the entire project. In all such cases, the decision of the Owner shall be accepted as final. The temporary delay of the Contractor's work due to such circumstances shall not be considered as justification for claims for additional compensation.

END OF SECTION

SECTION 01 32 33

CONSTRUCTION PHOTOGRAPHS

PART 1 - GENERAL

1.01 WORK INCLUDED:

A. This section covers construction progress photographs to be furnished by the Contractor on the project.

B. Construction photographs shall be provided by a commercial photographer acceptable to the Engineer.

PART 2 - PRODUCTS

2.01 PHOTOGRAPHS AND PRINTS:

A. Digital photographs shall be in .gif, .jpeg, .bmp or .tif format.

B. Prints shall be 8 x 10 full color on single weight, white base, and glossy paper, mounted with binder tabs.

C. Photographs shall be taken using a digital camera before groundbreaking, monthly throughout the Work, and on final acceptance of the project.

D. Twenty-four views shall be taken **once per month (specifier edit appropriately).** The Engineer shall approve selection of views. The Engineer will select eight views to be made into prints, from each disc produced at the frequency specified above.

E. Three prints of each of the eight views shall be furnished at the frequency specified above.

PART 3 - EXECUTION

3.01 COMPUTER DISC:

A. The twenty-four views shall be delivered to the Engineer on a CD-ROM Disc within six days of exposure.

B. Discs turned over to the Engineer shall be retained by the Engineer for future reference during the project.

3.02 PRINTS:

A. Each print shall be identified on the back with name of project, phase, orientation of view, date and time of exposure, name and address of photographer, and photographer's numbered identification of exposure.

B. Prints shall be delivered within 15 days after Engineer selects the views to print.

END OF SECTION

SECTION 01 33 23

SUBMITTALS

PART 1 - GENERAL

1.01 WORK INCLUDED:

A. The Contractor shall provide the Engineer with submittals as required by the contract documents.

1.02 RELATED WORK:

A. Divisions 1 – 32 of these specifications that require submittals.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

3.01 GENERAL:

A. As required by the General Conditions, Contractor shall submit a schedule of shop and working drawing submittals.

B. The Contractor shall submit the shop and working drawing submittals either electronically or hard copy.

3.02 ELECTRONIC SUBMITTALS:

A. In accordance with the accepted schedule, the Contractor shall submit promptly to the Engineer by email (marianom@wseinc.com), one electronic copy in Portable Document Format (PDF) of shop or working drawings required as noted in the specifications, of equipment, structural details and materials fabricated especially for this Contract.

B. Each electronic copy of the shop or working drawing shall be accompanied by the Engineer's standard shop drawing transmittal form, included as Exhibit 1 of this section (use only for electronic submittals), on which is a list of the drawings, descriptions and numbers and the names of the Owner, Project, Contractor and building, equipment or structure.

C. The Contractor shall receive a shop drawing memorandum with the Engineer's approval or comments via email.

3.03 HARD COPY SUBMITTALS:

A. In accordance with the accepted schedule, the Contractor shall submit promptly to the Engineer, by mail (to Weston & Sampson Engineers, attention: CSD), six (6) copies each of shop or working drawings required as noted in the specifications, of equipment, structural details and materials fabricated especially for this Contract.

B. Each shipment of drawings shall be accompanied by the Engineer's (if applicable) standard shop drawing transmittal form on which is a list of the drawings, descriptions and numbers and the names of the Owner, Project, Contractor and building, equipment or structure.

3.04 SHOP AND WORKING DRAWINGS:

A. Shop and working drawings shall show the principal dimensions, weight, structural and operating features, space required, clearances, type and/or brand of finish of shop coat, grease fittings, etc., depending on the subject of the drawings. When it is customary to do so, when the dimensions are of particular importance, or when so specified, the drawings shall be certified by the manufacturer or fabricator as correct for this Contract.

B. All shop and working drawings shall be submitted to the Engineer by and/or through the Contractor, who shall be responsible for obtaining shop and working drawings from his subcontractors and returning reviewed drawings to them. All shop and working drawings shall be prepared on standard size, 24-inch by 36-inch sheets, except those, which are made by changing existing standard shop or working drawings. All drawings shall be clearly marked with the names of the Owner, Project, Contractor and building, equipment or structure to which the drawing applies, and shall be suitably numbered. Each shipment of drawings shall be accompanied by the Engineer's (if applicable) standard shop drawing transmittal form on which is a list of the drawings, descriptions and numbers and the names mentioned above.

C. Only drawings that have been prepared, checked and corrected by the fabricator should be submitted to the Contractor by his subcontractors and vendors. Prior to submitting drawings to the Engineer, the Contractor shall check thoroughly all such drawings to satisfy himself that the subject matter thereof conforms to the Contract Documents in all respects. Shop drawings shall be reviewed and marked with the date, checker's name and indication of the Contractor's approval, and only then shall be submitted to the Engineer. Shop drawings unsatisfactory to the Contractor shall be returned directly to their source for correction, without submittal to the Engineer. Shop drawings submitted to the Engineer without the Contractor's approval stamp and signature will be rejected. Any deviation from the Contract Documents indicated on the shop drawings must be identified on the drawings and in a separate submittal to the Engineer, as required under subsection 6.17 Shop Drawings and Samples; D. Submittal Procedures, Paragraph 3 of the 1996 General Conditions.

D. The Contractor shall be responsible for the prompt submittal and resubmittal, as necessary, of all shop and working drawings so that there will be no delay in the work due to the absence of such drawings.

E. The Engineer will review the shop and working drawings as to their general conformance with the design concept of the project and general compliance with the information given in the Contract Documents. Corrections of comments made on the drawings during the review do not relieve the Contractor from compliance with requirements of the Contract Documents. The Contractor is responsible for: confirming and correlating all quantities and dimensions; selecting fabrication processes and techniques of construction; coordinating his work with that of all other trades; and performing his work in a safe and satisfactory manner. The review of the shop drawings is general and shall not relieve the Contractor of the responsibility for details of design, dimensions, code compliance, etc., necessary for interfacing with other components, proper fitting and construction of the work required by the Contract and for achieving the specified performance. The Engineer will review submittals two times: once upon original submission and a second time if the Engineer requires a revision or corrections. The Contractor shall reimburse the Owner amounts charged to the Owner by the Engineer for performing any review of a submittal for the third time or greater.

F. With few exceptions, shop drawings will be reviewed and returned to the Contractor within 30 days of submittal.

G. No material or equipment shall be purchased or fabricated especially for this Contract nor shall the Contractor proceed with any portion of the work, the design and details of which are dependent upon the design and details of equipment or other features for which review is required, until the required shop and working drawings have been submitted and reviewed by the Engineer as to their general conformance and compliance with the project and its Contract Documents. All materials and work involved in the construction shall then be as represented by said drawings.

H. Two copies of the shop and working drawings and/or catalog cuts will be returned to the Contractor. The Contractor shall furnish additional copies of such drawings or catalog cuts when he needs more than two copies or when so requested.

3.05 SAMPLES:

A. Samples specified in individual Sections include, but are not necessarily limited to, physical examples of the work such as sections of manufactured or fabricated work, small cuts or containers of materials, complete units of repetitively-used products, color/texture/pattern swatches and range sets, specimens for coordination of visual effect, graphic symbols, and units of work to be used by the Engineer or Owner for independent inspection and testing, as applicable to the work.

B. The number of samples submitted shall be as specified. Submittal and processing of samples shall follow the procedures outlined for shop and working drawings unless the specifications call for a field submittal or mock-up.

C. Acceptance of samples will be acknowledged via a copy of the transmittal noting status. When samples are not acceptable, prompt resubmittal will be required.

3.06 OPERATING AND MAINTENANCE MANUALS AND SPARE PARTS LISTS:

A. Where reference is made in technical specification sections to operating and maintenance manuals and/or spare parts lists, the Contractor shall submit four copies to the Engineer for review in accordance with the instructions furnished under "Shop and Working Drawings." If the submittal is complete and does not require any changes, an acknowledgement (copy of transmittal) will be returned noting status. If the submittal is incomplete or does require changes, corrections, additions, etc., two copies of the submittal will be returned with a copy of transmittal noting status. Four copies of the final operating and maintenance manuals and/or spare parts list shall be delivered to the Engineer prior to or with the equipment when it is delivered to the job site. For systems requiring field adjustment and balancing, such as heating and ventilating, the Contractor shall submit separate test results and adjustment data on completion of the work, to be incorporated into the system manual.

B. The information included in the manual shall be as described in the specification sections, but as a minimum shall contain clear and concise instructions for operating, adjusting, lubricating and maintaining the equipment, an exploded assembly drawing identifying each part by number and a listing of all parts of the equipment, with part numbers and descriptions required for ordering spare parts. Spare parts lists shall include recommended quantity and price.

C. Operating and maintenance manuals shall be in durable loose-leaf binders, on 8½-inch by 11-inch paper, with diagrams and illustrations either on 8½-inch by 11 inch or multiple foldouts. The instructions shall be annotated to indicate only the specific equipment furnished. Reference to other sizes or models of similar requirement shall be deleted or neatly lined out.

END OF SECTION

EXHIBIT 1 TO SECTION 01 33 23 SUBMITTALS

SHOP DRAWING TRANSMITTAL FORM

Shop Drawing Transmittal

Weston & Sampson℠

Instruction for Preparing Transmittal

No action will be taken on any item unless accompanied by this form.
TRANSMITTAL NOS. to be consecutive (1, 2, 3, etc.).
Each resubmittal of same item shall use same number with suffix letter (A, B, etc.).
SPEC. SECT. NO: Only one spec. section no. to each transmittal.
DESCRIPTION: Complete identification of document or group of documents.
SOURCE: Originator of document(s) being submitted.

DRAWING NO: Identification of document(s).
CONTRACT DRAWING REFERENCE: Contract drawing number(s) showing details of document(s).
SPECIAL INSTRUCTIONS: Special cases and emergencies, changes in distribution and special handling requests, etc. should be entered here.
SIGNATURE OF CONTRACTOR: Signature of individual who reviews and approves material prior to submittal to engineer.

THIS SECTION TO BE COMPLETED BY CONTRACTOR

TRANSM. NO.	SPEC. SECT. NO.	DATE	CONTRACTORS JOB NO.	W&S JOB NO.

PROJECT NAME & CONTRACT NO.	LOCATION

Attention: MM (marianom@wseinc.com)
Weston & Sampson
85 Devonshire Street Boston, MA 02109

FROM

By W&S

ITEM NO.	DESCRIPTION	SOURCE	DRAWING NO. CATALOG NO. BROUCHURE, ETC	NO. OF COPIES	CONTRACT DRAWING REF.	ACTION CODE	REVIEWED BY
1							
2							
3							
4							

THIS CERTIFIES THAT ALL ITEMS SUBMITTED HEREWITH HAVE BEEN CHECKED BY THE CONTRACTOR, ARE IN CONFORMANCE WITH THE REQUIREMENTS OF THE CONTRACT DOCUMENTS, EXCEPT AS NOTED, AND ARE APPROVED BY THE CONTRACTOR FOR THIS PROJECT.

SIGNATURE & TITLE

THIS SECTION TO BE COMPLETED BY WESTON & SAMPSON

ACTION CODE:
1. NO EXCEPTIONS TAKEN
2. MAKE CORRECTIONS NOTED
3. AMEND AND RESUBMIT
4. REJECTED- SEE REMARKS
5. ACKNOWLEDGEMENT
6. SUBMITTAL NOT REQUIRED, RETURNED WITHOUT REVIEW

a. INSTALLATION SHALL PROCEED ONLY WHEN ACTION CODE IS 1 OR 2
b. ACTION CODED 3 SHALL BE RESUBMITTED WITHIN TIME LIMIT SET IN CONTRACT
c. REVIEW DOES NOT RELIEVE CONTRACTOR FROM RESPONSIBILITY OF COMPLIANCE WITH ALL REQUIREMENTS OF THE CONTRACT DOCUMENTS

Weston & Sampson

SECTION 01 45 23

STRUCTURAL TESTS AND INSPECTIONS

PART 1 -GENERAL

The term "Contractor" or "General Contractor" as used in the Division 00, Division 01 and all Technical Specification Sections shall be synonymous with the installing contractor for which the work is applicable to, unless noted otherwise.

1.01 WORK INCLUDED:

A. Provide labor, materials, and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Obtaining, coordinating, and providing notifications to the Owner and Engineer.
2. Provide safe access to the work of this Contract to accommodate the indicated tests and inspections.
3. Implementing corrective action and providing additional tests and/or inspections for work identified as non-conforming by the Independent Testing Agency.

1.02 GENERAL REQUIREMENTS:

A. The Massachusetts State Building Code 9th Edition (2015 International Building Code with Massachusetts' Amendments), requires the Structural Engineer of Record (SER) to provide a program of structural tests and inspections for this project.

B. Attachment A, Program of Structural Tests and Inspections, shall not relieve the Contractor or its subcontractors of their responsibilities and obligations for quality control of the Work; their other obligations for supervising the Work; for any design work which is included in their scope of services; for full compliance with the requirements of the Contract Documents; the detection of, or failure to detect, deficiencies or defects, whether detected or undetected, in all parts of the Work, and to otherwise comply with all requirements of the Contract Documents.

C. The Program of Structural Tests and Inspection does not apply to the Contractor's equipment, temporary structures used by the Contractor to construct the project, the Contractor's means, methods, procedures, and job site safety.

1.03 CONTRACTOR RESPONSIBILITIES:

A. The Contractor shall provide free and safe access to the Work for the SER and all other individuals who are observing the Work or performing structural tests or inspections. The Contractor shall provide all ladders, scaffolding, staging, and up-to-date safety equipment, all in good and safe working order, and qualified personnel to handle and erect them, as may be required for safe access.

B. The Contractor shall give reasonable notice to the Owner and the Engineer of when the various parts of the Work will be ready for testing and/or inspection. The Contractor shall notify the Owner and the Engineer a minimum of 48 hours before such tests and/or inspections are to take place.

PART 2 - PRODUCTS

NOT USED.

PART 3 - EXECUTION

NOT USED.

ATTACHMENT A

PROGRAM OF STRUCTURAL TESTS AND INSPECTIONS

The following is a summary of Work subject to Tests and Inspections under the Program.

1. In-situ Bearing Strata for Footings
2. Controlled Structural Fill
3. Cast-In-Place Concrete
4. Structural Steel

Abbreviation	Agent
SER	Structural Engineer of Record
ITA	Contractor – Independent Testing Agency

In-Situ Bearing Strata for Footings

Item	Agent	Scope
1. Bearing Strata QC Review	ITA/SER	Review Contractor's field quality control procedures.
2. General Excavation	ITA/SER	Inspect strata for conformance to the structural drawings, specifications, and/or geotechnical report.
3. General Excavation	ITA/SER	Ensure that excavation is to proper depth or material.
4. General Excavation	ITA/SER	Ensure that excavation is controlled and contains no unsuitable materials.
5. Bearing surfaces for footings	ITA/SER	Inspect bearing surfaces for conformance to the requirements of the structural drawings, specifications, and/or geotechnical report.

Controlled Structural Fill

Item	Agent	Scope
1. Controlled Structural Fill QC Review	SER	Review Contractor's field quality control procedures
2. Fill Material	ITA	Test material for conformance to specifications or geotechnical report. Perform laboratory compaction tests in accordance with the specifications to determine optimum water content and maximum dry density.
3. Installation of controlled structural fill	ITA	Provide full-time inspection of the installation, in accordance with the specifications.
4. Density of Fill	ITA	Perform field density tests of the in-place fill in accordance with the specifications.

Cast-In-Place Concrete Construction

Item	Agent	Scope
1. Cast-In-Place Concrete Construction QC Review	SER	Review Contractor's field quality control procedures. Review frequency and scope of field testing and inspections.
2. Mix Design	SER	Review Mix Designs
3. Materials	SER	Review material certifications for conformance to Specifications
4. Batching Plant	ITA	Review Plant quality control procedures and batching and mixing methods
5. Reinforcement Installation	ITA	Inspect reinforcing for size, quantity, condition and placement
6. Anchor Rods	ITA	Inspect anchor rods prior to and during placement of concrete.
6. Formwork	ITA	Inspect form sizes for proper sizes of concrete members.
7. Concrete Placement and Sampling fresh Concrete	ITA	Observe concrete placement operations. Verify conformance to specifications including cold-weather and hot-weather placement procedures. Perform slump, density and air content tests at point of discharge.
8. Evaluation of Concrete	ITA	Test and evaluate in accordance with the specifications.
9. Curing and Protection	ITA	Observe procedures for conformance to the specifications.

Structural Steel

Item	Agent	Scope
1. Fabricator Certification/Quality Control Procedures	SER	Review Contractor's field quality control procedures. Review frequency and scope of field testing and inspections.
2. Fabricator Certification/Quality Control Procedures	SER	Review each Fabricator's quality control procedures.
3. Fabricator Inspection	SER	Inspect in-plant fabrication, or review Fabricator's approved Independent Inspection Agency's reports.
4. Materials	SER	Review materials certifications for conformance to the specifications.
5. Anchor Rods	SER	Review Contractor's as-built survey.
6. Anchor Rods	ITA	Verify that all anchor rods have been properly torqued and have adequate fit-up.
7. Bolting	ITA	Test and inspect bolted connections in accordance with specifications. Verify bolt size and grade.
8. Welding	ITA	Check welder qualifications. Visually inspect fillet welds and test full penetration field welds in accordance with specifications
9. Shear Connectors	ITA	Inspect for size and placement. Test for proper weld attachment
10. Structural Framing, Details, and Assembly	ITA	Inspect for size, grade of steel, camber, installation and connection details. Check against Contract Documents and approved shop drawings.
11. Expansion and Adhesive Anchors	SER	Review installation procedures for both mechanical anchors and adhesive anchors. Verify that materials are suitable for job conditions.

Item	Agent	Scope
12. Metal Decking	ITA	Verify gage, width, and type. Inspect placement, laps, welds, side laps attachment and screws or other mechanical fasteners. Check welder qualifications.
13. Field Correction of Fabricated Items	ITA	Review documentation of approved repairs and verify completion of repairs.

END OF SECTION

SECTION 01 55 26.13

TRAFFIC CONTROL SIGNAGE

PART 1 - GENERAL

1.01 WORK INCLUDED:

This Section covers furnishing and installing traffic control signs and other devices.

1.02 SYSTEM DESCRIPTION:

The Contractor shall furnish and install all construction signs deemed necessary by and in accordance with the latest edition of Part VI of the Manual on Uniform Traffic Control Devices (MUTCD) as published by the U.S. Department of Transportation.

PART 2 - PRODUCTS

2.01 TRAFFIC WARNING AND REGULATING DEVICES:

Contractor shall provide warning signs, barricades and other devices in accordance with the specifications provided in the MUTCD. Size of signs, lettering, colors, method of support and other factors prescribed in the MUTCD shall be adhered to.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Contractor shall erect barricades, barrier fences, traffic signs, and other traffic control devices as required by the MUTCD, or as required by the Engineer, to protect the work area from traffic, pedestrians, and animals.

B. Contractor shall relocate barricades, signs and other devices as necessary as the work progresses.

C. Unless extended protection is required for specific areas, when the work has been completed, all temporary warning and regulatory devices used by the Contractor shall be removed so that traffic can move unimpeded through the area.

END OF SECTION

SECTION 01 56 26

TEMPORARY CHAIN LINK FENCE

PART 1 - GENERAL

1.01 WORK INCLUDED:

A. The Contractor shall provide all labor, materials and appurtenances necessary for the installation, maintenance and dismantling of 6-foot temporary fencing.

B. The Contractor shall be responsible for securing the site from trespassers.

1.02 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF GENERAL SPECIFICATIONS, SUBMIT THE FOLLOWING:

A. Electronic submittal of manufacturers literature of the materials specified herein shall be submitted to the Engineer for review.

B. Electronic submittal of shop drawings of the temporary chain link fence and gates shall be submitted to the Engineers for review.

1. Shop drawings shall indicate layout of temporary fencing, location and size of gates, existing pavement and roads, and other site specific conditions. Prepare drawing after site observation and verification of existing conditions.

PART 2 - PRODUCTS-GALVANIZED

2.01 TEMPORARY CHAIN LINK FENCING

A. Unless otherwise indicated, type of 8-foot temporary chain link fencing shall be Contractor's option. Following types are acceptable:

1. New materials or previously used salvaged chain link fencing in good condition.

2. Posts: Galvanized steel pipe of diameter to provide rigidity. Post shall be suitable for setting precast concrete blocks.

3. Fabric: Woven galvanized steel wire mesh. Provide in continuous lengths to be wire tied to fence posts or prefabricated into modular pipe-framed fence panels.

4. Screen: The contractor shall furnish and install screen on the temporary fence.

B. Gates: Provide gates of the quantity and size indicated on the Contract Drawings or required for functional access to Site.

1. Fabricate of same material as used for fencing.

2. Vehicle gates:

   a. Minimum width: 20 feet to allow access for emergency vehicles.
   b. Capable of manual operation by one person.

PART 3 - EXECUTION

3.01 INSTALLATION

A. The fence and gates shall be erected by skilled mechanics in accordance with the recommendations of the manufacturer and these specifications. These specifications shall take precedence over the recommendations of the manufacturer if any discrepancy exists between them.

B. Posts

   1. Maximum post spacing shall be 10-feet. Post spacing shall be uniform and posts shall be plumb.

   2. Drive posts, set in holes and backfill, or anchor in precast concrete blocks.

   3. For soft and unstable ground conditions, cast concrete plug around post.

   4. Posts over pavement: Use steel post plates or precast concrete blocks.

   5. Gate posts: Use bracing or concrete footings to provide rigidity for accommodating size of gate.

   6. Temporary terminal posts shall be securely connected to existing fence posts to prevent site access/trespassing.

C. Securely attach wire fabric to posts. Maximum area of unbraced fence fabric shall not exceed 1,500 square feet.

D. Install with required hardware.

E. Fabric shall be stretched taut, with the bottom edge following the existing grade, and shall be a continuous mesh between terminal posts. Each span of fabric shall be attached independently at terminal posts. Where terminal posts do not have provisions for weaving fabric to posts, stretcher bars shall be placed through the end weave of the fabric and secured to the post with bar bands spaced not more than 15-inches apart on the post.

Temporary terminal posts shall be secured to existing fence posts to prevent Site access/trespassing.

F. Fabric shall be attached with ties to line posts at intervals of not more than 14-inches (and to the top railing and braces at intervals not exceeding 24-inches).

G. The bottom tension wire shall be interlaced in the weave of the fabric, pulled taut and fastened to terminal posts.

3.02 MAINTENANCE AND REMOVAL

A. Maintain fencing in good condition. If damaged, immediately repair.

B. Remove temporary fencing upon completion of Work or when no longer required for security or control. Backfill holes and compact. Holes in pavement shall be surfaced to match existing paving. Repair damage caused by installation of temporary fencing.

END OF SECTION

SECTION 01 57 19

ENVIRONMENTAL PROTECTION

PART 1 – GENERAL

1.01 DESCRIPTION:

A. The work covered by this section of the specifications consists of furnishing all labor, materials, tools and equipment and performing all work required for the prevention of environmental pollution during and as a result of construction operations under this contract.

B. The requirements set forth in this section of the specifications apply to cross-country areas, river and stream crossings, and construction in and adjacent to wetlands, unless otherwise specifically stated.

C. Prior to commencement of work, the Contractor shall meet with representatives of the Engineer to develop mutual understandings relative to compliance of the environmental protection program.

1.02 RELATED WORK:

A. Section 00 31 43, PERMITS

B. Section 01 33 23, SUBMITTALS

C. Section 31 00 00, EARTHWORK

D. Section 31 23 19, DEWATERING

PART 2 - PRODUCTS

2.01 STRAW BALES:

A. Straw bales shall consist of certified seed free stems of agricultural grain and cereal crops and shall be free of grasses and legumes. Standard bales shall be 14-inches high, 18- inches wide and 36- to 40-inches long tied with polypropylene twine and weigh within 5 percent of 7 lbs. per cubic ft.

2.02 STRAW WATTLES:

A. Straw Wattles shall consist of a 100% biodegradable exterior jute or coir netting with 100% wheat straw interior filling as manufactured by Granite Environmental, Inc., Sebastian, Florida (Phone: 888-703-9889; website: www.erosionpollution.com), or approved equal.

2.03 CATCH BASIN PROTECTION:

A. To trap sediment and to prevent sediment from clogging drainage systems, catch basin protection in the form of a siltation sack (Siltsack as manufactured by ACF Environmental, Inc. or approved equal) shall be provided as approved by the Engineer.

PART 3- EXECUTION

3.01 NOTIFICATION AND STOPPAGE OF WORK:

A. The Engineer will notify the Contractor in writing of any non-compliance with the provisions of the Order of Conditions. The Contractor shall, after receipt of such notice, immediately take corrective action. Such notice, when delivered to the Contractor or his authorized representative at the site of the work, shall be deemed sufficient for the purpose. If the Contractor fails to act promptly, the Owner may order stoppage of all or part of the work through the Engineer until satisfactory corrective action has been taken. No claim for an extension of time or for excess costs or damage incurred by the Contractor as a result of time lost due to any stop work orders shall be made unless it was later determined that the Contractor was in compliance.

3.02 AREA OF CONSTRUCTION ACTIVITY:

A. Insofar as possible, the Contractor shall confine his construction activities to those areas defined by the plans and specifications. All land resources within the project boundaries and outside the limits of permanent work performed under this contract shall be preserved in their present condition or be restored to a condition after completion of construction at least equal to that which existed prior to work under this contract.

3.03 PROTECTION OF WATER RESOURCES:

A. The Contractor shall not pollute streams, lakes or reservoirs with fuels, oils, bitumen’s, calcium chloride, acids or other harmful materials. It is the Contractor's responsibility to comply with all applicable Federal, State, County and Municipal laws regarding pollution of rivers and streams.

B. Special measures should be taken to insure against spillage of any pollutants into public waters.

3.04 CONSTRUCTION IN AREAS DESIGNATED AS WETLANDS:

A. Insofar as possible, the Contractor shall make every effort to minimize disturbance within areas designated as wetlands or within 100-feet of wetland resource areas. Total easement widths shall be limited to the widths shown.

B. The Contractor shall perform his work in such a way that these areas are left in the condition existing prior to construction.

C. The elevations of areas designated as wetlands shall not be unduly disturbed by the Contractor's operations outside of the trench limits. If such disturbance does occur, the Contractor shall take all measures necessary to return these areas to the elevations which existed prior to construction.

D. In areas designated as wetlands, the Contractor shall carefully remove and stockpile the top 24 inches of soil. This topsoil material shall be used as backfill for the trench excavation top layer. The elevation of the trench shall be restored to the preconstruction elevations wherever disturbed by the Contractor's operation.

E. The Contractor shall use a trench box, sheeting or bracing to support the excavation in areas designated as wetlands.

F. Excavated materials shall not be permanently placed or temporarily stored in areas designated as wetlands. Temporary storage areas for excavated material shall be as required by the Engineer.

G. The use of a temporary gravel roadway to construct the pipeline in the wetlands area is not acceptable. The Contractor will be required to utilize timber or rubber matting to support his equipment in these areas. The timber or rubber matting shall be constructed in such a way that it is capable of supporting all equipment necessary to install the pipeline. The timber or rubber matting shall be constructed of materials and placed in such a way that when removed the material below the matting will not be unduly disturbed, mixed or compacted so as to adversely affect recovery of the existing plant life.

H. Bentonite dams shall be placed in wetlands to prevent drainage. Locations for dams are as indicated on the drawings or as required by the Engineer.

I. During construction, easements within wetlands shall be lined with a continuous straw bale/siltation fence barrier or line of straw wattles (aka compost filter tube, silt/filter sock).

3.05 PROTECTING AND MINIMIZING EXPOSED AREAS:

A. The Contractor shall limit the area of land which is exposed and free from vegetation during construction. In areas where the period of exposure will be greater than two (2) months, temporary vegetation, mulching or other protective measures shall be provided as specified.

B. The Contractor shall take account of the conditions of the soil where temporary cover crop will be used to ensure that materials used for temporary vegetation are adaptive to the sediment control. Materials to be used for temporary vegetation shall be approved by the Engineer.

3.06 LOCATION OF STORAGE AREAS:

A. The location of the Contractor's storage areas for equipment and/or materials shall be upon cleared portions of the job site or areas to be cleared as a part of this project, and shall require written approval of the Engineer. Plans showing storage facilities for equipment and materials shall be submitted for approval of the Engineer.

B. No excavated materials or materials used in backfill operations shall be deposited within a minimum distance of one hundred (100) feet of any watercourse or any drainage facility. Adequate measures for erosion and sediment control such as the placement of baled straw around the downstream perimeter of stockpiles shall be employed to protect any downstream areas from siltation.

C. There shall be no storage of equipment or materials in areas designated as wetlands.

D. The Engineer may designate a particular area or areas where the Contractor may store materials used in his operations.

E. Storage areas in cross-country locations shall be restored to pre-construction conditions with the planting of native species of trees and shrubs.

3.07 PROTECTION OF LANDSCAPE:

A. The Contractor shall not deface, injure, or destroy trees or shrubs nor remove or cut them without written authority from the Owner. No ropes, cables, or guys shall be fastened to or attached to any existing nearby trees for anchorages unless specifically authorized by the Engineer. Excavating machinery and cranes shall be of suitable type and be operated with care to prevent injury to trees which are not to be removed, particularly overhanging branches and limbs. The Contractor shall, in any event, be responsible for any damage resulting from such use.

B. Branches, limbs, and roots shall not be cut except by permission of the Engineer. All cutting shall be smoothly and neatly done without splitting or crushing. When there is unavoidable injury to branches, limbs and trunks of trees, the injured portions shall be neatly trimmed and covered with an application of grafting wax or tree healing paint as directed.

C. Where, in the opinion of the Engineer, trees may possibly be defaced, bruised, injured, or otherwise damaged by the Contractor's equipment or by his blasting or other

operations, the Engineer may require the Contractor to adequately protect such trees by placing boards, planks, poles or fencing around them. Any trees or landscape feature scarred or damaged by the Contractor's equipment or operations shall be restored as nearly as possible to its original condition at the expense of the Contractor. The Engineer will decide what method of restoration shall be used, and whether damaged trees shall be treated and healed or removed and disposed of.

D. Cultivated hedges, shrubs, and plants which could be injured by the Contractor's operations shall be protected by suitable means or shall be dug up, balled and temporarily replanted and maintained. After construction operations have been substantially completed, they shall be replanted in their original positions and cared for until growth is re-established. If cultivated hedges, shrubs, and plants are injured to such a degree as to affect their growth or diminish their beauty or usefulness, they shall be replaced by items of a kind and quality at least equal to that existing at the start of the work.

3.08 DISCHARGE OF DEWATERING OPERATIONS:

A. Any water that is pumped and discharged from the trench and/or excavation as part of the Contractor's water handling shall be filtered by an approved method prior to its discharge into a receiving water or drainage system.

B. Under no circumstances shall the Contractor discharge water to the areas designated as wetlands. When constructing in a wetlands area, the Contractor shall discharge water from dewatering operations directly to the nearest drainage system, stream, or waterway after filtering by an approved method.

C. The pumped water shall be filtered through filter fabric and baled straw, a vegetative filter strip or a vegetated channel to trap sediment occurring as a result of the construction operations. The vegetated channel shall be constructed such that the discharge flow rate shall not exceed a velocity of more than 1 foot per second. Accumulated sediment shall be cleared from the channel periodically.

3.09 DUST CONTROL:

A. During the progress of the work, the Contractor shall conduct his operations and maintain the area of his activities, including sweeping and sprinkling of streets as necessary, to minimize creation and dispersion of dust. If the Engineer decides it is necessary to use calcium chloride for more effective dust control, the Contractor shall furnish and spread the material, as directed.

B. Calcium Chloride shall not be used for dust control within a drainage basin or in the vicinity of any source of potable water.

3.10 SEPARATION AND REPLACEMENT OF TOPSOIL:

A. Topsoil shall be carefully removed from cross-country areas where excavations are to be made, and separately stored to be used again as required. The topsoil shall be stored in an area acceptable to the Engineer and adequate measures shall be employed to prevent erosion of said material.

3.11 CATCH BASIN PROTECTION:

A. Catch basin protection shall be used for every catch basin, shown on the plans or as required by the Engineer, to trap sediment and prevent it from clogging drainage systems and entering wetlands. Siltation sacks shall be securely installed under the catch basin grate. Care shall be taken to keep the siltation sacks from breaking apart or clogging. All deposited sediment shall be removed periodically and at times prior to predicted precipitation to allow free drainage flow. Prior to working in areas where catch basins are to be protected, each catch basin sump shall be cleaned of all debris and protected. The Contractor shall properly dispose of all debris at no additional cost to the Owner.

3.12 STRAW WATTLES:

A. The wattles will be placed in a shallow trench (2-3 inches deep) and staked in the ground using wooden stakes driven at 4-foot intervals. The wooden stakes will be placed at a minimum depth of 24-inches into the ground.

END OF SECTION

SECTION 01 74 13

CLEANING UP

PART 1 - GENERAL

1.01 DESCRIPTION:

The Contractor must employ at all times during the progress of its work adequate cleanup measures and safety precautions to prevent injuries to persons or damage to property. The Contractor shall immediately, upon request by the Engineer provide adequate material, equipment and labor to cleanup and make safe any and all areas deemed necessary by the Engineer.

1.02 RELATED WORK:

A. Section 01 11 00 CONTROL OF WORK AND MATERIALS

B. Section 01 14 00 SPECIAL PROVISIONS

C. Section 01 57 19 ENVIRONMENTAL PROTECTION

PART 2 - PRODUCTS

Not applicable

PART 3 - EXECUTION

2.01 DAILY CLEANUP:

A. The Contractor shall clean up, at least daily, all refuse, rubbish, scrap and surplus material, debris and unneeded construction equipment resulting from the construction operations and sweep the area. The site of the work and the adjacent areas affected thereby shall at all times present a neat, orderly and workmanlike appearance.

B. Upon written notification by the Engineer, the Contractor shall within 24 hours clean up those areas, which in the Engineer's opinion are in violation of this section and the above referenced sections of the specifications.

C. If in the opinion of the Engineer, the referenced areas are not satisfactorily cleaned up, all other work on the project shall stop until the cleanup is satisfactory.

2.02 MATERIAL OR DEBRIS IN DRAINAGE FACILITIES:

A. Where material or debris has washed or flowed into or has been placed in existing watercourses, ditches, gutters, drains, pipes, structures, such material or debris shall be entirely removed and satisfactorily disposed of during progress of the work, and the ditches, channels, drains, pipes, structures, and work shall, upon completion of the work, be left in a clean and neat condition.

2.03 REMOVAL OF TEMPORARY BUILDINGS, STRUCTURES AND EQUIPMENT:

A. On or before completion of the work, the Contractor shall, unless otherwise specifically required or permitted in writing, tear down and remove all temporary buildings and structures it built; shall remove all temporary works, tools and machinery or other construction equipment it furnished; shall remove all rubbish from any grounds which it has occupied; shall remove silt fences and hay bales used for trapping sediment; and shall leave the roads and all parts of the property and adjacent property affected by its operations in a neat and satisfactory condition.

2.04 RESTORATION OF DAMAGED PROPERTY:

A. The Contractor shall restore or replace, when and as required, any property damaged by its work, equipment or employees, to a condition at least equal to that existing immediately prior to the beginning of operations. To this end the Contractor shall do as required all necessary highway or driveway, walk and landscaping work. Materials, equipment, and methods for such restoration shall be as approved by the Engineer.

2.05 FINAL CLEANUP:

A. Before acceptance by the Owner, the Contractor shall perform a final cleanup to bring the construction site to its original or specified condition. This cleanup shall include removing all trash and debris off of the premises. Before acceptance, the Engineer shall approve the condition of the site.

END OF SECTION

SECTION 01 78 00

PROJECT CLOSEOUT

PART 1 - GENERAL

1.01 WORK INCLUDED:

A. This Section covers administrative and procedural requirements for closing out the project, including, but not limited to:

1. Project as-built documents
2. Checkout and Certification
3. Startup and Testing
4. Final Cleaning
5. Substantial Completion
6. Closeout Procedures
7. Final Completion
8. Correction/Warranty Period

B. Closeout checklist to be completed by the Engineer.

1.02 RELATED WORK:

A. General Requirements in their entirety.

B. Section 01 74 13, CLEANING UP

C. Division 2 through Division 31.

1.03 AS-BUILT DOCUMENTS:

A. Contractor shall maintain on site, separate from the documents used for construction, one set of the documents listed below, and as construction progresses, shall legibly record on these documents all changes made during construction.

1. Contract Drawings.

2. Specifications.

3. Addenda.

4. Change Orders and other Modifications to the Contract.

5. Reviewed shop drawings, product data, and samples.

6. Written interpretations and clarifications.

7. Field Orders.

8. Field test reports properly verified.

B. The completed set of as-built documents shall be submitted to the Engineer with the final Application for Payment.

1.04 CHECKOUT AND CERTIFICATIONS:

A. Prior to checkout and certifications, the following tasks shall be completed:

1. Construction shall be complete. For this purpose, completion of construction is defined as follows:

a. The Contractor has completed construction and erection of the work in conformance with the Contract Drawings and Specifications.

b. The Contractor has installed and adjusted operating equipment, systems, or facilities, as applicable, as defined by the manufacturers' erection, installation, operation and maintenance instructions.

2. All shop drawings shall have final approval.

3. All shop tests shall be complete and approved test results submitted to the Engineer.

1.05 START-UP AND TESTING:

A. Prior to start-up the following tasks shall be complete:

1. All checkout and certifications shall be satisfactorily completed,

2. All operations and maintenance manuals shall be approved,

3. All preliminary training by the manufacturer's representative shall be completed,

4. An approved start-up procedure shall be in place.

1.06 FINAL CLEANING:

A. Complete the following cleaning operations before requesting inspection for Certification of Substantial Completion.

1. Clean the site, including landscape development areas of rubbish, litter and other foreign substances. Sweep paved areas broom clean; remove stains, spills and other foreign deposits. Rake grounds that are neither paved nor planted, to smooth, even textured surfaces.

2. Remove waste and surplus materials, rubbish, fencing equipment, temporary utilities and construction facilities from the site, unless otherwise required by the Engineer.

3. Comply with requirements of Section 01 74 13 CLEANING UP.

1.07 SUBSTANTIAL COMPLETION:

A. Substantial Completion is officially defined in the General and Supplementary Conditions. The date of substantial completion will be certified by the Engineer. This date will not be certified until the following requirements have been satisfied by the Contractor:

1. All Contract requirements are coordinated into a fully operational system. All individual units of equipment and treatment are fully operative and performing at specified efficiencies. Where efficiencies are not specified, performance shall meet acceptable standards for the particular unit.

2. All field tests have been satisfactorily completed and reports forwarded to the Engineer.

3. All final training has been completed by the manufacturers' representatives.

4. All spare parts and lubricants have been satisfactorily delivered to the Owner. Spare parts are for the exclusive use of the Owner when the facility has been turned over. Contractor is responsible for all maintenance and repair materials required until the facility is accepted by the Owner.

1.08 CLOSEOUT PROCEDURES:

A. Submit written certification that Contract Documents have been reviewed, Work has been

inspected, and is complete in accordance with Contract Documents and ready for Engineer's and Owner's inspection.

B. Accompany Engineer and Owner on inspection to verify conformance with the Contract Documents. Prepare a punch list of work items that have been determined by inspection to not conform to Contract Documents. Punch list items shall include work items that are missing, incomplete, damaged, incorrect items, or improperly installed or constructed. The Contractor shall correct the punch list deficiencies by re-work, modifications, or replacement, as appropriate, until the items conform to the Contract Documents. The initial punch list shall be produced by the Contractor, with copies to the Engineer and Owner. When the Contractor has reduced the number of deficient items to a reasonable level, the Engineer will develop a definitive punch list for the use of the Contractor.

C. Provide submittals to Engineer that are required by governing or other authorities.

D. Submit final Application for Payment identifying total adjusted Contract Sum, previous payments, and sum remaining due. The Contractor shall submit the following documents with or prior to Final Application for Payment: Set of as-built documents, Contract Completion and Acceptance Certificate, Consent of Surety to Final Payment, Release and Waiver of Liens and Claims, Affidavit of Payment of Debts and Claims, and remaining releases, waivers, warranties/guarantees, and all other data required by the Contract Documents.

1.09 FINAL COMPLETION:

A. Prior to final completion, the following tasks shall be completed:

1. All items in the punch list shall be completed.

2. All Contract closeout documentation shall be submitted to and accepted by the Engineer.

1.10 CORRECTION/WARRANTY PERIOD:

A. During the correction period, the Contractor shall correct all deficiencies in equipment and materials.

B. During the warranty period, the Contractor shall perform all corrective work on warranty deficiencies.

C. Corrective work will be identified by the Engineer or Owner, as appropriate. The Contractor will be notified of the item(s) requiring corrective work.

D. The Contractor shall begin work on all corrective work within ten days of being notified of the deficiency by the Engineer and shall then work continuously until the deficiency is

corrected. Upon completion of the corrective work, the Contractor shall submit a letter report to the Engineer describing the deficiency and the corrective action that was taken.

E. The Contractor shall coordinate all corrective work with the Engineer and/or the Owner.

1.11 COMPLETION CHECKLIST:

PROJECT COMPLETION CHECKLIST

Owner _____ Job No.

Project

As part of the project closeout, all items listed below must be checked off as being complete or otherwise accounted for. The person verifying completion of the item shall list the completion date and his/her initials.

Project Closeout Checklist		
	Date Completion Verified	Verified by
AS-BUILT DOCUMENTS HANDED OVER		
1. Contract Drawings		
2. Specifications		
3. Addenda		
4. Change Orders/Contract Modifications		
5. Reviewed Shop Drawings, Product Data and Samples		
6. Written Interpretations/Clarifications		
7. Field Orders		
8. Field Test Reports		
EQUIPMENT CHECKOUT AND CERTIFICATIONS		
1. Construction Complete per Drawings/Specifications		
2. Equipment Installed and Adjusted		
3. All Shop Drawings have Final Approval		
4. All Shop Tests Complete and Results Submitted		

Project Closeout Checklist

	Date Completion Verified	Verified By
START-UP AND TESTING		
1. All Checkout and Certifications Complete		
2. All O&M Manuals Approved		
3. All Preliminary Training by Manufacturers Rep. Completed		
FINAL CLEANING		
1. All Construction Facilities Removed		
2. All Construction Debris Removed		
3. All Areas Swept/Cleared		
SUBSTANTIAL COMPLETION		
1. All Items Coordinated Into a Fully Operational System		
2. All Equipment Units Operational at Specified Efficiencies		
3. All Field Tests Completed and Reports Submitted		
4. All Final Training by Manufacturer's Rep. Completed		
5. All Spare Parts and Lubricants Provided		
CLOSEOUT PROCEDURES		
1. Written Certification Submitted that Work is Ready for Owner & Engineer Inspector		
2. Inspection by Owner, Engineer, Contractor completed		
3. Punch List of Nonconforming Items Prepared		
4. Documents Required by Governing or Other Authorities Submitted (List Them)		
5. Final Application for Payment Received		
6. Contact Completion and Acceptance Certificate Submittal		
7. Consent of Surety to Final Payment Submittal		
8. Release and Waiver of Liens and Claims Submitted		

Project Closeout Checklist		
	Date Completion Verified	Verified By
9. Affidavit of Payment of Debts and Claims Submitted		
10. Warranties/Guarantees Submitted		
11. Other Required Releases and Waivers Submitted (List Them)		
12. Permits Submitted (List Them)		
13. Weekly Payrolls Submitted as Required by Law		
FINAL COMPLETION		
1. All Items in Punch List Completed		
2. All Other Required Documentation Submitted (List It)		
CORRECTION/WARRANTY PERIOD		
1. Correction Period Start Date: _____ End Date: _____		
2. Specific Warranties Provided Item Warranty Duration		

Full name of persons signing their initials on this checklist:

_____

_____

_____

_____

_____

END OF SECTION

SECTION 01 92 13

OPERATION AND MAINTENANCE MANUALS

PART 1 - GENERAL

1.01 SCOPE OF WORK:

A. This section includes procedural requirements for compiling and submitting operation and maintenance data required to complete the project.

1.02 RELATED WORK:

A. General Requirements in their entirety

B. Individual Technical Specification Sections Specific for Operation and Maintenance Data.

C. Section 01 33 23, SUBMITTALS

1.03 FORMAT:

A. Prepare data in form of an instructional manual.

B. Binders: Commercial quality, 8 ½- x 11-inch three-ring binders with hardback, washable, plastic covers; two inch maximum ring size. When multiple binders are used, correlate data into related, consistent groupings. Provide a table of contents in each binder.

C. Cover: Identify each binder cover and spine with typed or printed title OPERATION AND MAINTENANCE INSTRUCTION; list title of Project facility; identify subject matter of contents.

D. Arrange contents by systems under section numbers and sequence of Table of Contents.

E. Provide tabbed flyleaf for each separate product and system, with typed description of product and major component parts of equipment.

F. Text: Manufacturer’s printed data, or typewritten date - on 20-pound paper.

G. Drawings: Provide with reinforced punched, binder tab. Bind in with text; fold larger drawings to size of text pages.

H. Submit certification that the data and drawings provided pertain exactly to the model, size, and series product and equipment installed in the work.

I. All documents will be electronically scannable.

J. All products, systems, and drawings must be cross-referenced with tag ID numbers.

K. The manual for each piece of equipment shall be a separate document with the following specific requirement:

1. Contents:

Table of Contents and Index

Brief description of each system and components

Starting and stopping procedures

Special operating instructions

Routine maintenance procedures

Manufacturer's printed operating and maintenance instructions, parts list, illustrations, and diagrams

One copy of each wiring diagram

One copy of each approved shop drawing and each Contractor's coordination and layout drawing

List of spare parts, manufacturer's price, and recommended quantity

Name, address and telephone number of local service representatives.

2. Material

Loose leaf on 60 pound, punched paper

Holes reinforced with plastic cloth or metal

Page size, 8 ½- x 11-inches

Diagrams, illustrations and attached foldouts as required, of original quality, reproduced by dry copy method

Covers: oil, moisture and wear resistant 9 x 12 size

1.04 QUALITY ASSURANCE:

A. Prepare instructions and data by personnel experienced in maintenance and operations of described products.

1.05 CONTENTS, EACH VOLUME (BINDER):

A. Table of Contents: Provide title of Contract, schedule of products and systems, indexed to content of the volume. A listing of all relevant tag ID numbers for each volume shall be placed immediately after the Table of Contents.

B. For each product or systems: List names, addresses, and telephone numbers of subcontractors and suppliers, including local source of suppliers and replacement parts.

C. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.

D. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.

E. Text: As required to supplement product data, provide logical sequence of instructions for each procedure incorporating manufacturer' s instructions.

F. Warranties, Guarantees, and Bonds: Bind copy of each

G. See O&M Manual Review Checklist at end of this specification section.

1.06 MANUAL FOR MATERIALS AND FINISHES:

A. Building Products, Applied Materials, and Finishes: Include product data with catalog number, size composition, and color and texture designations. Provide information for re-ordering custom manufactured products.

B. Instructions for Care and Maintenance: Include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.

C. Moisture Protection and Weather Exposed Products: Include product data listing applicable reference standards, chemical composition, and details of installation. Provide recommendations for inspections, maintenance, and repair.

D. Additional Requirements: As specified in individual product specification sections.

1.07 MANUAL FOR EQUIPMENT AND SYSTEMS:

A. Each Item of Equipment and Each System: Include description of unit or system and component parts. Identify function, normal operating characteristics and limiting conditions. Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.

B. Data submitted on all equipment shall include complete maintenance instructions (including preventive and corrective maintenance) and parts lists in sufficient detail to facilitate ordering replacements.

C. All products, systems, equipment, electrical wiring, instrumentation wiring, personnel protection systems wiring, presented in this manual will have tag numbers corresponding to contract drawings and specifications. In the event, numbers do not exist; the Engineer will specify a series of numbers.

D. Panelboard Circuit Directories: Provide electrical service characteristics, controls and communications.

E. Include color-coded wiring diagrams as installed.

F. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequence. Include regulation, control, stopping, shutdown, and emergency instructions. Include summer, winter and any special operating instructions.

G. Provide servicing and lubrication schedule, and list of lubricants required. Cross-reference lubricants to products offered by at least three major lubricant suppliers.

H. Include manufacturer’s printed operation and maintenance instructions.

I. Include sequence of operation by controls manufacturer.

J. Provide original manufacturer’s parts list, illustrations, assembly drawings, and diagrams required for maintenance.

K. Provide control diagrams by controls manufacturer as installed.

L. Provide Contractor’s coordination drawings, with color-coded piping diagrams as installed.

M. Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.

N. Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.

O. Include test and balancing reports, calibration data, alignment records, and other information.

P. Additional Requirements: as specified in individual product specification sections.

Q. Provide a listing in table of Contents for design data with tabbed flysheet and space for insertion of data.

R. Incorporation of all Physical Checkout information obtained through the field-testing and correction phases of the Work. Input must be specific to the actions and information obtained during those phases.

1.08 SUBMITTALS:

A. Submit draft and final copies of operation and maintenance manuals as described in Section 01 33 23.13 SUBMITTAL OF OPERATION AND MAINTENANCE MANUALS.

PART 2 – PRODUCTS

Not used.

PART 3 – EXECUTION

Not used.

Note to Specifier: Review the attached Checklist and add items that are required or delete items not relative to this project.

OPERATION AND MAINTENANCE MANUAL
REVIEW CHECKLIST

1. Name, address, telephone/fax number of the manufacturer ☐
2. Name, address, contact name, telephone/fax of local representative ☐
3. Name, address, telephone/fax number of the contractor ☐
4. Exploded view/general arrangement of materials of construction ☐
5. Description of operation/operating principal ☐
6. Project specific Operating parameters ☐
7. Wiring Diagrams (If Applicable) ☐
8. Troubleshooting checklist ☐
9. Recommended spare parts list with prices, and ordering instructions ☐
10. Model number and the serial number of the model provided ☐
11. Performance curves or tabulated data ☐
12. Routine Maintenance instructions/service instructions with recommended Intervals ☐
13. Assembly and disassembly instructions ☐
14. Recommended lubricates and lubrication schedule. ☐
15. Approved copies of Shop Drawings are to be included in the manual ☐
16. Startup/break-in and adjustment instructions ☐
17. Warranty information ☐

Reviewed By: _____ Date: _____
Weston & Sampson Engineers

END OF SECTION

SECTION 02 41 19

SELECTIVE DEMOLITION

PART 1 - GENERAL

1.01 SUMMARY:

A. Provide selective demolition of designated mechanical room equipment.

B. Remove all existing mechanical room equipment, electrical panels and eye wash station.

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

1.02 DEFINITIONS:

A. Remove: Detach items from existing construction and legally dispose of them off-site.

B. Removed and Reinstalled: Existing items removed and reinstalled in their original locations after selective demolition.

C. Existing to Remain: Existing items of construction that are not to be removed and salvaged, or removed and reinstalled.

1.03 SUBMITTALS:

A. Schedule: Submit selective demolition schedules, including schedule and methods for capping utilities to be abandoned and maintaining existing utility service

1.04 QUALITY ASSURANCE:

A. Codes and Regulations: Comply with governing codes and regulations. Use experienced workers

B. Temporary Shoring: Temporary shoring shall be designed to support all anticipated loads and shall further be designed and constructed such that the Work can be properly constructed. Sufficient clearances shall be provided by the temporary shoring to permit all required construction activities to proceed unhindered.

1.05 PROJECT CONDITIONS:

A. Occupancy: Immediate areas of work will be occupied during selective demolition. The facility employees may occupy adjacent areas outside of Work limit. Coordinate demolition schedule with Owner activities.

B. Existing Conditions: No responsibility for items to be demolished will be assumed by the Owner.

PART 2 - PRODUCTS

2.01 DEMOLITION APPLICATIONS:

A. Selective Building Demolition:

1. Application: Protection of portions of building or affected by selective demolition.

2. Application: Notification to Owner of schedule of shut-off of utilities which serve occupied spaces.

3. Application: Pollution control during selective demolition, including noise control.

4. Application: Removal and legal disposal of materials.

5. Utilities: Interruption, capping or removal as applicable.

6. Hazardous Materials:

   a. Not present in doors or walls. If encountered, stop work immediately and notify the Owner and the Engineer.

PART 3 - EXECUTION

3.01 SELECTIVE DEMOLITION:

A. Demolition Operations: Do not damage building elements and improvements indicated to remain. Utilities: Locate, identify, disconnect, and seal or cap off utilities in buildings to be demolished.

B. Occupied Spaces: Do not obstruct occupied or used spaces or facilities without the written permission of the Owner and the authorities having jurisdiction. Do not interrupt utilities serving occupied or used facilities without the written permission of the Owner and authorities having jurisdiction. If necessary, provide temporary utilities.

C. Operations: Cease operations if public safety or remaining structures are endangered. Perform temporary corrective measures until operations can be continued properly.

D. Security: Provide adequate protection against accidental trespassing. Secure project after work hours.

E. Restoration: Restore finishes of patched areas and any damaged adjacent construction and finishes.

3.03 SCHEDULE

A. Items to be Salvaged for Reinstallation:

1. None

B. Items to be Salvaged for Delivery to Owner:

1. None

C. Utilities Requiring Interruption, Capping, or Removal:

1. Electric
2. Plumbing
3. Mechanical

END OF SECTION

SECTION 02 82 33

ASBESTOS ABATEMENT FOR BUILDINGS

PART 1 GENERAL

1.01 GENERAL PROVISIONS:

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all sections within DIVISION 1-GENERAL REQUIREMENTS, which are hereby made part of this Section of the Specifications.

B. Equality of material, article, assembly or system other than those named or described in this Section shall be determined in accordance with the provisions of Article VI of the GENERAL CONDITIONS.

C. Examine all conditions as they exist at the Site related to the project before submitting a bid for the work of this Section.

D. All provisions of this Section relating to the health and safety of workers and the public, as well as protection of the environment are minimum standards. The Contractor is responsible for determining whether any additional and/or more stringent protective measures are required by any legal requirements or prudent conservative work practices and implementing such measures if deemed necessary. Nothing in this Section shall be deemed to relieve the Contractor from any liability with respect to any such legal requirements or requirement of prudent conservative practice.

E. Should demolition activities, as performed by the Contractor, uncover materials not readily identified as non-asbestos-containing, the material should be assumed to be asbestos-containing until classified otherwise. Removal should be performed in compliance with all requirements outlined in the Massachusetts Department of Labor Standards (DLS) 453 CMR 6.00; 310 CMR 7.15; NESHAP 40 CFR 61; and OSHA 29 CFR 1926.1101, including all applicable local ordinances.

F. All work under this Section shall be performed by a contractor holding a current Massachusetts DLS asbestos abatement contractor's license. The Contractor shall furnish all labor, worker training, materials, equipment, and services for the complete and proper removal and disposal of asbestos-containing materials, as Specified in Section 1.02 of this Specification. The Contractor shall be responsible for the preparation and all costs and communications associated with any Massachusetts Department of Environmental Protection (DEP) Non-Traditional Asbestos Abatement Work Plan (NTAAWP) submitted for the project. Contractor shall be aware of the process and requirements for preparation, submittal and review/revision process of an NTAAWP, and shall incorporate

into their project schedule. No delay claims will be accepted related to DEP review or edit requests.

G. Sampling for asbestos-containing materials (ACMs) was performed in support of up-coming renovation of the Site Building. Laboratory bulk sample results identified roof flashing (tars/felts) at the Site building as ACM.

H. For the purpose of this Section, the following definitions apply:

"Site" shall refer to the Pump House at the Arlington Reservoir Beach located at 250 Lowell Street in Arlington, Massachusetts.
"Contractor" shall refer to the asbestos abatement contractor.
"Engineer" shall refer to Weston and Sampson.
"Owner" shall refer to the Town of Arlington.

1.02 DESCRIPTION OF WORK - GENERAL:

A. Provide labor, materials, and equipment to complete the work of this Section, including but not limited to:

1. Removal and disposal of all specified ACM and specified non-ACM materials, as indicated in Section 1.03, in accordance with the provisions set forth in this Section. This shall include the removal and disposal of asbestos-containing identified roof flashing (tars/felts) ACM debris, other specified ACMs and contaminated debris throughout the Site.

   All quantities of ACM will be verified by the Contractor, and agreed upon by Engineer and the Owner, before any work area preparations. As such, the Contractor shall visually inspect the site building prior to bid submission.

2. Work area preparations, including pre-cleaning, installation of critical barriers and polyethylene sheeting, construction of decontamination facilities, work area enclosures, sealing, isolation, and other activities.

3. Decontamination and clean up following removal activities in each designated work area as noted and as required.

4. Performance of any other work or activities required by this Specification, applicable regulations, or as necessary to perform a complete job.

5. Compliance with all applicable federal, state, and local regulations, as well as all requirements set forth in these Specifications and facility requirements.

6. Demolition, abatement, and bulk loading (if any) activities at the Site must be conducted in accordance with applicable federal, state, and Town of Arlington

regulations and ordinances and any work plan to be prepared by the Contractor and approved by the Massachusetts DEP.

7. In areas where ACMs exist above, below or behind any metal trim, mechanical equipment, support structure, insulation, etc. the contractor shall be responsible for removing the structure or building component in order to access ACM for removal.

8. The Engineer shall retain a third-party Massachusetts-licensed Asbestos Project Monitor to provide project monitoring services, abatement oversight and final air clearance sampling and analysis.

9. The Engineer, Owner and the Town of Arlington reserve the right to perform job site inspections at any time during the project. The Engineer shall perform a final walkthrough of the site at the conclusion of abatement activities.

10. Contractor is responsible for clearing and grubbing of vegetative growth as described on the Contract Drawings to provide access to all sides.

11. Contractor shall be responsible for site security. If a containment or work area becomes vandalized and requires repair the Contractor shall reconstruct the containment or work area at no cost to the Owner.

1.03 DESCRIPTION OF WORK - DETAILED:

A. The following is the approximate location and quantities of ACMs identified at the Site.

Material	Location	Approximate Quantity
Roof flashing – tars/felts (multiple layers)	Roof – perimeter, penetrations, drains	150 LF

B. Flashing materials (tars/felts) identified as ACM may be adhered to non-ACM substrate building material such as roofing, roof decking, insulation, brick, glazed block, wood, plaster, concrete block, concrete, metal, masonry and structural components.

1.04 RELATED WORK:

A. Related work specified elsewhere: Examine all Drawings and all other Sections of the Specifications for requirements of related sections affecting the work of this Section, including, but not limited to:

1. Section 00 31 43– PERMITS
2. Section 02 41 19 – SELECTIVE STRUCTURE DEMOLITION
3. Section 02 83 19 – LEAD BASED COATINGS REMOVAL

B. The work of this Section shall be performed as stated herein. In performing the work of this Section, the Contractor shall refer to Division 1 for additional procedures. The Contractor is responsible for the coordination of the work of this section with other related work.

1.05 SEQUENCE OF WORK:

A. The following is a typical sequence of work that the Contractor shall adhere to during the asbestos abatement project. Engineer may authorize deviations from this typical sequence based upon the specific conditions encountered during the project.

1. Post all required signage.

2. Isolate work area from unauthorized access.

3. Prepare the specified Work Area as described in Part 3 of this Section.

4. Construct decontamination unit, and any other construction needed to complete the work area, as described in this Section.

5. The Engineers' third-party Massachusetts-licensed Asbestos Project Monitor shall provide air monitoring at the perimeter of the work area and also shall collect and analyze air samples.

6. Request Engineer to inspect work area preparation and obtain Engineer approval before beginning removal work.

7. Remove and dispose all asbestos-containing materials as required by these Specifications.

8. Decontaminate the work area upon completion of removal.

9. Request Engineer to perform a final visual inspection to assure that no visible debris exists in the work area. Contractor shall re-clean the work areas as needed until they pass a visual inspection by the Engineers' third-party Massachusetts-licensed Asbestos Project Monitor.

10. Remove all work area barriers, equipment, polyethylene sheeting, etc. and clean any areas as described in this Section.

11. Submit all materials as required at the post abatement removal meeting not more than thirty days after completion of asbestos removal work.

1.06 ESTIMATES:

A. Section 1.03 represents a brief description of the location of asbestos-containing materials. This data is provided for informational purposes only and is based on the best information available at the time of specification preparation. Nothing in this section may be interpreted as limiting the scope of work otherwise required by this contract and related documents.

B. The quantities and location of ACM and the extent of work included in this section are only best estimates that are limited by the physical constraints imposed by safety of entering the buildings. Accordingly, minor variations of plus or minus 15% of the estimated quantities of ACM are considered as having no impact on the price of this contract.

1.07 COORDINATION AND PHASING OF WORK:

A. Contractor shall coordinate all work in this Section with all other work of this Project. Where additional regulatory requirements apply to the work in this Section, the Contractor shall ensure compliance with all requirements.

B. Contractors work schedule must be coordinated with, and acceptable to the Owner. Contractor shall work continuously and diligently in each work area on the days and during the hours indicated on their work schedule.

C. Contractor shall cooperate fully with other Contractors at the facility.

D. Contractor shall subdivide work areas and/or otherwise provide additional containments and mobilization where and when necessary to accomplish asbestos abatement in accordance with the project phasing, as determined and specified by the Owner.

E. Contractor shall provide the third-party Massachusetts-licensed Asbestos Project Monitor with at least 48-hours of advance notice to schedule any final air clearance sampling.

1.08 SUBMITTALS:

A. PRE-ABATEMENT MEETING:

The Contractor shall meet with the Owner and the Engineer for a Pre-Abatement meeting before commencing work on the project. At the meeting, the Contractor shall be represented by authorized representatives and the field supervisor who shall run the

project on a daily basis, and who shall present evidence that all requirements for initiation of the work have been met. The minimum agenda for the meeting shall be:

1. Review of "Pre-Job Submittals".
2. Channels of communication.
3. Abatement schedule, including sequence of critical work.
4. Designation of responsible personnel.
5. Procedures for safety, security, quality controls, housekeeping, and related matters.
6. Use of premises, facilities, and utilities.

B. PRE-JOB SUBMITTALS:

The Contractor shall provide two copies of the following Pre-Job Submittals at the Pre-abatement Conference:

1. Copies of all notifications, permits, applications, personal licenses and like documents required by Federal, State, or local regulations obtained or submitted in proper fashion.

2. List of employees to be used on this project.

3. Copies of medical records as required by OSHA or a notarized statement by examining medical doctor that such examinations took place and when for each employee to be used on project.

4. Record of successful respiratory fit test performed by a competent person (as defined by OSHA) within the previous 12 months, as required elsewhere in the documents for each employee to be used on this project.

5. Certificate of Insurance. Owner and Engineer shall be listed as additional insured on the certificate.

6. Proposed respiratory program for employees throughout all phases of the job, including make, model and NIOSH approval numbers of respirators to be used.

7. Written description of all procedures, methods, or equipment to be utilized by the Contractor that differ from the Contract Specifications, including manufacturers specifications on any equipment not specified for use by the Contract Specifications.

8. Proposed electrical safeguards to be implemented, including but not limited to location of transformers, GFCI outlets, lighting, etc., necessary to safely perform the job, including a description of an electrical hazards safety plan for common practices in the work area.

9. A list of all equipment to be used on site, by make and model, including negative pressure equipment, HEPA vacuums, Water Atomizing Devices, etc.

10. Chain of Command of responsibility at work site including supervisors, foreman, and competent person, their names, resumes and certificates of training.

11. Contractor's testing lab, AIHA PAT proficiency, and Certification in the State where work site is located.

12. Abatement schedule detailing phasing, including approximate days per phase, for asbestos abatement of all materials.

C. POST-CONSTRUCTION SUBMITTALS:

1. Submittals shall be prepared in accordance with Section 01 33 23 - SUBMITTALS.

2. The Contractor shall submit the following to the Engineer within thirty (30) days after completion of the project:

   a. Manifests and waste receipts acknowledging disposal of all waste material from the project showing delivery date, quantity, and appropriate signature of landfill's authorized representative.

   b. A copy of the entry-exit logbook required elsewhere in these Specifications.

   c. All personnel monitoring results as required by OSHA and elsewhere in these Specifications.

   d. Copy of licenses, medical, and fit tests of all workers and supervisors who performed work on the project.

   e. All notifications as required elsewhere in these Specifications.

   f. Copies of all asbestos related air sampling data including required final air clearance sampling data.

1.09 REFERENCE STANDARDS, REGULATIONS AND CODES:

A. All work shall be performed strictly according to the Specifications contained herein, any DEP-approved Abatement Work Plan, and with the regulations cited in this Article. The Contractor and all sub-contractors undertaking asbestos abatement work and persons in their employ shall comply with and be bound to requirements of the following Federal, State, and Local standards, regulations and codes. These standards and codes shall be by reference made part of this Section and shall be complied with. Whenever regulations are conflicting, the more stringent regulation will prevail.

1. US Department of Labor; Occupational Safety and Health Act of 1970. (Particular attention is drawn to the Asbestos Regulations: CFR Title 29, Part 1910, Sec. 1910.1001 and Part 1926, Sec. 1926.1101, and the Respirator Regulations; CFR Title 29, Part 1910, Sec. 1910.134 and the Hazard Communication Program, CFR Title 29, Part 1910.1200).

2. US Environmental Protection Agency, CFR, Title 40, Part 61, Subparts A and M, National Emission Standards for Hazardous Air Pollutants; Asbestos NESHAP Revision; Final Rule, Dated Tuesday, November 20, 1990.

3. US Environmental Protection Agency; TSCA Title II, Asbestos Hazard and Emergency Response Act (AHERA), 40 CFR Part 763 Subpart E - "Asbestos-Containing Materials in Schools" and also 40 CFR, Part 763, Subpart G - "Worker Protection Rule".

4. US Department of Transportation regulations, 49 CFR Parts 172 and 173.

5. All Commonwealth of Massachusetts laws, regulations and standards, including the regulations 453 CMR 6.00 "The Removal, Containment or Encapsulation of Asbestos" and 310 CMR 7.15 "Asbestos", 18.00 and 19.00 and MGL Chapter 21E.

6. Other Federal, State and local statutes, ordinances, regulations, or rules pertaining to this Section and the work described herein, including the storage, transportation and disposal of asbestos.

B. All regulations by these and other governing agencies in their most recent version are applicable. These specifications refer to many requirements found in these references, but in no way, intend to cite or reiterate all provisions therein or elsewhere. It is the contractor's responsibility to know, understand, and abide by all such regulations and common practices. Other provisions contained in these references may from time to time during the execution of this contract be enforced by the Owner at his own discretion.

1.10 REGULATORY SUBMITTALS:

A. The Contractor shall be responsible for securing all necessary permits for asbestos related work, including hauling, removal, and disposal, fire, and materials usage, or any other permits required to perform the specified work.

B. The Contractor shall notify the following agencies in appropriate manner and place of impending work, and shall provide evidence of notifications at the pre-construction conference:

1. U.S. Environmental Protection Agency,
J. F. Kennedy Federal Building
Boston, Massachusetts 02203
(10 working days in advance)

2. Massachusetts Department of Environmental Protection
Division of Air and Hazardous Materials
(10 working days in advance)
Send Notification to:

Commonwealth of Massachusetts
Asbestos Program
205 Lowell Street
Wilmington, Massachusetts 01887

3. Massachusetts Department of Labor Standards
Asbestos Control Unit
(10 working days in advance)

4. Town of Arlington Fire Department, Building/Planning Department or Inspectional Services Department, Office of Health and Hospitals, Department of Public Works, Water Department, Police Department and any other state or city agencies as required by law or ordinance.

1.11 PROJECT CONDITIONS:

A. Working space and space available for storing materials is restricted within the confines of the project and as shown in the Drawings.

B. Provide access and personal protective equipment, to the Engineer and the Owner.

C. Schedule the use of existing utilities with the Owner. No utility service, fire protection system, or communication system may be interrupted without prior approval of the Owner and Engineer.

D. Water, electric power, lighting and other utilities, toilets, and other facilities shall be provided by the Contractor from existing sources where Contractor's use is not excessive and does not interfere with buildings normal use. Where existing utilities of the development are not adequate or cannot be used, the Contractor is responsible for

providing alternative sources. The use of the building's utilities shall be coordinated through the Owner.

E. Post and affix caution signs and labels as required by OSHA regulation, 29.CFR.1926.1101 (k) (1). Post safety signs outside the work project as may be required by the Owner. Obtain two copies of 29.CFR.1910.1001, 29.CFR.1926.1101, 40.CFR.61, Subpart M, and Commonwealth of Massachusetts Regulations 453 CMR 6.00 and 310 CMR 7.00, and post one copy at the job site and retain one copy on file.

F. Post at the job site, or at the entrance to each independent Work Area, one copy of all Material Safety Data Sheets (MSDS's) of all chemicals and other substances to be used on this contract. These sheets shall be made available to the Engineer for review.

G. It will be the responsibility of the Contractor to maintain strict security of equipment, containments, work areas, buildings, trenches and excavations during the duration of their activities on the site.

1.12 GENERAL REQUIREMENTS:

A. All work-site preparations and practices will be conducted in accordance with all Federal, Massachusetts and appropriate City and other local regulations, standards and codes pertaining to worker health protection, protection of the public health and the environment, including current US Environmental Protection Agency (EPA), Department of Labor Occupational Safety and Health Administration (OSHA), US Department of Transportation (DOT), DLS, DEP, local and all other Federal, Commonwealth of Massachusetts and local regulations pertaining to asbestos removal, its transportation and disposal.

B. All operations involving exposure to airborne asbestos fiber shall be carried out according to the requirements of Part 3 of this Section.

C. Prior to use of any design, device, material, method of operation, or process covered by letters patent or copyright, the right for such use shall be secured by suitable legal agreement with the patentee or Owner of the letters patent or copyright. No arrangement involving letters patent or copyright is acceptable, if subsequent payment for permanent use following completion of the work is required or implied.

1.13 QUALITY CONTROL:

A. The Owner may retain the services of the Engineer to provide project administration, monitoring of Contractor work practices and performance, inspection of the work-sites, bulk fiber identification, and air sampling and analysis throughout the asbestos removal project.

B. AIR MONITORING:

1. Background (pre-testing) air and appropriate dust samples may be taken by the Engineers' third-party Massachusetts-licensed Asbestos Project Monitor to represent conditions before the Contractor starts masking and sealing operations.

2. During removal, area samples may be collected by the Owner or his agent in locations proximate to those areas where removal of asbestos-containing materials is ongoing. Contractor shall be responsible for all OSHA personal sampling. The Engineers' third-party Massachusetts-licensed Asbestos Project Monitor shall collect perimeter air samples during bulk loading, if necessary. Samples shall be collected from all four sides of the work area. A minimum of two samples per location per day shall be collected and analyzed onsite.

3. A Final Visual Inspection of the work area may be conducted by the Owner or his agent to ensure no visible asbestos debris exists in the work area, prior to demobilizing from the work area.

4. The air clearance acceptance criteria for this project is <0.010 fibers per cubic centimeter of air (f/cc) by Phase Contrast Microscopy (PCM) using the NIOSH 7400 Method. NOTE: Encapsulation on all surfaces (including floor) must be dry prior to final air sampling.

5. A sufficient number of samples to reliably characterize the work place air quality will be taken. Air will be agitated by means of a small leaf blower prior to the test and kept agitated by means of a small electric fan. The results of all samples must comply with the regulations set forth in this specification. Failure to meet the specified criteria will require the Contractor to re-clean the designated work site and then the Engineers' third-party Massachusetts-licensed Asbestos Project Monitor to repeat the final air clearance testing. All repeat air testing shall be the Contractor's financial responsibility. Cleaning and testing will be repeated until the specified criteria are met.

C. WORK REVIEW:

1. Outside the work area, airborne fiber concentrations must not exceed **0.010 fibers/cc**. If concentrations exceed this level, the work must be stopped, conditions reviewed as to the probable cause, and then corrected.

D. INSPECTIONS:

1. The Engineer will conduct a pre-abatement inspection. The Engineer will also conduct periodic inspections during abatement. The Engineers' third-party Massachusetts-licensed Asbestos Project Monitor will conduct a final visual inspection.

1.14 PERSONAL PROTECTION:

A. RESPIRATORS AND PROTECTIVE CLOTHING:

1. Personal protection, in the form of disposable Tyvek suits, and NIOSH approved respirators, are required for mechanics, contractor supervision, Engineer and visitors at the work site during the set-up, removal, and cleaning operations. Contractor shall provide all this protective equipment for workers, Engineer and authorized personnel to access this work site.

2. Each worker shall be supplied with a minimum of two complete disposable uniforms every day. Removal workers shall not be limited to two uniforms. Supply additional uniforms as is necessary. Under no circumstances will anyone entering the work area be allowed to reuse a contaminated uniform.

3. Work clothes shall consist of disposable full body suits, head covers, gloves, footwear, and eye protection.

4. Supply workers and supervisory personnel with NIOSH approved protective respirators and HEPA/filters (P100 filters). Appropriate respirator selection shall be determined by the daily personnel samples being taken and strictly follow the guidelines set forth in the OSHA respiratory program 29 CFR 1910.134 and the Massachusetts DLS Regulations 453 CMR 6.00. The respirators shall be sanitized and maintained according to the manufacturer's specifications. Appropriate respirators shall be selected using the information provided in OSHA Title 29 CFR Part 1910.1926 Final Rules. Disposable respirators shall not be considered acceptable in any circumstance. The Contractor will maintain on site a sufficient supply of disposable HEPA/filters to allow workers and supervisory personnel to change contaminated filters at least three (3) times daily. The Contractor is solely responsible for means and methods used and for compliance with applicable regulations.

5. Respirators shall be individually assigned to removal workers for their exclusive use. All respiratory protection shall be provided to workers in accordance with the written submitted respiratory protection program, which includes all items in OSHA 29 CFR 1910.134 (b) (1-11). A copy of this program shall be kept at the worksite and shall be posted in the Clean Room of the Decontamination Unit.

6. Workers must perform negative and positive pressure fit tests each time a respirator is put on, whenever the respirator design so permits.

7. Workers shall be given a qualitative fit test in accordance with procedures detailed in the OSHA 29 CFR 1910.134, Qualitative Fit Test Protocols for all respirators to be used on this abatement project. An appropriately administered quantitative fit test may be substituted for the qualitative fit test.

8. Upon leaving the active work area, pre-filters shall be discarded, cartridges removed, and respirators cleaned in disinfectant solution and clean water rinse. Clean respirators shall be stored in plastic bags when not in use. The contractor shall inspect respirators daily for broken, missing, or damaged parts.

9. Provide daily personal sampling to check personal exposure levels for the purpose of establishing respiratory protection needs. Samples shall be taken for the duration of the work shift or for eight hours, whichever is less. Personal samples need not be taken every day after the first day if working conditions remain invariant but must be taken every time there is a change in the removal operation, either in terms of the location or the type of work. Sampling will be to determine eight-hour Time-Weighted-Averages (TWA). The contractor is responsible for personal sampling as outlined in OSHA Standard 1926.1001.

10. Sampling personnel shall be proficient in the taking of air samples under NIOSH 7400, and must be supervised by an individual who has completed the training course NIOSH 572 or equivalent.

11. Air sampling results shall be available at the job site in written form no more than twenty-four (24) hours after the completion of a sampling cycle. The document shall list each sample's result, sampling time and date, person monitored, flow rate, sample duration, microscope field area, number of fibers per fields counted, cassette size and analysts name and company. Air sample analysis results will be reported in fibers per cubic centimeter.

B. WORK PROCEDURES:

In order to avoid possible exposure to dangerous levels of asbestos, and to prevent possible contamination of areas outside the demarcated work zone, work shall follow the guidelines listed below.

1. Before leaving the work area, the worker shall remove all gross contamination and debris from the coveralls. In practice, this is carried out by one worker assisting another.

2. All equipment used by the workers inside the demarcated work zone shall be either left in the Dirty Room of the Decontamination Unit or thoroughly decontaminated before being removed from the area. Extra work clothing (that in addition to the disposable garment) shall be left in the Dirty Room of the Decontamination Unit until the completion of work in that area.

3. As stated in Section 3.01(D) (Decontamination Unit and Procedures), all persons leaving the removal area must decontaminate before leaving the demarcated work area.

4. Under no circumstance shall workers or supervisory personnel be allowed to eat, drink, smoke, chew gum, or chew tobacco in the work area. Only in the case of life threatening emergency shall workers or supervisory personnel be allowed to remove their protective respirators while in the work area. In this situation, respirators are to be removed for as short a duration as possible.

1.15 SPECIAL CONSIDERATIONS:

A. Storage - Limited storage space may be provided by the Owner on the property for this project. Contractor will supply any additional temporary storage as needed. All materials and equipment are to be kept in orderly fashion in designated areas, free and clear of high traffic areas and doorways, and in conformance with all regulations, codes, and in consideration of building usage. Contractor will be allowed to store waste in a waste dumpster on-site, to be coordinated with the Owner.

B. Working Hours - Working hours are specified in Division 1 - GENERAL REQUIREMENTS.

C. Security - The Owner will provide specific access as required during the project to the Contractor and personnel assigned to the project. The Contractor will be responsible for the security of the section of the building involved in the abatement project. It will also be the Contractor's responsibility to allow only authorized personnel into the work area, and to secure all assigned entrances and exits at the end of the workday. Any person entering or leaving the contained areas must sign the Contractor's bound logbook and enter the date and time. The logbook must be located immediately outside the entrance to the Decontamination Unit at all times and be open for inspection by the Owner.

PART 2 PRODUCTS

2.01 MATERIALS:

A. Wetting Agents: The wetting agent shall be approved by the Engineer.

B. Sealants: Sealing material shall be both penetrating and bridging and may be applied by a one or two coat system and shall meet the following criteria:

1. ASTM Standard E-84.
2. Underwriter's Laboratory approval for Class 1A
3. Fire Rating: Class A
    a. Flame Spread: 0-25
    b. Fuel contribution: 10

c. Smoke Density: 5

C. Containment Bags: Upon approval of the Engineer, containment bags may be utilized for the removal of pipe insulation. Removal shall be as manufacturer's instructions and as described in these specifications.

D. Framing Materials and Doors: As required to construct temporary decontamination facilities and critical barriers.

E. Fire Retardant Clear Polyethylene Sheeting, minimum thickness 8-mil.

F. Fire Retardant Black Plastic Sheeting, minimum thickness 6-mil.

G. Drums: Asbestos transporting drums, sealable and clearly marked with warning labels as required by OSHA and EPA.

H. Plastic Bags: Sealable, asbestos disposal bags, mm 6-mil thick and labeled

I. Signs: Asbestos warning signs for posting at perimeter of work area, as specified in 29 CFR 1926.1101(k)(1)(CIIi).

J. Tape: Tape shall be high quality polyethylene film as approved by the Engineer.

K. Contamination Control Flooring: As approved.

L. Spray Adhesive: As approved.

M. Respirators: NIOSH approved with HEPA cartridges.

N. Disposable Coveralls: As approved.

2.02 TOOLS AND EQUIPMENT:

A. Air Filtration Device (AFD): Air Filtration Devices shall be equipped with High Efficiency Particulate Absolute (HEPA) filtration systems.

B. Scaffolding: Scaffolding, as required to accomplish the specified work, shall meet all applicable safety regulations.

C. Transportation Equipment: Transportation Equipment, as required, shall be suitable for loading, temporary storage, transit and unloading of contaminated waste without exposure to persons or property. Waste material shall be stored in 30 cubic yard dosed dumpsters.

D. Vacuum Equipment: All vacuum equipment utilized in the work area shall utilize HEPA filtration systems. Vacuum equipment shall be as manufactured by Nilfisk of America of Malvern, Pennsylvania, Norclean Vacuum Systems distributed by Power Products and Services Co., Inc., Forest, Virginia or approved equal.

E. Vacuum attachments: Soft brush attachment, Asbestos Scraper Tool, Drill Dust Control Kit.

F. Electric Sprayer: An electric airless sprayer suitable for application of encapsulating material.

G. Water Sprayer: The water sprayer shall be an airless or other low-pressure sprayer for amended water application.

H. Portable Shower: For personnel decontamination.

I. Water Atomizer: Powered air misting device equipped to operate continuously.

J. Other Tools and Equipment: Provide other suitable tools for the stripping, removal, encapsulation, and disposal activities including but not limited to hand-held scrapers, wire brushes, sponge, rounded-edge shovels, brooms, and carts.

PART 3 EXECUTION

3.01 GENERAL CONSIDERATIONS:

A. APPROVALS AND INSPECTION:

All temporary facilities, work procedures, equipment, materials, services, and agreements must strictly adhere to and meet these contract specifications along with EPA, OSHA, NIOSH, regulations and recommendations as well as any other federal, state, and local regulations. Where there exists overlap of these regulations, the most stringent one applies.

Modifications to this isolation and sealing methods, procedures, and design may be considered if all elements of proper and safe procedures to prevent contamination and exposure can be demonstrated. Written modifications to these specifications must be made to the Engineer for review before they can be used for work on this project.

B. DAMAGE AND REPAIRS TO THE WORK SITE:

Asbestos removal and disposal shall be performed without damage to the adjacent roadways, trees and buildings outside the limit of work. Contractor shall provide protection of these items and materials as part of the work area preparation. Where asbestos abatement activity causes damage, the Contractor shall patch, repair, replace or otherwise restore the area to its original condition at no additional cost to the Owner.

C. BARRIERS AND ISOLATION AREAS:

Construct and maintain suitable critical barriers within the building to separate work areas from occupied spaces. Critical barriers shall be of sufficient size and strength to prevent staff, the public and others from entering the work areas.

Warning signs shall be posted on all critical barriers at the commencement of the work area preparation, as required in 1926.1101 of the Occupational Safety and Health Standards Federal Register, Volume 51, Number 119, June 20, 1986. The signs shall display the proper legend in the lower panel, with letter sizes and styles of a visibility at least equal to that specified in OSHA Standard 1926.1101.(k)(1)(ii). The signs will read as follows:

Danger
Asbestos
May Cause Cancer
Causes Damage to Lungs
Authorized Personnel Only

The signs shall be posted at the perimeters of asbestos removal, demolition or construction areas where the asbestos-containing material to be removed exists.

The Contractor shall maintain all temporary and critical barriers, facilities and controls as long as needed for the safe and proper completion of the work. Work will not be allowed to commence until all control systems are in place and operable.

No barriers shall be removed until the work areas are thoroughly cleaned, and all debris has been properly bagged and removed from work areas, and the area has passed final visual inspection, in accordance with provisions detailed herein.

Additionally, the Contractor shall erect a conspicuous ‘No Trespassing’ sign approximately 4’x4’ at gated entries to the work site. Adjacent to the ‘No Trespassing’ sign, a sign or notification that unauthorized vehicles will be towed at the owners’ expense shall also be erected.

D. DECONTAMINATION UNIT AND PROCEDURES:

A remote two-stage decontamination unit shall be constructed in conformance with requirements set forth in OSHA 29 CFR 1926.1101, and may be used at the approval of the Engineer for the removal of asbestos-containing roofing materials to be removed in accordance with all applicable Sections of this specification. A "two stage" unit resembles the "three-stage" unit in construction detail, but it is built without a shower section.

E. HEPA FILTRATION

If necessary, adequate negative pressure shall be provided within any enclosure as specified below.

1. After asbestos work area is totally isolated, and prior to commencement of work, the Engineer will perform, at their discretion, a visual inspection of the work area. This will consist of checking the integrity of barriers including smoke testing the containment if deemed necessary by the Engineer. This does not in any way relieve the Contractor's responsibilities to ensure the isolation of the work area. The volume of air within the contained work area shall be changed a minimum of four (4) times per hour. A pressure differential reading of -0.02 inches of water shall be maintained in the negative pressure work area relative to adjacent areas. A manometer with a strip chart recorder shall be used to show that the proper pressure differential is being maintained.

2. Equipment used for producing a negative pressure work area shall have a filtering device that is at least 99.97% efficient at a 0.3-micron pore size. Filters meeting these standards are referred to as High Efficiency Particulate Absolute (HEPA) filters. The HEPA filtration units shall be equipped with the following:

    a. Magnehelic gauge to monitor the unit's air pressure difference across the filters and be able to interpret magnehelic readings to cubic feet per minute (CPM).

    b. An affixed label, clearly marked and conspicuous, showing the most recent installation date and hour reading of the primary internal HEPA filter.

    c. A clock to record the unit's operation time.

    d. Automatic shut off for filter failure or absence.

    e. Audible alarm for unit shutdown.

    f. Amber flashing warning light for filter loading.

    g. The unit must be equipped with a safety system that prevents it from being operated with the HEPA filter in an improper orientation.

    h. All flexible ducting, vent tubing, adapter plates and other equipment used for the passage of filtered air shall be undamaged, uncontaminated, and free of air leaks at all points.

3. Pre-filters shall be changed frequently during the abatement.

4. All HEPA units shall exhaust to the outside of the building. All HEPA units shall be DOP tested on-site by the Contractor.

5. Air movement shall flow uninterrupted from outside the work area through the Decontamination Unit into the work area. There shall be no other openings for air to enter the containment unless approved by the Engineer in writing.

6. HEPA filtration units shall be placed as far as possible from the air intake to the containment to prevent short cycling of fresh air.

7. This containment, along with the decontamination chamber, shall constitute the critical containment of the work area from the surrounding areas. All openings to this critical containment are to be sealed except where air must enter the work site due to the use of exhaust equipment.

8. Unless approved by the Engineer, air shall enter the critical containment only through the Decontamination Unit. A pressure differential meter will be installed and maintained. If pressure differential drops below -0.02 inches of water, stop work until proper negative pressure is restored.

9. Written modifications to these isolations and sealing methods, procedures, and design may be considered if all elements of proper and safe procedures to prevent contamination and exposure can be demonstrated.

10. Written modifications to these specifications must be made to the Engineer for review before they can be used for work on this project.

F. ASPHALT-BASED ASBESTOS ROOFING AND FLASHING MATERIAL REMOVAL

1. Operations involving the cutting or abrading of asphalt-based asbestos roofing material is considered to release sufficient friable material to constitute an asbestos abatement activity. All work using such equipment must be performed by licensed asbestos workers in a negative pressure enclosure. These restrictions may be lifted if the Contractor uses slicing equipment or manual means to remove the asbestos materials and US EPA and/or a NTAAWP is applied for and accepted by DEP.

2. Work Procedure

a. Perform whatever procedures are necessary including the application of wet methods and covering materials to ensure that release of asbestos materials is reduced to no visible emissions. Work using any cutting or abrading equipment must be performed in a negative pressure enclosure.

b. Remove asbestos roofing materials using tools and equipment specified in regulatory guidance documents.

c. Continuously mist the work area as asbestos roofing materials are being removed from the structure.

d. All asbestos roofing materials must be removed intact and not be broken, sanded, sawed, ground, drilled or compacted.

e. All loose debris shall be immediately collected via HEPA vacuum or wet wipe. The vacuum debris and wipe materials shall be segregated and disposed as asbestos-contaminated waste.

f. Wet methods shall be used whenever operations call for the scraping of resilient roofing materials or mastic.

g. Where cutting and abrading is prohibited, a negative pressure enclosure is not required. Waste must be lowered by a crane, hoist, or dust-tight chute, in accordance with applicable regulations.

3.02 DISPOSAL OF ASBESTOS WASTE:

A. Waste removal procedure shall be done in accordance with all regulations as set forth by the agencies having authority to regulate.

B. Provide proof that disposal sites for the waste materials have current and valid permits to dump asbestos waste at the time of the pre-construction meeting.

C. Obtain receipts from the dumping site(s) and submit to the Engineer upon request for final payment.

D. Warning labels having permanent, waterproof print and adhesive shall be affixed to all bags, trucks, drums (lids and sides), and other containers used to store and/or transport asbestos-containing material. Labels must be conspicuous and legible and contain the following warning:

Danger
Contains Asbestos Fibers
May Cause Cancer
Causes Damage to Lungs
Do Not Breathe Dust
Avoid Creating Dust

E. Be responsible for all necessary precautions to prevent pollution by spilling during the performance of services and shall assume full responsibility for all Contractor caused spills, which shall be cleaned up at the Contractor's expense.

3.03 HOUSEKEEPING:

A. Throughout the work period, maintain the work areas in a standard of cleanliness as specified throughout these specifications.

1. Contaminated disposable clothing, respirator filters, and other debris shall be bagged and sealed at the end of each workday.

2. All asbestos generated by either removal or repair shall be bagged immediately and not allowed to be left exposed at the end of each workday.

3. Respirators shall be thoroughly cleaned at the end of each workday and stored for the next day's use.

4. Retain all stored items in an orderly arrangement allowing maximum access, not impeding traffic, and providing the required protection materials.

5. Do not allow the accumulation of scrap, debris, waste material, and other items not required for completion of the work.

6. Provide adequate storage for all items awaiting removal from the job site, observing all requirements for fire protection and protection of the ecology.

7. Daily and more often if necessary, inspect the work areas and adjoining spaces, and pick up all scrap, debris, and waste material. Remove all such items to the place designated for their storage.

8. Maintain the site in a neat and orderly condition at all times.

3.04 TEMPORARY UTILITIES:

Provide temporary connections to electrical and water utilities as they exist at the property or at the street and provide temporary facilities as required and necessary to carry out the work.

A. WATER SERVICE:

1. The Contractor shall provide temporary connections to any roadside fire hydrant and provide all lines necessary for distribution of water. The Contractor is responsible for obtaining permits for connection to Town of Arlington water lines. The Contractor is also responsible for payment of all permit and water usage fees, as applicable. All fire hydrant use locations shall be determined and approved by the Town of Arlington Water Department prior to use.

B. ELECTRICAL SERVICE:

1. General: Comply with applicable NEMA, NECA and UL standards and governing regulations for materials and layout of temporary electrical service. All power connections and panel work are to be performed by a licensed electrician.

2. Temporary Power: Provide power sources as required. Sub-panel and disconnect shall be sized and equipped to accommodate all electrical equipment required for completion.

3. Voltage Differences: Provide I.D. warning signs at power outlets which are other than 110-120-volt power. Provide polarized outlets for plug-in type outlets, to prevent insertion of 110-120 volt plugs into higher voltage outlets.

4. Ground Fault Protection: Provide all receptacle outlets equipped with ground fault circuit interrupters (GFCI) and reset button for plug-in connection of equipment.

5. Electrical Power Cords: Use only graded extension cords.

C. LIGHTING:

1. The Contractor must supply temporary lighting for all lighting requirements within work areas as required.

END OF SECTION

SECTION 02 83 19

LEAD BASED COATINGS REMOVAL

PART 1 - GENERAL:

1.01 DESCRIPTION:

A. This Section specifies selective demolition of components/structures involving lead paint and lead-containing dust/debris at the Pump House at Arlington Reservoir Beach.

B. Documents affecting work of this Section include, but are necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Divisions One through Thirteen of these Specifications.

C. Examine all Drawings and all other Sections of the Specifications for requirements of related sections affecting the work of this Section. A lead determination of the Site buildings indicates that various painted components are considered to be lead-containing.

D. The work of this Section shall be performed as stated herein. In performing the work of this Section, the Contractor shall refer to other Sections for additional procedures. The Contractor is responsible for the coordination of the work of this Section with related work. No delays in completion of the work may be claimed for lack of coordination.

E. Contractor shall comply with all applicable local, state, and federal guidelines and regulations regarding all work involving the presence of lead-containing paint.

F. The work of this Section references work of the Contractor performing the selective demolition. Additionally, requirements of the Contractor regarding coordination and related work are identified in this Section and shall be considered the responsibility of the Contractor.

1.02 DESCRIPTION OF WORK:

A. The work of this Section includes selective demolition. The procedures described herein apply to all demolition work where a worker may be occupationally exposed to lead as well as to the disposal of the demolition debris. The Contractor shall assume that any painted surface not tested under this specification shall be assumed to contain lead paint and it shall be the Contractor's responsibility to protect workers performing under this Contract. This may require additional testing by the Contractor to verify lead content.

B. The Contractor shall assume full responsibility and liability for the compliance with all applicable Federal, State and local regulations pertaining to work practices, hauling and disposal of hazardous waste, protection of workers and visitors to the site, and persons

occupying areas adjacent to the site. The Contractor shall hold the Engineer and Owner harmless for failure to comply with any applicable work, hauling, disposal, safety, health or regulation on the part of himself, his workers or his subcontractors.

C. The Contractor is required to ensure the protection of workers performing any related demolition work that will affect surfaces coated with lead containing paint, lead-containing dust, as well as, protecting the public and the environment from exposure to lead dust.

D. CODES AND STANDARDS:

1. All work shall conform to the standards set by applicable Federal, State and local laws, regulations, ordinances, and guidelines in such form in which they exist at the time of the work on the contract and as may be required by subsequent regulations.

2. In addition to any detailed requirements of the Specification, the Contractor shall at his own cost and expense comply with all laws, ordinances, rules and regulations of Federal, State, Regional and Local Authorities regarding handling and storing of lead waste material.

3. The following references are cited as applicable standard and regulations as amended:

a. Code of Federal Regulations (CFR) Publications:

29 CFR 1910	General Industry
29 CFR 1926.55	Gases, Vapors, Fumes, Dusts and Mists
29 CFR 1926.57	Ventilation
29 CFR 1926.62	Lead in Construction
29 CFR 1926.200	Signs, Signals and Barricades
29 CFR 1926.354	Welding, Cutting and Heating in Way of Preservative Coatings
29 CFR Subpart T	Demolition
40 CFR 50	National Primary and Secondary Ambient Air Quality Standards for Lead
40 CFR 61 Subpart A	General Provisions

40 CFR 61.152	Standard for Waste Manufacturing, Demolition, Renovation, Spraying, and Fabricating Operations.
40 CFR 241	Guidelines for the Land Disposal of Solid Wastes
40 CFR 257	Criteria for Classification of Solid Waste
40 CFR 261 and 262	Waste Disposal Facilities and Practices

b. Massachusetts Regulations:

454 CMR 23.00	Occupational Lead Exposure

c. American National Standards Institute (ANSI) Publications:

29.2-79	Fundamentals Governing the Design and Operation of Local Exhaust Systems
288.2-80	Practices for Respiratory Protection

d. National Institute of Occupational Safety and Health (NIOSH) Publications:

Manual of Analytical Methods, 4th Ed.

e. Underwriters Laboratories, Inc. (UL) Fire Resistance Directory Publications:

586-77 (R 1982)	Test Performance of High Efficiency Particulate, Air Filter Units

E. All regulations by the above and other governing agencies in their most current version are applicable throughout this project. Where there is a conflict between this Specification and the cited State, Federal, or local regulations, the more restrictive or stringent requirements shall prevail.

THIS SECTION REFERS TO MANY REQUIREMENTS FOUND IN THESE REFERENCES, BUT IN NO WAY, IS IT INTENDED TO CITE OR REITERATE ALL PROVISIONS THEREIN OR ELSEWHERE. IT IS THE CONTRACTOR'S RESPONSIBILITY TO KNOW, UNDERSTAND, AND ABIDE BY ALL SUCH REGULATIONS AND COMMON PRACTICES.

1.03 DEFINITIONS:

A. The following definitions apply to the performance of the work of this project.

1. Action Level: An airborne concentration of lead above 30 micrograms per cubic meter ($\mu g/m^3$) as a time weighted average (TWA) for more than 30 days per year.

2. Area Monitoring: Sampling of lead concentrations within the work area and outside the work area which is representative of the airborne concentrations of lead.

3. Clean Room: An uncontaminated change room directly adjacent to the work area having facilities for storage of employees' personal clothing and uncontaminated work clothes, materials and equipment provided when the airborne exposure to lead is above the PEL.

4. Contractor: The Contractor who is performing work involving lead containing paint under this Section.

5. Decontamination Area: A contained area adjacent to or connected to the abatement work area and consisting of an equipment room, shower area, and clean room which is used for decontamination of workers, materials and equipment.

6. HEPA Filter Equipment: High efficiency particulate air (HEPA) filtered vacuuming or exhaust ventilation equipment with a UL 586 filter system. Filters shall be of 99.97 percent efficiency for retaining 0.3 micrometer diameter particles.

7. Lead-Containing Paint: Paint, varnish, or stain, which contains lead in excess of 0.0% lead by weight.

8. Lead Permissible Exposure Limit (PEL): 50 $\mu g/m^3$ of air, based upon an 8-hour time weighted average.

9. Sample Location: Area or place where an air or wipe sample is collected.

10. Time Weighted Average (TWA): The TWA is an 8-hour time weighted average for the test of the concentration of lead for worker exposure.

11. Wet Cleaning: The process of removing lead contamination from building surfaces, equipment and other objects by using cloths, mops, or other cleaning tools which have been dampened with water, and by afterwards disposing of these cleaning tools as lead contaminated wastes.

12. Work Area: A controlled-access work area, which has no plastic sheeting or other containment barriers, erected to separate the trades.

1.04 SUBMITTALS:

A. NOTIFICATIONS:

1. Provide in proper and timely fashion, all necessary notifications to relevant federal, state, and local authorities and obtain and comply with provisions of all permits or applications required by the work specified, as well as make all required submittals required under those auspices. Contractor shall indemnify the Owner and Engineer from and pay for all claims resulting from failure to adhere to these provisions. Costs for all permits, applications, and the like are to be assumed by Contractor. Required notifications include but are not limited to the following:

   a. Massachusetts Department of Environmental Protection, Form AQ06 - Construction/Demolition Notification.

B. Provide four (4) copies of the following Submittals at least 4 weeks prior to commencement of the work of the contract:

1. Copies of all notifications, permits, applications, licenses and like documents required by Federal, State, or local regulations and this specification obtained or submitted in proper fashion,

2. Copies of written medical opinions for each employee who may be occupationally exposed to lead as required by 29 CFR 1926.62 (j)(3)(v),

3. Copies of supervisors' and workers' training certificates,

4. Record of successful respirator fit testing performed by a qualified individual within the previous 6 months for each employee to be used on this project with the employee's name and social security number with each record,

5. Employer's Lead Compliance Program as required by 29 CFR 1926.62, including proposed respiratory protection program and medical monitoring for all employees throughout all phases of the job, including make, model and NIOSH approval numbers of respirators to be used; worker orientation plan; written description of all proposed procedures, methods, or equipment to be utilized, including those that may differ from the Contract Specifications. In all instances, Contractor must comply with all applicable federal, state and local regulations.

6. Proposed number and type (i.e., hazardous waste or non-hazardous waste, open top, front loading, etc.) of dumpsters for waste, proposed location(s),

7. A list of all equipment to be used on site, by make and model,

8. Chain of Command of responsibility at work site including supervisors and competent person, their names, resumes and certificates of training and phone numbers,

9. List of total number of supervisors and workers intended to be assigned to the project, including name and lead awareness qualifications,

10. Material Safety Data Sheets on potentially hazardous materials to be used on the project,

11. Waste Disposal Plan which describes the waste stream and the disposal means (i.e. landfill, recycle, etc.) and includes the name, address, and ID number of the proposed hazardous waste hauler, waste transfer route, and proposed disposal reclamation or treatment facility,

12. Name and address of the proposed construction debris site,

13. Construction schedule including sequence of critical work.

    No work on the project will be allowed to begin until the Pre-Construction Submittals as listed herein are accepted by the Engineer. Any delay caused by the Contractor's refusal to submit this documentation in a timely fashion does not constitute a claim for extra compensation or a time extension.

C. Submit the following to the Engineer as a Post-Construction submittal package:

1. Copies of waste manifests and receipts acknowledging disposal of all lead waste material from the project, showing delivery date, quantity, and appropriate signature of landfill's authorized representative,

2. DEP approval for all waste reduction techniques, if utilized,

3. A notarized copy of the daily list of workers and site entry-exit logbook,

4. All personnel monitoring results,

5. All TCLP testing results.

1.05 GENERAL WORK PROCEDURES:

A. Work shall be carried out in sequential phases. Inspection and approval of each phase by the Engineer shall be sought and gained before proceeding to the next phase and in accordance with the schedule approved. This shall include demolition requirements for work area clearance and work area release before other work. As a Contract requirement, any reasonable delay caused by this requirement will not constitute a basis for claim

against the Owner or Engineer. Contractor must coordinate the work of this section with the work of all other trades.

B. At no time will the Owner permit storage of lead waste materials generated from demolition activities inside the Site building, and any storage of materials will be subject to the Owner's approval. Assure security of lead waste materials at all times.

1.06 SPECIAL CONSIDERATIONS:

A. TESTING REFERENCES:

1. Testing for lead paint has been performed on a representative number of painted components at the Pump House located at 250 Lowell Street in Arlington, Massachusetts using Atomic Absorption Spectrophotometry (AAS) analysis.

B. The Contractors shall follow the requirements of this Section regarding component removal, demolition, worker exposure and protection, work area cleaning, and waste disposal.

C. Work Affected – In general, the following activities are minimum requirements of this Section and affect the demolition performed on the painted components:

1. No torch cutting, mechanical sanding, stripping, or abrasive methods of paint removal shall occur.

2. No demolition activities may occur which increase the workers' exposure above the Action Level of 30 $\mu g/m^3$. Contractor shall fully complete with the OSHA lead standard at 29 CFR 1926.62.

3. Workers shall be informed of the components to be renovated or demolished that have been identified as containing lead.

4. Worker protection, at a minimum, shall comply with the OSHA Lead Standard 29 CFR 1926.62. Worker Right to Know and Health and Safety Standards of 1926.62 shall also apply to the work of this Section.

5. Separation of Trades: Unprotected, untrained workers or trades shall not perform any related work within the same vicinity as demolition-involving components identified with lead.

6. Clean-up Activities: The Contractor shall maintain work zones free of accumulated debris, lead dust, and paint chips.

C. Lead Contaminated Materials Clean-Up

1. Due to the presence of lead on representative painted surfaces, all loose and flaking paint at the Site buildings shall be removed from the substrate to which it is applied.

2. All debris with visible paint chips within the building, including, but not limited to piles of plastic, debris, plywood, blue tarps, etc. shall be considered lead contaminated.

3. The Contractor shall perform TCLP testing of the stored materials and properly package and dispose of these stored materials.

1.08 FEES, PERMITS & LICENSES:

A. The Contractor shall pay all licensing fees, royalties, and other costs necessary for the use of any copyrighted or patented product, design, invention, or process in the performance of the work specified in this Section. The Contractor shall be solely responsible for costs, damages, or losses resulting from any infringement of these patent rights or copyrights. The Contractor shall hold the Owner and Engineer harmless from any costs, damages, and losses resulting from any infringement of these patent rights or copyrights. If the Contract Specification requests the use of any product, design, invention, or process that requires a licensing, patent or royalty fee for use in the performance of the job, the Contractor shall be responsible for the fee or royalty fee and shall disclose the existence of such rights.

B. Contractor shall be responsible for costs for all licensing requirements, where applicable and notification requirements and all other fees related to the Contractor's ability to perform the work in this Section.

C. Secure all necessary permits for work under this Section, including hauling, removal, and disposal, fire, and materials usage, or any other permits required to perform the specified work.

1.09 CLEAN-UP:

A. Maintain the work site in a neat and orderly manner at all times, so as not to interrupt or infringe upon the work of other trades.

B. Comply with all requirements for release of work areas as described in the project specification.

C. It is the prerogative of the Engineer to inspect whenever deemed necessary, the Contractor is responsible for meeting, and correcting any deficiencies discovered which do not meet the current applicable regulations and requirements of these specifications.

1.10 COORDINATION:

A. At no time shall Contractor cause or allow to be caused conditions which may cause risk or hazard to the general public or conditions that might impair safe use of the facility. The use of the facility's electricity, water or like utilities by the Contractor shall be as specified in Division 1.

B. Coordinate the work of this Section with that of all other trades. Phasing and scheduling of this project will be subject to the approval of the Engineer. The work of this Section shall be scheduled and performed so as not to impede the progress of the project as a whole. Work shall not proceed in any area without the express consent of the Engineer. The Contractor shall be available within 24 hours notice for additional work if after acceptance of the work it is found that complete demolition was not achieved from the initial work effort as determined by the Engineer.

C. The proposed schedule for the work in this Section shall show the time involved from start to finish of demolition operations, including preparation, removal, clean-up, Engineer's inspections and de-mobilization portions of the job.

D. A final schedule shall then be prepared and coordinated with the Owner and Engineer. The final scheduling shall be submitted in writing before the commencement of work.

E. Complete activities in the phases of the agreed upon final schedule. The work must be completed in a continuous, uninterrupted operation.

F. Unless specifically authorized by the Engineer, the work of this project shall be conducted according to the hours established in Division 1.

G. Inspections: The Engineer may perform visual inspections during the work of this section, as described below. Contractor shall not proceed with work until Contractor has received Engineer's approval at the stages identified below:

1. During: Before the commencement of a proposed alternative method other than specified.

2. Post Inspection: At the completion of work and final clean-up, before clearance or removal of any critical barriers and decontamination unit from the work area.

3. Waste Removal Inspection: Notify Engineer removal of hazardous waste from the site.

1.11 AUTHORITY TO STOP WORK:

A. The Engineer has the authority to stop the lead-based coatings removal and lead dust cleanup work at any time the Engineer determines that conditions are not within the

Specifications and applicable regulations. The stoppage of work shall continue until conditions have been corrected and corrective steps have been taken to the satisfaction of the Engineer. Standby time required to resolve violations shall be at the Contractor's expense and shall not be cause for extending the completion date.

1.12 EMERGENCY PRECAUTIONS:

A. The Contractor shall establish emergency and fire exits from the work area.

B. When an injury occurs, the Contractor shall stop work until the injured person has been removed from the work area.

1.13 DISPOSAL OF WASTE MATERIAL:

A. GENERAL:

1. Contractor and transporting Contractor will be required to comply with the Resource Conservation and Recovery Act (RCRA) and with all applicable federal, state, and local regulations.

2. Contractor shall be responsible for disposing of all waste determined by Toxicity Characteristic Leaching Procedure (TCLP) to be hazardous. If TCLP testing has not been performed, the Contractor shall be responsible for testing the waste.

3. Contractor and all sub-contractors shall comply with all EPA regulations.

PART 2 – PRODUCTS

2.01 GENERAL REQUIREMENTS:

A. The Contractor shall deliver all materials and equipment to the site in the original containers bearing the name of the manufacturer, and details for proper storage and use.

B. All materials or equipment delivered to the site shall be unloaded, temporarily stored, and transferred to the work area in a manner that shall not interfere with other trades working in the area.

C. Unloading and temporary storage sites, and transfer routes, must be approved in advance by the Owner and Engineer.

D. Damaged or deteriorated materials may not be used and must be promptly removed from the premises. Material that becomes contaminated shall be packaged and legally disposed in an approved, secure landfill.

2.02 MATERIALS:

A. All materials and equipment proposed to be used on this project shall be subject to the acceptance of the Engineer. The list of required materials shall include, but not necessarily limited to the following:

1. Fire retardant polyethylene sheeting, minimum thickness of six (6)-mil.

2. Plastic bags, minimum thickness of six (6)-mil.

3. Duct Tape, up to 3-inch width

4. Lead Warning Signs, as required by the DOS Regulations and OSHA Hazard Communication requirements.

5. Flexible duct for ventilation units (if required)

6. Spray adhesive, fire retardant

7. Personal Protective Equipment, NIOSH approved respirators

8. Ventilation units with HEPA filtration and exhaust fans.

9. HEPA vacuums

10. Trisodium-Phosphate (TSP) and product data

11. Cloth tarpaulin

2.03 TOOLS AND EQUIPMENT:

A. Transportation Equipment: Transportation equipment, as required, shall be suitable for loading, temporary storage, transporting, an unloading waste without exposure to persons or property. All over-the-road transportation equipment must carry the appropriate hazardous waste transport licenses and insurance.

B. Vacuum Equipment: All vacuum equipment utilized in the work area shall utilize HEPA filtration systems.

C. Water Sprayer: The water sprayer shall be an airless or other low-pressure sprayer for water application.

D. Other Tools and Equipment: The Contractor shall provide other suitable tools including but not limited to: rounded edge shovels, rakes, brooms, and carts.

E. The Contractor shall provide ground fault circuit interrupters (GFCI) to protect all electrical cord and connections.

F. Approved lighting equipment for use in the work area.

G. Scaffolding: Scaffolding, as required to accomplish specified work, shall meet all applicable Federal, State and local safety regulations and used in accordance with manufacturer's specifications.

PART 3 – EXECUTION

3.01 SCHEDULING:

A. The Contractor shall coordinate all scheduling with the Engineer. A schedule of work shall be submitted to the Engineer before contract performance.

3.02 UTILITIES:

A. Provide all necessary connections for temporary utilities in the workplace during work. Shut down and disconnect all electrical power to the work area so that there is no possibility of reactivation and electrical shock during the work. The temporary electrical power shall be in accordance with all OSHA requirements.

3.03 IDENTIFICATION OF HAZARDS:

A. Prior to any work involving lead-containing items, the contractor shall identify all work activities in which a worker may be occupationally exposed to lead.

B. The Contractor shall initially determine if any worker may be exposed to lead above the action level.

3.04 BARRIERS AND ISOLATION AREAS:

A. All lead in demolition work areas shall remain isolated from all other trades on the project and remain inaccessible to the public. Contractor shall monitor the access to the demolition work areas. The below listed items are required to control the generation of lead-containing dust during demolition activities. The Contractor is ultimately responsible for cleaning all generated dust and paint debris from demolition operations and must maintain work areas free from lead dust generated from demolition activities.

1. Signs shall be posted at all approaches to the work area warning that work-involving lead is being conducted in the vicinity. Signs shall be in bold lettering not smaller than two inches tall.

2. Barriers shall not be removed until the work areas are thoroughly cleaned and approved by the Engineer.

3.05 APPROVALS AND INSPECTIONS:

A. All temporary facilities, work procedures, equipment, materials, services, and agreements must strictly adhere to and meet this Section along with EPA, OSHA, regulations and recommendations as well as federal, state, and local regulations. Where there exists overlap of these regulations, the most stringent one applies. All work performed by the Contractor is further subject to approval of the Engineer.

3.06 PERSONAL SAMPLING – CONTRACTOR:

A. Perform personal air sampling during all demolition work to determine worker exposure limits. The results of such sampling shall be posted, provided to individual workers, and submitted to Engineer as described herein.

B. Provide sampling to check personal exposure levels. Representative sampling shall be taken for the duration of the work shift or for eight hours, whichever is less. Personal samples need not be taken for repeated working conditions if working conditions remain unchanged, but must be taken every time there is a change in the removal operation, either in terms of the location or the type of work. Sampling will be used to determine eight-hour Time-Weighted-Averages (TWA). Personal sampling shall be as outlined in OSHA Standard 29 CFR 1926.62.

C. Air sampling results shall be transmitted to the Engineer and individual workers available at the job site in written form no more than forty-eight (48) hours after the completion of a sampling cycle. The reporting document shall list each sample's result, sampling time and date, personnel monitored and their social security numbers, flow rate, sample duration, sample yield, cassette size, and analyst’s name and company, and shall include an interpretation of the results. Air sample analysis results will be reported in micrograms/cubic meter ($\mu g/m^3$).

D. The Contractor’s testing lab shall be AIHA accredited for analysis of metals. Contractor shall submit for Engineer’s review and acceptance the name and address of the laboratory, certification(s) of AIHA accreditation for metal analysis, listing of relevant experience in air lead analysis, and presentation of a documented Quality Assurance and Quality Control program.

E. Air monitoring frequency will be established in accordance with the requirements set forth in 29 CFR 1926.62.

3.07 WORK PROCEDURES:

A. The contractor shall initiate, and continue, sufficient engineering and work practice controls, as described in the Contractor's Lead Compliance Program, to reduce and maintain worker exposures to lead at or below the Action Level.

B. The following work practices are specifically required by these specifications:

1. All persons except those directly involved in the work shall be excluded from the work area. Physical barriers shall be used, where necessary, to limit access to the work area for the duration of the demolition operations. Warning signs may be posted in accordance with applicable regulations.

2. Provide hand-washing facilities and assure that all workers thoroughly wash their hands and face upon exiting the work area. Workers shall pay careful attention to cleanse the hands and face when decontaminating. Provide hygiene facilities, including shower, as required based on initial assessment and continued monitoring.

3. Thoroughly wet the building materials or areas to be demolished and mist the air to reduce the potential for creating airborne lead and dust.

4. All equipment used by the workers inside the work area shall be either left in the work area or thoroughly decontaminated before being removed from the area. Extra work clothing (in addition to the disposable suits supplied by the Contractor) shall be left in the clean area until the completion of work in that area. The clean area shall be cleaned of all visible debris and disposable materials daily.

5. Under no circumstances shall workers or supervisory personnel eat, drink, smoke, chew gum, or chew tobacco in the work area; to do so shall be grounds for the Engineer to stop all demolition operations. Only in the case of life threatening emergency shall workers or supervisory personnel be allowed to remove their protective respirators while in the work area. In this situation, respirators are to be removed for as short a duration as possible.

6. Feasible engineering controls shall be implemented by the Contractor as described in the Lead Compliance Program to minimize the possibility of contamination of areas adjacent to the work area. The following activities are the minimum requirements of this section and affect the demolition performed on the painted components:

1. No torch cutting, mechanical sanding, stripping, or abrasive methods of paint removal shall occur.

2. No demolition activities may occur which increase the worker's exposure above the Action Level of 30 $\mu g/m^3$. Contractor shall fully comply with the OSHA lead standard 29 CFR 1926.62.

7. Workers shall be informed of the components to be renovated that are identified as containing lead.

8. Separation of Trades: Unprotected, untrained workers or trades shall not perform any related work within the same areas as demolition involving components identified as containing lead. Other trades may not enter these areas until clean-up procedures are completed.

3.08 STORAGE OF WASTE:

A. Use of waste containers on site shall be controlled under the following requirements:

1. Location of waste containers on site shall be subject to Owner's approval.

2. The waste containers lined shall be lined with two layers of six-mil polyethylene sheeting, be solid, enclosed containers, locked and sealed at all times. This requirement applies to waste classified as hazardous based on TCLP testing.

3. Contractor shall comply with all federal, state, and local regulations and ordinances regarding lead waste storage.

END OF SECTION

SECTION 03 30 00

CAST-IN-PLACE CONCRETE

PART 1 -GENERAL

1.01 GENERAL PROVISIONS:

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 1 – GENERAL REQUIREMENTS, which are hereby made part of this Section of the Specifications.

1.02 DESCRIPTION OF WORK:

A. Work Included: This Section specifies cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes for the following:

1. Footings
2. Foundation walls
3. Interior equipment (housekeeping) pads
4. Exterior slabs and sidewalks
5. Grout

B. Items To Be Installed Only:

1. Anchor rods
2. Leveling plates

C. Items To Be Furnished Only: Not Applicable

D. Related Work: The following items are not included in this Section and will be performed under the designated Sections:

1. Section 01 45 23, STRUCTURAL TESTS AND INSPECTIONS
2. Section 05 12 33, STRUCTURAL STEEL
3. Section 31 00 00, EARTHWORK; Excavation, backfill, and establishment of subgrade elevations.

1.03 SUBMITTALS:

A. Refer to Section 01 33 23, SUBMITTALS for submittal provisions and procedures.

B. Product data for proprietary materials and items, including reinforcement and forming accessories, admixtures, patching compounds, water-stops, joint systems, curing compounds, dry-shake finish materials, and others if requested by the Engineer or SER.

C. Shop drawings for reinforcement detailing, fabricating, bending, and placing concrete reinforcement. Comply with ACI 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures". Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing and supports for concrete.

D. Submit shop drawings for all formwork for Architecturally Exposed Concrete (Concrete Exposed to View) showing cone tie patterns.

E. Concrete mix design for each mix specified. Supporting test data shall be submitted if requested.

1. Submit alternate mix designs when the characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.
2. Indicate the amounts of mixing water to be withheld for later addition at the Project site.

F. Proposed method of curing and associated products.

G. Proposed precautions for hot weather and cold weather concreting.

H. Laboratory test reports for concrete materials and mix design test.

I. Material test reports for the following, from a qualified testing agency, indicating compliance with specification requirements:

1. Aggregates. Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.

J. Material certificates for each of the following, signed by the manufacturers:

1. Cementitious material.
2. Admixtures

3. Form materials and form-release agents.
4. Steel reinforcement and accessories.
5. Non-metallic shrinkage resistant grout.
6. Waterstops.
7. Curing compounds.
8. Floor and slab treatments.
9. Bonding agents.
10. Adhesives.
11. Vapor retarders.
12. Semi-rigid joint filler.
13. Joint-filler strips.
14. Repair materials.

K. Qualification Data: For Installer and Manufacturer.

L. Minutes of pre-installation conference.

1.04 QUALITY ASSURANCE:

A. Installer Qualifications: A qualified installer who employs on the Project personnel qualified as ACI certified Flatwork Technician and Finisher and a supervisor who is an ACI certified Concrete Flatwork Technician.

B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mix concrete products that complies with ASTM C 94 requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

C. Testing Agency for Mix Design Qualifications: An independent agency, registered in the State of Massachusetts as an approved testing agency, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-01 or an equivalent certification program.
2. Personnel performing laboratory tests shall be ACI certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician –

Grade 1. The Testing Agency Laboratory supervisor shall be an ACI certified Concrete Laboratory Testing Technician – Grade II.

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

E. ACI Publications:

1. Comply with the following unless modified by requirements in the Contract Documents:
   a. ACI 117, "Standard Specifications for Tolerances for Concrete Construction and Materials."
   b. ACI 211.1, "Recommended Practice for Selecting Proportions for Normal and Heavyweight Concrete."
   c. ACI 214, "Evaluation of Strength Test Results of Concrete."
   d. ACI 301, "Specification for Structural Concrete."
   e. ACI 304, "Guide for Measuring, Mixing, Transporting and Placing Concrete."
   f. ACI 305, "Hot Weather Concreting."
   g. ACI 306, "Cold Weather Concreting."
   h. ACI 308, "Guide to Curing Concrete."
   i. ACI 309, "Guide for Consolidation of Concrete."
   j. ACI 311.1, "ACI Manual of Concrete Inspection."
   k. ACI 315, "Details and Detailing of Concrete Reinforcement."
   l. ACI 318, "Building Code Requirements for Structural Concrete and Commentary."
   m. ACI 347, "Guide for Formwork for Concrete."
   n. ACI 350, "Code Requirements for Environmental Engineering Concrete Structures"
2. Where the language in any of the documents referred to herein is in the form of a recommendation or suggestion, such recommendations or suggestions shall be deemed to be mandatory under this Contract.

F. American Society for Testing and Materials (ASTM):

1. ASTM C309 "Liquid Membrane-Forming Compounds for Curing Concrete."

2. ASTM C494 "Standard Specification for Chemical Admixtures for Concrete."
3. ASTM C979 "Standard Specification for Pigments for Integrally Colored Concrete."

G. American Association of State Highway and Transportation Officials (AASHTO):

1. AASHTO M194 "Chemical Admixtures."

H. Pre-installation Conference: Conduct a conference at the Project site to comply with requirements in Division 1 Section “Project Management and Coordination.”

1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend including the following:
   a. Contractor’s superintendent.
   b. Independent testing agency responsible for concrete design mixtures.
   c. Ready-mix concrete manufacturer.
   d. Concrete subcontractor.
   e. Structural Engineer.
   f. Independent testing agency responsible for field testing.
   g. Owner’s Authorized Representative.
   h. Engineer.
2. Review inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold and hot-weather concreting procedures, curing procedures, construction contraction and isolation joints, and joint filler strips, semi-rigid joint fillers, forms and form removal limitations, anchor rod and anchorage device installation tolerances, steel reinforcement installation, floor slab and slab flatness and levelness measurement, concrete repair procedures, and concrete protection.

1.05 DELIVERY, STORAGE, AND HANDLING:

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.

PART 2 - PRODUCTS

2.01 FORM-FACING MATERIALS:

A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.

1. Plywood, metal, or other approved panel materials.

B. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that will produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.

C. Chamfer Strips: Wood, metal, PVC, or rubber strips, ¾-inch by ¾-inch, minimum.

D. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.

E. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

F. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral earth pressure of fresh concrete on forms and to prevent spalling of concrete on removal.

G. Furnish units that will leave no corrodible metal closer than 1-inch to the plane of exposed concrete surface.

H. Furnish ties with integral water-barrier plates to walls indicated to receive damp proofing or waterproofing.

2.02 STEEL REINFORCEMENT:

A. Reinforcing Bars: ASTM A 615, Grade 60, deformed.

B. Plain Steel Wire: ASTM A 82, as drawn.

C. Plain-Steel Welded Wire Reinforcement: ASTM A 185, plain, fabricated from as-drawn steel wire into flat sheets.

2.03 NON-METALLIC SHRINKAGE RESISTANT GROUT:

A. Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, non-staining, mixed with water to consistency suitable for application and a 30-minute working time. The minimum ultimate compressive strength of the grout shall be 5000 psi at 7 days and 7500 psi at 28 days.

2.04 REINFORCEMENT ACCESSORIES:

A. Joint Dowel Bars: ASTM A 615, Grade 60, plain-steel bars, cut bars true to length with ends square and free of burrs.

B. Bar Supports: Bolster, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice", of greater of compressive strength than concrete and as follows:

1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless steel bar supports.
2. For slabs-on-grade, use supports with sand plates or horizontal runners where base material will not support chair legs. Concrete bricks may be used to support reinforcing steel where application allows.

2.05 CONCRETE MATERIALS:

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout the Project:

1. Portland Cement: ASTM C 150, Type I/II. Supplement with the following:

B. Fly Ash: ASTM C 618, Class C or F.

C. Ground Granulated Blast Furnace Slag: ASTM C 989, Grade 100 or 120.

D. Cementitious Materials: Percentage, by weight, of cementitious materials other than Portland cement in concrete as follows:

1. Fly Ash or Ground Granulated Blast Furnace Slag: 25 percent, minimum.
2. Combined Fly Ash and Pozzolan: 35 percent, maximum.
3. Ground Granulated Blast Furnace Slag: 50 percent, maximum.

4. Combined Fly Ash or Pozzolan and Ground Granulated Blast Furnace Slag: 50 percent Portland cement minimum, with fly ash or pozzolan not exceeding 35 percent.

E. Normal-Weight Aggregates: ASTM C 33, Class 3S coarse aggregate or better, graded. Provide aggregates from a single source.

1. Maximum Coarse Aggregate Size: ¾-inch nominal.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

F. Water: ASTM C 94 and potable.

2.06 ADMIXTURES:

A. Air-Entraining Admixture: ASTM C 260.

B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C 494, Type A.
2. Retarding Admixture: ASTM C 494, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494, Type G.
6. Plasticizing and Retarding Admixture: ASTM C 1017, Type II.

C. Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, anodic inhibitor or mixed cathodic and anodic inhibitor,; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete and complying with ASTM C 494, Type C.

1. Products:
2. Euclid Chemical Company; Eucon CIA.
3. Grace Construction Products, W.R. Grace & Co.; DCI.
4. BASF Admixtures, Inc.; Rheocrete CNI.
5. Sika Corporation; Sika CNI.

D. Non-Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, non-set-accelerating, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete.

1. Products:
    a. Grace Construction Products, W.R. Grace & Co.; DCI-S.

2.07 WATERSTOPS:

A. Self-Expanding Butyl Strip Waterstops: Manufactured rectangular or trapezoidal strip, butyl rubber with sodium bentonite or other hydrophilic polymers, for adhesive bonding to concrete, ¾-inch by 1-inch.

1. Colloid Environmental Technologies Company; Volclay Waterstop-RX.
2. Concrete Sealants, Inc.; Conseal CS-231.
3. Greenstreak; Swellstop.
4. Henry Company, Sealants Division; Hydro-Flex.
5. Progress Unlimited, Inc.; Superstop.
6. TCMiraDRI; Mirastop.

B. Self-Expanding Rubber Strip Waterstops: Manufactured rectangular or trapezoidal strip, bentonite-free hydrophilic polymer modified chloroprene rubber, for adhesive bonding to concrete, 3/8-inch by ¾-inch.

1. Deneef Construction Chemicals; Swellseal.
2. Greenstreak; Hydrotite.
3. Mitsubishi International Corporation; Adeka Ultra Seal.
4. Progress Unlimited, Inc.; Superstop.

C. Waterstops: Provide ribbed, dumbbell type or center bulb type waterstops at construction joints and other joints as indicated.

1. Polyvinyl Chloride Waterstops: Corps of Engineers CRD-C 572.

2.08 FLOOR AND SLAB TREATMENTS:

A. Penetrating Liquid Floor Treatment: Clear, chemically reactive, waterborne solution of inorganic silicate or siliconate materials and proprietary components; odorless; colorless; that penetrates, hardens, and densifies concrete surfaces.

1. Products:

a. Burke by Edoco; Titan Hard.
b. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; Intraseal.
c. Curecrete Distribution Inc.; Ashford Formula.
d. Dayton Superior Corporation; Day-Chem Sure Hard.
e. Euclid Chemical Company; Euco Diamond Hard.
f. Kaufman Products, Inc.; SureHard.
g. L&M Construction Chemicals, Inc.; Seal Hard.
h. Meadows, W.R., Inc.; Liqui-Hard.
i. Symons Corporation, a Dayton Superior Company; Buff Hard.

2.09 CURING MATERIALS:

A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz. /sq. yd. when dry.

B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

C. Water: Potable.

D. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, 18 to 25 percent solids, non-dissipating, certified by curing compound manufacturer to not interfere with bonding of floor coverings.

1. Products:
   a. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; High Seal.
   b. Dayton Superior Corporation; Safe Cure and Seal (J-19).
   c. Euclid Chemical Company; Diamond Clear VOX.
   d. Lambert Corporation; Glazecote Sealer-20.
   e. L&M Construction Chemicals, Inc.; Dress & Seal WB.
   f. Meadows, W.R., Inc.; Vocomp-20.
   g. Nox-Crete Products Group, Kinsman Corporation; Cure & Seal 200E.
   h. Sonneborn, Div. Of ChemRex; Kure-N-Seal.
   i. Symons Corporation, a Dayton Superior Company; Cure & Seal 18 Percent E.

E. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

1. Products:
   a. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; Sealcure 1315 WB.
   b. Euclid Chemical Company; Super Diamond Clear VOX.
   c. Lambert Corporation; UV Safe Seal.
   d. L&M Construction Chemicals, Inc.; Lumiseal WB Plus.
   e. Meadows, W.R., Inc.; Vocomp-30.
   f. Symons Corporation, a Dayton Superior Company; Cure & Seal 31 Percent E.

2.10 RELATED MATERIALS:

A. Expansion and Isolation Joint Filler Strips: ASTM D 1752, cork or self-expanding cork.

B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 per ASTM D 2240.

C. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

D. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:

1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

E. Reglets: Fabricate reglets of not less than 0.0217-inch thick, galvanized steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.

B. Dovetail Anchor Slots: Hot-dip galvanized steel sheet, not less than 0.0336-inch thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

2.11 REPAIR MATERIALS:

A. Repair Underlayment: Cement based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8-inch and that can be feathered at edges to match adjacent floor elevations.

1. Cement Binder: ASTM C 150, Portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8-inch to ¼-inch or coarse sand as recommended by the underlayment manufacturer.
4. Compressive Strength: Not less than 4100 psi at 28 days when tested in accordance with ASTM C 109.

B. Repair Overlayment: Cement based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8-inch and that can be feathered at edges to match adjacent floor elevations.

1. Cement Binder: ASTM C 150, Portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8-inch to ¼-inch or coarse sand as recommended by the topping manufacturer.
4. Compressive Strength: Not less than 5000 psi at 28 days when tested in accordance with ASTM C 109.

2.12 CONCRETE MIXTURES, GENERAL:

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.

1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on trial mixtures.

B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than Portland cement in concrete as follows:

1. Fly Ash: 25 percent.
2. Combined Fly Ash and Pozzolan: 25 percent.

3. Ground Granulated Blast-Furnace Slag: 50 percent.
4. Combined Fly Ash or Pozzolan and Ground Granulated Blast-Furnace Slag: 50 percent.

C. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

D. Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use water-reducing, high-range water reducing or plasticizing admixture in concrete, as required, for placement and workability.
2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water cementitious materials ratio below 0.50.
4. Use retarding admixture in combination with Set accelerating Corrosion Inhibitor. Retarder is not required for non-set accelerating corrosion inhibitor.
5. Use corrosion inhibiting admixture in concrete mixtures where indicated.

2.13 CONCRETE MIXTURES FOR BUILDING ELEMENTS:

A. Footings, Foundation Walls, and Knee Walls: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 4000 psi at 28 days.
2. Maximum Water-Cementitious Materials Ratio: 0.45.
3. Slump Limit: 4-inches for concrete with verified slump of 2-inch to 4-inches before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1-inch.
4. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch nominal maximum aggregate size.

B. Interior Slabs-on-Grade and Equipment Pads: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 4500 psi at 28 days.
2. Maximum Water-Cementitious Materials Ratio: 0.45.
3. Slump Limit: 4-inches, plus or minus 1-inch.

4. Air Content: Do not allow air content of troweled finished floors to exceed 3 percent.
5. Corrosion Inhibiting Admixture at Vehicle Storage and Maintenance Areas: Apply to all slabs at a rate of 3 gallons per cubic yard of concrete.

C. Exterior Slabs, and Sidewalks: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 5000 psi at 28 days.
2. Maximum Water-Cementitious Materials Ratio: 0.40.
3. Slump Limit: 4-inches for concrete with verified slump of 2-inch to 4-inches before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1-inch.
4. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch nominal maximum aggregate size
5. Corrosion Inhibiting Admixture: Apply to all slabs at a rate of 3 gallons per cubic yard of concrete.

2.14 FABRICATING REINFORCEMENT:

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

2.15 CONCRETE MIXING:

A. Ready-Mix Concrete: Measure, batch, mix, and deliver concrete according to ASTM C94, and furnish batch ticket information.

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

PART 3 - EXECUTION

3.01 GENERAL:

A. Coordinate the installation of joint materials, vapor retarder/barrier, and other related materials with placement of forms and reinforcing.

3.02 FORMWORK:

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:

1. Class A, 1/8-inch for smooth-formed finished surfaces.

D. Construct forms tight enough to prevent loss of concrete mortar.

E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.

1. Install keyways, reglets, recesses, and the like for easy removal.
2. Do not use rust-stained steel form-facing material.

F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

G. Provide temporary openings for cleanouts and inspections ports where interior area formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

H. Chamfer exterior corners and edges of permanently exposed concrete.

I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.03 EMBEDDED ITEMS:

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

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

B. Forms for Slabs: Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and contours in finished surfaces. Provide and secure units to support screed strips using strike-off templates or compacting type screeds.

3.04 REMOVING AND REUSING FORMS:

A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 degrees F for 24 hours after placing concrete, if concrete is hard enough to not be damaged by form removal operations and curing and protection operations are maintained.

B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.

C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by the Engineer.

3.05 STEEL REINFORCEMENT:

A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.

1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.

D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

E. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire ties.

3.06 JOINTS:

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or approved by the Engineer.

1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
2. Form keyed joints as indicated. Embed keys at least 1-1/2-inches into concrete.
3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
4. Locate horizontal joints in walls and columns at the underside of floors, slabs, beams, and girders and at the top of footings and floor slabs.
5. Space vertical joints in walls at 60-feet on center maximum. Locate joints besides piers integral with walls, near corners, and in concealed locations where possible.
6. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

7. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge joint to a radius of 1/8-inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

1. Terminate full-width joint filler strips not less than ½-inch or more than 1-inch below finished concrete surface where joint sealants, specified in Division 7 Section “Joint Sealants”, are indicated.
2. Install joint filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

E. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.07 CONCRETE PLACEMENT:

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Engineer.

C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.

1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.

1. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
3. Do not use vibrators to transport concrete. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6-inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

E. Deposit and consolidate concrete for floors and slabs in continuous operation, within limits of construction joints, until placement of panel or section is complete.

1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
2. Maintain reinforcement in position on chairs during concrete placement.
3. Screed slab surfaces with a straightedge and strike off to correct elevations.
4. Slope surfaces uniformly to drains where required.
5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

F. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When average high and low temperature is expected to fall below 40 degrees F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.

3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

G. Hot-Weather Placement: Comply with ACI 301 and as follows:

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

3.08 FINISHING FORMED SURFACES:

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces not exposed to view.

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with minimum number of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces exposed to view.

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

3.09 FINISHING FLOORS AND SLABS:

A. General: Comply with ACI 302.1R recommendations for screeding, re-straightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Re-straighten, cut down high spots, and fill low spots. Repeat float passes and re-straightening until surface is left with a uniform, smooth, granular texture.

1. Apply float finish to surfaces to receive trowel finish.

C. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and re-straightening until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.

1. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film finish coating system.
2. Finish surfaces to the following tolerances, according to ASTM E 1155 for a randomly trafficked floor surface:
3. Specified overall values of flatness, F(F) 25; and of levelness, F(L) 20; with minimum local values of flatness, F(F) 17; and of levelness, F(L) 15.

D. Broom Finish: Apply a broom finish to exterior platforms, steps, and ramps, and elsewhere as indicated.

1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Engineer before application.

3.10 MISCELLANEOUS CONCRETE ITEMS:

A. Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates from manufacturer furnishing machines and equipment.

3.11 CONCRETE PROTECTING AND CURING:

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.

B. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.

C. Cure concrete according to ACI 308.1, by one or a combination of the following methods:

1. Moisture Curing: Curing all slabs in the project with moisture curing. Keep surfaces continually moist for not less than seven days with the following materials:
    a. Water.
    b. Continuous water-fog spray.
    c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
2. Moisture-Retaining Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in the widest practicable width, with sides and ends lapped at least 12-inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
    a. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or curing compound that the manufacturer certifies will not interfere with bonding of floor covering used on Project.
3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subject to heavy rainfall within three hours after initial applications. Maintain continuity of coating and repair damage during curing period.
    a. After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound will not interfere with bonding of floor covering used on Project.
4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's

written instructions. Recoat areas subject to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply second coat. Maintain continuity of coating and repair damage during curing period.

D. Curing Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces, by moist curing with forms in place for the full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.

3.12 LIQUID FLOOR TREATMENTS:

A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment to concrete floors exposed to view according to manufacturer's written instructions.

1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
2. Comply with Manufacturer's written instructions for application.

B. Sealing Coat: Uniformly apply a continuous sealing coat of curing and sealing compound to hardened concrete by power spray or roller according to manufacturer's written instructions.

3.13 JOINT FILLING:

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

1. Defer joint filling until concrete has aged at least one month. Do not fill joints until construction traffic has permanently ceased.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.

3.14 CONCRETE SURFACE REPAIRS:

A. Defective Concrete: repair and patch defective areas when approved by the Engineer. Remove and replace concrete that cannot be repaired and patched to the Engineer's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part Portland cement to two and one-half parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than ½-inch in any dimension in solid concrete, but not less than 1-inch in depth. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush coat holes and voids with bonding agent. Fill and compact patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
2. Repair defects on surfaces exposed to view by blending white Portland cement and standard Portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by the Engineer.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

1. Repair finished surfaces containing defects. Surface defects include spalls, pop outs, honeycombs, rock pockets, crazing and cracks in excess of 0.01-inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
2. After concrete has cured at least 14-days, correct high areas by grinding.
3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
5. Repair defective areas, except random cracks and single holes 1-inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least ¾-inch clearance all around. Dampen concrete surfaces in contact with

patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

6. Repair random cracks and single holes 1-inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72-hours.

E. Perform structural repairs of concrete, subject to Engineer's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to the Engineer's approval.

3.15 FIELD QUALITY CONTROL:

A. Testing and Inspecting: Owner will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Inspections:

1. Steel reinforcement placement.
2. Steel reinforcement welding.
3. Headed bolts and studs.
4. Verification of use of required design mixture.
5. Concrete placement, including conveying and depositing.
6. Curing procedures and maintenance of curing temperature.

C. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:

1. Testing Frequency: Obtain one composite sample of each day's pour of each concrete mixture exceeding 5 cubic yards, but less than 25 cubic yards, plus one set for each additional 50 cubic yards or fraction thereof.
2. Slump: ASTM C 143; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.

3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 degrees F and below and when 80 degrees F and above, and one test for each composite sample.
5. Compression Test Specimens: ASTM C 31.
6. Cast and laboratory cure five standard cylinder specimens for each composite sample.
7. Compressive Strength Tests: ASTM C 39; test one set of two-laboratory-cured specimens at 7 days and one set of two specimens at 28 days. Test remaining specimen at 28 days if previous results are satisfactory or retain this specimen for 56 day testing if results are not satisfactory.
8. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive strength tests equals or exceeds specified compressive strength and no compressive strength test value falls below specified compressive strength by more than 500 psi.

D. Test results shall be reported in writing to the Engineer, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7 and 28 day tests.

1. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Engineer but will not be used as the sole basis for approval or rejection of concrete.
2. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as required by the Engineer. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42 or by other methods as required by the Engineer.
3. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
4. Correct deficiencies in the Work that test reports and inspections indicate does not comply with the Contract Documents.

E. Measure floor and slab flatness and levelness according to ASTM E 1155 within 24 hours of finishing.

3.16 GROUTING:

A. Mix grout in accordance with the approved manufacturer's instructions to a consistency which will permit placement. Place grout so as to ensure complete bearing and elimination of air pockets.

3.17 TEST FOR WATERTIGHTNESS:

A. All concrete shall be watertight against leakage or groundwater infiltration. Special care shall be taken in the construction joints and any noticeable leakage or seepage causing wet spots on the concrete walls or slabs shall be repaired by and at the expense of the Contractor and by methods approved by the Engineer.

B. All liquid holding concrete structures shall be tested for leakage before backfilling and after the concrete has attained the specified minimum 28-day design strength, as indicated by test cylinders.

C. The structure shall be filled with water to the overflow level, allowed to stand for at least 24-hours, and refilled to overflow to begin the test. After 72 hours, the liquid loss per 24 hour period shall be determined, either by measuring the amount required to refill the tank to overflow, by measuring the drop in water level, or by an equivalent procedure approved by the Engineer. Evaporative losses shall be calculated and deducted from the measured loss to determine net liquid loss (leakage). If the leakage per 24-hour period exceeds the allowable, the structure shall be repaired and retested until the leakage falls within the allowable limit.

D. For structures designed to hold water, one twentieth of one percent leakage will be allowed during a 24-hour period. No leakage (zero leakage) will be permitted for structures designed to hold liquid chemicals or fuels.

E. The Contractor shall pay all costs (including water) incurred in the testing for water tightness.

F. The Engineer shall be given a minimum notice of 48 hours prior to commencement of the leakage test.

END OF SECTION

SECTION 03 48 00

PRECAST CONCRETE BACKWASH TANK & STRUCTURES

PART 1 - GENERAL

1.01 WORK INCLUDED

This section of the specification covers the furnishing and installation of the holding tank and valve vaults.

1.02 RELATED WORK

A. SECTION 13 00 00, SUMMARY OF WORK FOR FILTRATION SYSTEMS

B. SECTION 22 51 00, FILTRATION SYSTEM EQUIPMENT

C. SECTION 31 00 00, EARTHWORK

1.03 QUALITY ASSURANCE

A. The collector tank shall be tested with a static water test to ensure the tank does not leak.

1.04 SUBMITTALS

In accordance with requirements of General Specifications, submit the following:

A. Six sets of shop drawings of the materials of this section shall be submitted to the Engineer for review.

B. Tank drawings shall be stamped by a Registered Massachusetts Professional Engineer. They shall display that they are designed to withstand hydraulic uplift.

PART 2 - PRODUCTS

2.01 BACKWASH TANK

A. The backwash tank shall be sized in accordance with contract plans, reinforced concrete tank, having a minimum capacity of 4,000 gallons. Precast concrete collector tank shall have an H-20 minimum load rating. A hatch cover shall be incorporated into the precast.

B. The tank shall be constructed of 5,000 psi concrete, shall have a minimum wall thickness of 6-inches, and shall be coated with a bituminous coating on the exterior of the structure.

C. The backwash tank shall be constructed to meet or exceed a design loading class of AASHTO HS20-44.

D. A 3'-0" by 3'-0" riser section for the backwash tank shall be an aluminum hatch with stainless steel frame and hardware as specified on the contract plans. Hatches shall extend from the top slab of the backwash tank finished flush with the ground surface, as indicated on the drawings. Riser sections seams shall be water tight. Hatch covers shall be Model J-AL-H20 manufactured by Bilco. Providing H-20 Live Load.

E. All tank segment seals shall be Butyl Rubber, designed for drinking water use. The Butyl Rubber seal shall be able to withstand breakdown from Sodium Hypochlorite, or Calcium Hypochlorite.

F. All penetrations shall be sealed with a Link Seal or approved equal. All penetrations shall have a mechanical seal.

G. Backwash tank shall be designed by the manufacturer to be hydraulically ballast in an empty state. Contractor shall furnish shop drawings stamped by a Professional Engineer providing the structure to be hydraulically ballast.

2.02 PRECAST SKIMMER STRUCTURES:

A. The precast structure shall be sized in accordance with contract plans, reinforced concrete tank, providing the minimum dimensions as shown on the drawings. A hatch cover shall be incorporated into the precast.

B. The tank shall be constructed of 5,000 psi concrete, shall have a minimum wall thickness of 4-inches thick.

C. A 2'-0" by 2'-0" riser section for the skimmer structure shall be an aluminum hatch with stainless steel frame and hardware as specified on the contract plans. Hatches shall extend from the top slab of the structure. Hatch shall have the ability to receive one inch of concrete topping on the hatch cover. Riser sections seams shall be water tight. Hatch covers shall be Model TER manufactured by Bilco. Providing 300 lb/SF Live Load.

D. All tank segment seals shall be Butyl Rubber, designed for drinking water use. The Butyl Rubber seal shall be able to withstand breakdown from Sodium Hypochlorite, or Calcium Hypochlorite.

E. All penetrations shall be sealed with a Link Seal or approved equal. All penetrations shall have a mechanical seal.

PART 3 - EXECUTION

3.01 INSTALLATION

A. The backwash tank and appurtenances shall be installed in accordance with the manufacturer's instructions, as detailed on the drawings, and in accordance with local and state codes.

B. Penetrations shall be coordinated by the Contractor.

3.02 TESTING

A. The backwash tank shall be water tested for a 24-hour period. The tank shall be filled to the static water level proposed. The tank shall stay at the static water level for a minimum of 24 hours. If in this time the water in the tank drops more than a ¼-inch, the tank shall be drained, repaired, and retested until the tank complies with the above-mentioned allowable loss.

END OF SECTION

SECTION 04 01 00.61

MASONRY RE-POINTING

PART 1 - GENERAL

1.01 WORK INCLUDED:

This section specifies the requirements for re-pointing of existing masonry structures.

1.02 REFERENCES:

The following standards form a part of these specifications as referenced:

American Society for Testing and Materials (ASTM):

C 67 Brick and Structural Clay Tile, Sampling and Testing

C 144 Aggregate for Masonry Mortar

C 150 Portland Cement

C 207 Hydrated Lime for Masonry Purposes

C 270 Mortar for Unit Masonry

PART 2 - PRODUCTS

2.01 MORTAR:

A. Mortar shall be Type K and shall meet the requirements of ASTM C 270 and shall match the existing mortar color.

B. Sand for mortar shall be clean and shall meet the gradation requirements of ASTM C 144.

C. Lime shall conform to ASTM C 207, Type S.

D. Portland cement shall conform to ASTM C 150, Type II. Cements shall contain less than 0.6% alkalis and less than 0.15% soluble alkalis.

E. Water shall be clean, potable, and free of deleterious amounts of acids, alkalies, or organic materials.

F. Chemical additives shall not be used, unless approved by the Engineer.

PART 3 - EXECUTION

3.01 GENERAL:

A. All work shall be completed by qualified and experienced re-pointing craftsmen and shall be completed in accordance with the re-pointing index of ASTM C 270.

B. The mortar shall be pre-hydrated to reduce excessive shrinkage. All dry components shall be thoroughly mixed and only enough water should be added to produce a damp, workable consistency that will retain its shape when formed into a ball. The mortar should then stand for 1 to 1½ hours.

C. Just enough water should be added to the pre-hydrated mortar to provide a plastic mixture that will give a smooth surface when the back of the trowel is used to smooth the surface of the mortar.

3.01 MORTAR REMOVAL:

A. As shown on the Drawings, all joints with cracks that are 1/16-inches or wider shall be raked and re-pointed as described herein.

B. Remove existing mortar with a chisel to a minimum depth that is 2 times the width of the mortar joint, or until sound mortar is reached. Take care to not damage edges of existing masonry units to remain.

C. The depth of the joint shall be uniform across the bottom.

D. The use of rotary grinders is not acceptable.

E. Remove dust and debris from the joints by brushing, blowing with air or rinsing with water. Do not rinse when temperature is below freezing.

3.02 INSTALLATION OF MORTAR:

A. Immediately prior to application of mortar, dampen joints to be re-pointed. Prior to application of re-pointing mortar, allow masonry units to absorb surface water.

B. Tightly pack mortar into joints in thin layers, approximately 1/4-inch thick maximum.

C. Allow layer to become "thumbprint hard" before applying next layer.

D. Pack final layer flush with surfaces of masonry units. When mortar becomes "thumbprint hard", tool joints.

E. Protect newly re-pointed joints from rain, until re-pointed joints are sufficiently hard enough to prevent damage.

3.04 TOOLING OF JOINTS:

Tool joints with a jointing tool to produce a smooth, compacted, concaved joint.

3.05 CLEANING:

A. Clean exposed masonry surfaces on completion.

B. Remove mortar droppings and other foreign substances from wall surfaces.

C. First wet surfaces with clean water, then wash down with a solution of soapless detergent specially prepared for cleaning brick.

D. Brush with stiff fiber brushes while washing, and immediately thereafter hose down with clean water.

E. Free clean surfaces from traces of detergent, foreign streaks or stains. Protect materials during cleaning operations including adjoining construction.

F. Use of muriatic acid for cleaning is prohibited.

END OF SECTION

SECTION 05 12 33

STRUCTURAL STEEL

PART 1 - GENERAL

1.01 WORK INCLUDED:

A. The work of this Section consists of providing all labor, materials, and equipment required to furnish, fabricate, and erect the work of this Section including but not limited to:

1. Providing leveling plates, bearing plates, anchor rods, beams, baseplates, leveling plates, bracing and connections, angles, channels, stiffeners, separator plates, clips, openings, connections, welding filler material and electrodes, connection bolts, erection bolts, and any other structural steel called for on the Drawings.
2. Items of structural steel required to be built into concrete or masonry, as indicated or specified, shall be furnished to the respective trades at the proper time with complete instructions and template to facilitate inspection.
3. Design of bolted/welded connections.
4. Furnishing and installation of non-shrink grout under leveling and base plates.
5. Unless specifically excluded, providing all other items for structural steel work indicated on the Drawings, specified, or obviously needed to make the work of this Section complete.
6. All steel items shown or indicated on the Structural Drawings.
7. Furnishing any temporary bracing necessary for support and alignment of the work, and shop painting as herein specified.
8. Structural steel shall consist of all material as defined in Section 2, "Definition of Structural Steel," of the AISC Code, and accessory material called for, or reasonably implied by the drawings.

1.02 RELATED WORK:

A. Section 01 45 23, STRUCTURAL TESTS AND INSPECTIONS

B. Section 03 30 00, CAST-IN-PLACE CONCRETE

C. Section 05 31 23, STEEL DECK

D. Section 05 50 00, MISCELLANEOUS METALS

E. Section 09 91 00, PAINTING

1.03 REFERENCES:

A. The following standards from a part of these specifications as referenced:

1. American Institute of Steel Construction (AISC)
   a. Code of Standard Practice for Steel Buildings and Bridges
   b. Specification for Structural Steel for Buildings
   c. Manual of Steel Construction
   d. Specification for Structural Joints Using ASTM A325 or A490 Bolts
2. American Society for Testing and Materials (ASTM)
   a. ASTM A36 Structural Steel
   b. ASTM A307 Carbon Steel Externally and Internally Threaded Standard Fasteners
   c. ASTM A325 High Strength Bolts for Structural Steel Joints
   d. ASTM A490 Heat-treated Steel Structural Bolts, 150 ksi Min. Tensile Strength
   e. ASTM A500 Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing
   f. ASTM A563 Carbon and Alloy Steel Nuts
   g. ASTM F436 Hardened Steel Washers
   h. ASTM A992 Standard Specifications for Structural Steel Shapes
   i. ASTM F1554 Standard Specification for Anchor Rods
3. American Welding Society (AWS)
   a. AWS D1.1 Structural Welding Code Steel
4. Steel Structures Painting Council (SSPC)
   a. SSPC-SP 6 Commercial Blast Cleaning
   b. SSPC-PA 2, Shop, Field and Maintenance Painting
5. Massachusetts State Building Code, Latest Edition.

1.04 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF GENERAL SPECIFICATIONS, SUBMIT THE FOLLOWING:

A. Product Data: Provide manufacturer's specifications and installation instructions for the following products. Include laboratory test reports and other data to show compliance with specifications (including specified standards).

1. Structural steel (each type), including certified copies of mill reports covering chemical and physical properties.
2. High-strength bolts (each type), including certified copies of mill reports for nuts and washers; include direct tension indicators if used.
3. Anchor rods (each type), including certified copies of mill reports for nuts and washers
4. Structural steel primer paint.
5. Touch-up paint for galvanized steel.
6. Grout.
7. Headed Stud Anchors.
8. Adhesive/Expansion Anchors

B. As-built Survey: Submit to the Engineer an as-built survey showing the locations of the anchor bolts prior to installation of leveling and bearing plates. This submittal is for information and file record.

C. Standard Shop Details and Connection Design Calculations: Submit to the Engineer prior to submitting detailed shop drawings, design calculations and details for connections not shown on the Drawings. Calculations shall be prepared, signed, and sealed by a registered professional engineer. Calculations and drawings are subject to review by the Engineer. The Engineer reserves the right to require revisions to this work at no additional cost to the Owner.

D. Checked shop drawings shall be submitted to the Engineer for review and approval. Fabrication shall not begin until the Engineer has approved the shop drawings.

E. Shop drawings shall include detail drawings, erection drawings, certifications, schedules, and all other information necessary for the fabrication and erection of component parts of the structure. The shop drawings shall be checked and properly coordinated with other parts of the construction. The following shall be included in the shop drawings:

1. Type of steel for each member, location and identification mark of each member, dimensions, size and weight of members, location and size of cuts, copes, slots, holes and openings required by other trades, type and location of

shop and field connections, type, size, and extent of all welds, joint welding procedures, welding sequence, and painting requirements.

2. All requirements such as temporary members required for erection, including connections.
3. Use standard welding symbols of the American Welding Society.

F. Except as otherwise noted, the approval of shop drawings will be for size and arrangement of primary and secondary components and strength of connections. Any error in dimensions shown on the shop drawings shall be the responsibility of the Contractor.

G. Submit manufacturer's certification of bolts, nuts, and filler metal for welding.

1.05 QUALITY ASSURANCE:

A. Testing and Inspection

1. Refer to Section 01 45 23 for Structural Testing and Inspections. Comply with the additional requirements specified in Section 01 45 23, Structural Tests and Inspections.
2. The inspection and testing services provided by the Independent Testing Agency do not relieve the Contractor, the steel fabricator and erector from the responsibility to provide supervision, testing, inspection, and quality control in order to assure conformance with these specifications.

B. The Contractor must utilize the services of a Professional Structural Engineer licensed in the State of Massachusetts to design, sign, and seal calculations and drawings for the following:

1. Connection designs indicated on the Drawings to be designed by the Contractor.
2. Weld repairs.
3. Welded and bolted connection repairs.
4. Revisions required because of erection misalignment, fabrication defects, damage from construction activities.

C. The Contractor is responsible for fit up and installation of all steel work and shall field verify all dimensions and conditions.

D. The fabricator shall possess a valid certificate, category I Conventional Steel Building Structures as issued through the AISC Quality Certification Program, or

shall have a detailed Quality Control Plan subject to audit as indicated in Section 01 45 23.

E. Welder, Tacker and Welding Operator Qualifications: Use welders, tackers and welding operators who are currently qualified by tests as prescribed in the Structural Welding Code, AWS D1.1 of the American Welding Society to perform type of work required. Headed stud welding operators shall also be qualified in accordance with AWS D1.1.

F. Welded connections shall be designed and detailed utilizing AWS prequalified joints.

1.06 DELIVERY, STORAGE, AND HANDLING:

A. Store steel on platforms, skids, blocking or other supports to prevent dirt and debris contact. Protect from exposure to conditions that produce rust.

B. Handle steel so no parts are bent, broken or otherwise damaged and avoid damage to other material and work. Store beams with webs vertical. Exercise care to avoid scraping and overstressing the steelwork.

C. Ship small parts, such as bolts, nuts, washers, pins, fillers, and small connecting plates and anchors, in boxes, crates, or barrels. Pack separately each length and diameter of bolt and each size of nut and washer. Plainly mark an itemized list and description of the contents on the outside of each container.

PART 2 - PRODUCTS

2.01 STRUCTURAL STEEL MATERIALS:

A. Rolled steel wide-flange shapes: ASTM A992.

B. Steel channels, angles, plates and bars: ASTM A36.

C. Structural Steel Tubing: ASTM A500 Grade B.

2.02 BOLTS, CONNECTORS, AND ANCHORS:

A. High-Strength Structural Steel Bolts, Nuts and Washers:

1. Bolts: ASTM A325.
2. Nuts: ASTM A563.
3. Washers: ASTM F436.

4. Where steel is indicated on the Drawings to be galvanized, bolts, nuts and washers shall be hot dip galvanized in accordance with ASTM A153.
5. Refer to the Drawings for bolt head style requirements.

B. Anchor Bolts: ASTM F1554. Grade 55 - Weldable, unless noted otherwise. Headed type unless otherwise noted. Provide suitable nuts in accordance with ASTM F1554 and ASTM A563 and washers in accordance with ASTM F436.

C. Beveled Washers: Square, smooth and sloped to make contact surface of bolt head and nut parallel.

D. Headed Stud Anchors: Embedment anchors shall be headed anchors with fluxed ends or approved equal. Stud size as indicated on the Drawings. Studs shall be automatically end welded with suitable equipment in the shop or field on spacing's indicated on the Drawings. All welds shall be made in accordance with the stud manufacturer's requirements. Field installed anchors shall be classified as Structural Steel.

1. Mechanical Properties of Headed Anchors. Low Carbon Steel complying with ASTM A108 Physical Properties:
   a. Tensile (Minimum) 60,000 PSI (60KSI)
   b. Yield (Minimum) 50,000 PSI (50KSI) (0.2% Offset)
   c. Elongation (Minimum) 20% in 2-inches.

E. Adhesive Anchoring Systems: Composed of an anchor rod, nut, washer and an anchor rod adhesive cartridge.

1. Anchor Rod Assembly: Chamfered end, all thread steel anchor rod with nut and washer. Size and load capacity as indicated on the Drawings.
2. Adhesive Cartridge: Sealed capsule containing premeasured amounts of (resin, quartz sand aggregate, and a hardener contained in a separate vial within the capsule. Capsule ingredients activated by the insertion procedure of the anchor rod assembly.
3. Acceptable Manufacturers:
   a. Hilti Fastening Systems; HIT-HY 200 Adhesive System.
   b. Or Approved Equal.

F. Welding Electrodes: E70XX in accordance with AWS Dl.l. Refer to the Drawings for special requirements at moment connections.

2.03 GROUT:

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.04 SHOP PRIMER PAINT:

A. Products to be used shall meet the regulations of jurisdiction for Volatile Organic Compounds (VOC) emissions.

B. Exterior Exposed Steel, Not Galvanized: Zinc-rich epoxy primer followed by an intermediate coat of epoxy paint.

C. Other Steel, Not Galvanized: Zinc-rich epoxy primer.

D. Shop primer paint shall be compatible with the specified finish paint system. Finish paints shall be in accordance with Section 09 91 00.

2.05 HOT-DIPPED GALVANIZING:

A. Hot-dip galvanized steel fabrications so designated herein and on the drawings and after fabrication in compliance with ASTM A 123.

B. Hot-dip galvanized iron and steel hardware shall be in accordance with ASTM A 153.

PART 3 - EXECUTION

3.01 FABRICATION:

A. Shop Fabrication and Assembly: Fabricate and assemble structural assemblies in the shop to the greatest extent possible. Fabricate items of structural steel in accordance with AISC Specifications and as indicated on final shop drawings.

1. Provide camber in structural members where indicated.
2. Do not splice steel members unless given written approval by the Engineer.
3. Properly mark and match-mark materials for field assembly. Fabricate for delivery sequence that will expedite erection and minimize field handling of materials.

4. Where finishing is required, complete assembly, including welding of units, before start of finishing operations. Provide finish surfaces of members exposed in final structure free of markings, burrs, and other defects.

B. Holes for Other Work: Provide holes required for securing other work to structural steel framing and for passage of other work through steel framing members, as shown on the final shop drawings.

C. Cut, drill, and punch holes perpendicular to metal surfaces. Do not flame cut holes or enlarge holes by burning. Drill holes in bearing plates.

D. Welding:

1. Provide quality control and qualification of welders and welding procedures and operations as specified under "Testing and Inspection" in this Section.
2. Shop Welded Process: Use shielded metal-arc, submerged arc, gas metal-arc, and flux cored-arc, or other process as approved by the Engineer.
3. Groove Welds: Provide complete penetration unless otherwise noted on the Drawings.
4. Fillet Welds: Where weld symbol is not shown or welds are not dimensioned, provide continuous fillet welds all around and on both sides as appropriate. Minimum dimension shall be as indicated in AISC Specification.
5. Base metal shall be checked by Contractor to insure absence of laminations or other defects. Welds shall be sound throughout and have no cracks.
6. Where structural joints are required to be welded, details of joints, technique of welding employed, appearance and quality of welds made, and methods used in correcting defective work shall conform to applicable requirements noted under References in this Section.
7. Prepare joint welding procedures and program of welding sequence (for each component and for welding jointing components to each other) and submit to Engineer for approval before any welding is done. After approval, welding procedures and sequences shall be followed without deviation unless specific approval for change is obtained from the Engineer. Engineer may require requalification's of these welding procedures by tests prescribed in AWS "Standard Qualification Procedures".
8. Each welder working on the project shall be assigned an identification symbol or mark. Each welder shall mark or stamp their identification symbol to each weldment completed, whether in shop or field.

9. Corrective Work: Structural steel elements having fabrication errors and/or which do not satisfy tolerance limits shall not be incorporated in finished work. Such elements may be corrected if permitted by the Engineer and/or Testing Agency. Submit to the Engineer drawings showing details of proposed corrective work. These drawings shall be approved by the Engineer prior to performing corrective work. Corrective work shall be performed in accordance with requirements of Contract Documents. Corrective work and any retesting which may be required shall be at the Contractor's expense.
10. Members scheduled to be fireproofed shall have surfaces prepared as required by the fireproofing material manufacturer.

3.02 SHOP PRIMER PAINTING:

A. General: Shop paint all structural steel, except as noted below:

1. Do not paint members which are to be galvanized.
2. Do not paint surfaces within two inches of any field weld (including shear connectors) or high strength bolted friction type connection.
3. Do not paint surfaces to be high-strength bolted with slip-critical connections, unless the paint is specifically compatible with slip-critical connections.
4. When members are to be partly embedded in concrete or mortar in the finished work, paint only the exposed portions and initial 2-inches of embedded areas. Do not paint members which will be entirely embedded in concrete or mortar in the finished work.
5. Do not paint surfaces to receive metal deck and/or shear connectors fastened by welding.
6. Do not paint surfaces to receive sprayed-on fireproofing.

B. Surface Preparation: At a minimum, clean steel in accordance with Steel Structures Painting Council (SSPC) as follows; except clean to more stringent surface preparation standard if required by primer manufacturer:

1. Steel to be primed with zinc-rich primer: Commercial Blast Clean (SSPC-SP6).
2. Comply with AISC requirements for slip-critical connections.

C. Painting

1. Immediately after surface preparation apply shop primer paint in accordance with manufacturer's recommendations.

2. Apply shop paint in accordance with SSPC-PA-2.
3. Minimum dry film thickness of shop paint shall be 4.0 mils.
4. Comply with AISC requirements for slip-critical connections.
5. Complete shop painting operations on completed shop welded connections after the connections have passed the specified structural tests and inspections.
6. Apply two coats of paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from the first.

3.03 GALVANIZING:

A. General: Hot-dip galvanize all steel exposed to weather or corrosive environments and as indicated on the drawings.

B. Hot-dip galvanized steel shall be inspected for compliance with ASTM A 123 and shall be marked with a stamp that indicates the name of the galvanizer, the ASTM number, and the ounces of zinc per square foot of surface. A notarized Certificate of Compliance with all of the above shall be required from the galvanizer.

C. Hot-dip galvanized hardware shall comply with ASTM A 153.

D. Provide thickness of galvanizing specified in referenced standards.

E. Fill vent holes and grind smooth after galvanizing.

F. All hot-dip galvanized steel shall be safeguarded against embrittlement in conformance with ASTM A-143.

G. Finish color, if required, will be specified by the Engineer.

3.04 ERECTION:

A. Erect structural steel in accordance with the Drawings, the approved submittal documents, pertinent regulations, the referenced AISC standards and these Specifications.

1. Allow concrete foundations to reach a minimum of 14-day curing time before torqueing of anchor rods.
2. Prior to installation of metal decking, clean the unpainted top flanges of structural steel members to be free of heavy rust, mill scale, dirt or such other substances detrimental to welding.
3. Comply with 29 CFR Part 1926 - Safety Standards for Steel Erection.

B. Surveys: Employ a licensed Land Surveyor or licensed engineer for accurate erection of structural steel. Check elevations on concrete and masonry bearing surfaces, and locations of anchor rods and similar devices, before erection work proceeds, and report discrepancies to Engineer. Do not proceed with erection until corrections have been made or until compensating adjustments to structural steel work have been agreed upon with Engineer.

C. Temporary Shoring and Bracing: Provide temporary shoring and bracing members with connections of sufficient strength to bear imposed loads. Remove temporary members and connections when permanent members are in place and final connections are made. Provide temporary guy lines to achieve proper alignment of structures as erection proceeds.

D. Setting base and bearing plates: Clean concrete and masonry bearing surfaces of bond-reducing materials and roughen to improve bond to surfaces. Clean bottom surfaces of leveling and bearing plates.

1. Set loose and attached leveling plates and bearing plates for structural members on steel wedges, shims, leveling devices, or as shown on the Drawings.
2. Grout under the plates after they have been positioned, plumbed and leveled. Do not remove wedges or shims but, if protruding, cut off flush with top or edges of base plates, or both prior to packing with grout.
3. Pack grout solidly between bearing surfaces and bases or plates to ensure no voids remain. Finish exposed surfaces, protect installed materials, and allow to cure.
4. For proprietary grout materials, comply with manufacturer’s instructions.

E. Field Assembly: Set structural frames accurately to lines and elevations indicated. Align and adjust various members forming part of the complete frame or structure before permanently fastening. Clean bearing surfaces and other surfaces that will be in permanent contact before assembly. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Level and plumb individual members of structure within specified AISC tolerances.
2. Establish required leveling and plumbing references with respect to expected mean service operating temperature inside the building. Make allowances for difference between temperature at time of erection and mean temperature at which structure will be when completed and in service.

F. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges".

G. Splice members only where indicated and accepted on shop drawings.

H. Erection Bolts: On exposed welded construction, remove erection bolts, fill holes with plug welds, and grind smooth at exposed surfaces.

3.05 FIELD CONNECTIONS:

A. General: Beams shall have framed connections using ¾-inch diameter, minimum, high strength bolts in accordance with the requirements of AISC "Manual of Steel Construction" and Contract Drawings.

B. High-Strength Bolts: Install high-strength steel-bolts in accordance with RCSC's "Specifications for Structural Joints Using ASTM A325 or A490 Bolts" for type of bolt and type of joint specified.

1. Joint Type: Snug tightened unless indicated otherwise on the drawings or where pretension or slip critical joints are recommended or required by RCSC or AISC.
2. Do not enlarge holes in members by burning or by using drift pins. Ram holes that must be enlarged to admit bolts.

C. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.

1. Comply with AISC's "Code of Standard Practice for Steel Buildings and Bridges" and "Specification for Structural Steel Buildings" for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.

D. Adhesive Anchor Bolt Anchoring System Installation:

1. General: Install adhesive anchors in strict accordance with manufacturer's instructions and in accordance with the following.
2. Drilling Holes: Use rotary hammer-type drill and make drill holes to the required diameter and depth as consistent with anchor manufacturer's instructions for size of anchors being installed,

a. Prior to setting cartridge and anchor rod clean drilled holes free of loose material by vacuum process, finishing with a blast of compressed air and cover hole until actual use.

3. Anchor Rod Installation: Following cartridge installation in prepared drill holes, set anchor rod to the required depth. Set anchor rods truly perpendicular (normal) to the base plate of item being anchored.

E. Headed Stud Anchors:

1. Welding Specifications: All materials shall be clean, dry and free of paint, rust, oil or other contaminants. Test welding should be done in the same position being used for production. Test welds, after cooling, should be bent by hammer 45° from the vertical position without failure. Non-failure of two studs indicates that the weld setup is satisfactory and production welding may be started.

2. Inspection Requirements: After welding, the ceramic ferrule should be removed from each stud and the weld fillet visually inspected. A fillet of less than 360° is cause for further inspection. Such studs should be hammer tested, bending the stud 15° from the vertical toward the closest end of the embedment plate or steel member. Bending without failure indicates a satisfactory weld. Bent studs may be left bent unless stud projects into concrete cover or obstructs other materials. All bending and straightening when required shall be done without heating before completion of the production stud welding operation.

3. Do not weld studs to steel plates or members with temperatures below 32° F. Welding shall not be done when the steel surface is wet or exposed to rain or snow.

4. The Engineer reserves the right to require the Contractor to repair any welds, which are not a complete 360°, weld at no additional cost. The Engineer also reserves the right to require replacement of studs and the repair of the base metal at no additional cost. Any additional testing and inspection required will be at no additional cost to the Owner.

3.06 FIELD QUALITY CONTROL:

A. Testing Agency: Owner will engage a qualified independent testing and inspection agency to inspect field welds and high-strength bolted connections.

1. Testing agency shall conduct and interpret tests, state in each report whether test specimens comply with requirements, and specifically state any deviations there from.
2. Provide access for testing agency to places where structural steel work is being fabricated or produced so that required inspection and testing can be accomplished.
3. Testing agency may inspect structural steel at plant before shipment.

B. Bolted Connections: Field and shop-bolted connections will be inspected according to RSCS's "Specification for Structural Joints Using ASTM A325 or A490 Bolts.

C. Welded Connections: Inspect and test during erection of structural steel as follows:

1. Review welder's certifications and certify welders if required. Conduct inspections and tests as required. Record types and locations of defects found in the work. Record work required and performed to correct deficiencies.
2. All field welds will be visually inspected according to AWS D1.1.
3. Test all full penetration welds using ultrasonic inspection methods in accordance with ASTM E164.
4. Perform magnetic particle inspection in accordance with ASTM E709 on at least 20% of fillet welds. Magnetic particle inspection shall be performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.

D. Correct deficiencies in structural steel work that inspections and laboratory test reports have indicated to be not in compliance with requirements. Perform additional tests, at Contractor's expense, as necessary to reconfirm any noncompliance of original work and to show compliance of corrected work.

3.07 FIELD TOUCH-UP PAINTING OF SHOP PRIMER PAINTED STEEL AND GALVANIZED STEEL:

A. General: Immediately after erection, clean field welds, bolted connections, and other surfaces required to be painted. Apply paint to areas required to be painted using same material as used for shop painting. Apply by brush or spray to provide minimum dry film thickness specified in Part 2 of this Section for the shop-applied coat.

B. Touch-up paint welded connections after the connections have passed the specified structural tests and inspections.

C. Do not paint when ambient temperature is below 40 degrees F, or when conditions differ from paint manufacturer's recommendations, as approved by the Engineer.

D. Touch up damaged galvanizing with zinc-rich paint in accordance with ASTM A 780 and manufacturer's written instructions.

END OF SECTION

SECTION 05 31 23

STEEL DECK

PART 1 -GENERAL

1.01 WORK INCLUDED:

A. Provide labor, materials and equipment necessary to complete the work of this Section, complete-in-place, including but not limited to the following:

1. Furnishing and installing steel roof deck.

1.02 RELATED WORK:

A. Section 01 45 23 – STRUCTURAL TESTS AND INSPECTIONS

B. Section 03 30 00 – CAST-IN-PLACE CONCRETE

C. Section 05 12 33 – STRUCTURAL STEEL

1.03 REFERENCES:

A. The following standards from a part of these specifications as referenced:

1. The American Iron & Steel Institute: (AISI)
   a. AISI Standard – North American Specification for the Design of Cold-Formed Steel Structural Members 2001 Edition with Supplement 2004.
   b. American Society for Testing and Materials (ASTM)
   c. ASTM A653 Structural Quality, Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.
   d. ASTM A924 Standard Specification for General requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process
2. American Welding Society (AWS)
   a. AWS D1.3 Structural Welding Code Sheet Steel
3. Steel Deck Institute (SDI)
   a. SDI Manual of Construction with Steel Deck
   b. SDI Standard Practice Details
   c. SDI 31 - Design Manual for Composite Decks, Form Decks, and Roof Decks.
   d. SDI Diaphragm Design Manual

4. Massachusetts State Building Code, Latest Edition.
5. American Society of Civil Engineers Standards:
    a. Standard for the Structural Design of Composite Slabs - ANSI/ASCE 3.
    b. Standard Practice for Construction and Inspection of Composite Slabs - ANSI/ASCE 9

1.04 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF GENERAL SPECIFICATIONS, SUBMIT THE FOLLOWING:

A. Shop Drawings and Product Data: For each type of decking specified, show large scaled cross-sectional details of decking, profiles, deck gages, form deck thicknesses, accessory gages, physical dimensions and properties of materials, accessories, finishes, layout of decking, penetrations, openings, accessories, various connections, bearing on structural supports, methods of welding and attachment of accessories, and methods of attachment of decking to structural supports.

1. Submit manufacturer's product catalogs for all materials and products.

B. Submit certified written evidence of qualification test records of welders, tackers and welding operators.

C. Submit documentation of testing conformance for composite slab construction.

D. Submit catalog data indicating capacities of the specified composite slab assemblies.

E. Submit manufacturer's catalogs and load tables for mechanical fasteners.

1.05 QUALITY ASSURANCE/QUALITY CONTROL

A. Applicator Qualifications: Use welders, tackers and welding operators who are currently qualified by tests as prescribed in Welding Sheet Steel in Structures, AWS D1.3 of the American Welding Society to perform type of work required.

B. Manufacturer of deck units must be a member of the Steel Deck Institute.

C. Provide supervision, testing and inspection, and quality control in order to assure conformance with these specifications.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Storage: Store decking on platforms, skids, blocking or other supports with one end elevated and protect from weather with nonasphaltic waterproof covering, adequately ventilated to prevent condensation. Protect from corrosion, deformation, and any other damage.

B. Protection: Exercise care so as not to damage decking during handling or rigging.

1. Do not use decking for storage or as a working platform for other construction materials. This requirement applies to bulk storage.
2. Exercise care so as not to overload decking during installation and during the entire construction period.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. Steel Roof Deck and Accessories: Form from steel sheets conforming to ASTM A653 Structural Quality, Grade 33 minimum and galvanized coating designation G 90 (Z275) conforming to ASTM A924. Deck shall be of the type indicated on the Drawings. Thickness and load capacity shall satisfy the minimums established by the Steel Deck Institute load tables.

1. Deck shall be a minimum of 3 spans unless otherwise indicated on the Drawings.

B. Accessories:

1. Provide ridge and valley plates, steel cant strips, eave plates, anchor clips, welding washers, sump pans and plates, pour stops, column closures, zee and cell closures, inside and outside closures, cover plates, filler plates, reinforcing channels, flat plates and such other accessories required as indicated in the Contract Documents and as required to provide a complete installation, of types, sizes and configurations as recommended by deck manufacturer. Galvanize accessories to match deck.
2. Provide flashing and closure shapes as recommended by deck manufacturer, and of galvanized sheet steel as specified for decking.
3. Galvanize Repair Paint: As recommended by deck manufacturer.
4. Closures: Rubber or closed-cell neoprene closures of same profile as that of metal decking. Provide closures to seal against weather at top of interior

partitions where there is no ceiling below deck, where deck is cantilevered over exterior beams or walls or where indicated elsewhere on Drawings.

C. Weld electrodes shall be E70XX.

PART 3 - EXECUTION

3.01 PREPARATION:

A. Decking supports, as well as decking, must be clean, free of dirt and debris, ice or other foreign materials that may prevent decking from bearing directly on structural members.

B. Verify support-framing locations to be as indicated, and bracing requirements performed, prior to decking installation.

C. Wire-brush and paint rusted and abraded areas of deck units with one coat of galvanized repair paint.

D. Remove paint and other materials from steel support framing, which would prevent proper welding of the decking to the steel support framing.

E. Prepare composite steel floor deck for concrete placement in accordance with S.D.I. specifications and ANSI/ASCE 9.

3.02 INSTALLATION:

A. Install deck panels and accessories according to applicable specifications and commentary in S.D.I. Publication No. 31, SDI “Manual of Construction with Steel Deck”, manufacturer’s written instructions, the approved submittal documents, the requirements of this Section, and as indicated on the Drawings.

B. Place deck panels flat and square on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before permanently fastening. Do not stretch or contract side-lap interlocks.

C. Place deck panels flat and square and fasten to supporting framework without warp or deflection.

D. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.

E. Provide additional reinforcement and closure pieces at openings and other work projecting through or adjacent to deck.

F. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

G. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install according to deck manufacturer's written instructions.

H. Attach steel decking accessories in place by welding in accordance with decking manufacturer's directions.

I. Place deck panels on structural supports and adjust to final position with ends lapped or butted over structural supports with a minimum end bearing of 1.5 inches. Increase end bearing where shown on the Drawings. End laps of sheets shall be a minimum of 2-inches and shall occur over supports. Attach the deck panels firmly to the supports immediately after placement in order to form a safe working platform.

J. Cutting of openings through the deck less than 16 square feet in area and all skew cutting shall be performed in the field. Trades that subsequently cut unscheduled openings through the roof deck are responsible for reinforcing those openings.

1. Locate openings for deck penetrations where indicated on the Drawings or as specified.
2. Steel Framing: Steel shapes for support framing and edge reinforcement shall comply with Section 05 12 33 - Structural Steel.

K. Reinforcement at Openings: Provide additional metal reinforcement and closure pieces as required for strength, continuity of decking, and support of other work shown.

L. Fasten steel deck units to structural supports using arc spot welds or mechanical fasteners according to manufacturer's specifications, approved shop drawings, and as indicated in this Section and on the Drawings. Decks thinner than 0.0280-inches shall be welded using 16 ga. welding washers with a 3/8-inch diameter hole. Side lap connections shall be welded or use mechanical fasteners as indicated on the Drawings and in this Section.

M. Arc spot welds (puddle welds) to supports shall have a diameter of 5/8-inches minimum, or an elongated weld of 3/8-inch minimum width and ¾-inch minimum length. Weld metal shall penetrate all layers of deck material at end laps and have

adequate fusion to the supporting members. Welding shall be done in accordance with AWS D1.3.

N. Mechanical fasteners shall be #12 stainless steel self-drilling screws or approved equal.

O. Fastening of deck to supports and side laps:

1. Deck ends at building perimeter: 12-inches on-center, maximum (36/4 min.)
2. Deck end laps: 12-inches on-center, maximum (36/4 min.)
3. Deck sides at building perimeter and deck side laps: Deck units with spans greater than five feet shall be fastened at midspan or at 36-inch intervals, whichever is smaller.
4. See Drawings for requirements beyond these minimum requirements.

P. Steel Roof Deck General Requirements:

1. Attach ridge and valley plates and steel cant strips directly to the steel deck where shown on the Drawings to provide a finished surface for application of the insulation and roofing.
2. At ends of decks or where changes of deck direction occur, fasten at each flute. Furnish and install adequate closures and fasten to both sides at a maximum of 18-inches on-center.
3. Accessories shall be fastened to supports or deck with welds or mechanical fasteners at not over 6-inches on-center and at all corners and ends.
4. Locate drain pans or sumps to suit drain fittings and drain locations. Position roof sump pans with flange bearing on top surface of deck. Mechanically fasten or weld at each deck flute.
5. Refer to the additional fastening requirements in S.D.I, for cantilevered deck areas.
6. Suspended ceilings, light fixtures, ducts, or other utilities shall not be supported by the steel roof deck.
7. Before placement of roof insulation and covering, the deck shall be inspected for tears, dents, or other damage that may prevent the deck from acting as a structural roof base. Repair the deck as required by the Engineer.
8. Before placement of roof insulation and covering, coat puddle welds or mechanical fastener connection locations with galvanize repair paint.

3.03 FIELD QUALITY CONTROL:

A. Testing Agency: The Owner shall engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test and inspection reports.

B. Field welds shall be visually inspected.

C. Mechanical fasteners shall be visually inspected.

D. Welder certification shall be verified.

E. Testing agency will report inspection results promptly and in writing to the Contractor and the Engineer.

F. Remove and replace work that does not comply with the specified requirements.

G. Additional inspecting will be performed at the Contractor's expense to determine compliance of corrected work with specified requirements.

3.04 REPAIRS:

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Painting Repairs: Wire brush and clean rust spots, welds, and abraded areas on both surfaces of prime-painted deck immediately after installation and apply repair paint.

END OF SECTION

SECTION 06 10 00

ROUGH CARPENTRY

PART 1 - GENERAL

1.01 WORK INCLUDED:

A. This Section covers tools, equipment, labor, and materials necessary to perform rough carpentry work complete and miscellaneous carpentry items not specified elsewhere including fasteners and supports.

B. Nails, screws, bolts, anchors, brackets, and other hardware for fastening and securing items provided under this section of the specification shall be furnished under this section.

1.02 RELATED WORK:

A. Section 07 54 19 POLYVINYL-CHLORIDE (PVC) ROOFING

B. Section 08 11 00, METAL DOORS AND FRAMES

C. Section 09 90 00, PAINTING

1.03 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF GENERAL SPECIFICATIONS, SUBMIT THE FOLLOWING:

Three sets of certificates of wood treatment upon delivery of treated wood product. Treated wood product shall bear appropriate American Wood Preservers Bureau (AWPB) quality mark.

1.04 DELIVERY:

Lumber, plywood, and other wood material shall be delivered to the job dry, and shall be protected from injury, dirt, dampness, and extreme changes of temperature and humidity at all times.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. LUMBER:

1. The grades of all materials under this section shall be defined by the rules of the recognized associations of lumber manufacturers producing the material specified, but the maximum defects and blemishes permissible in any specified grades shall not exceed the limitations of the American Lumber Standards.

2. Lumber shall bear the grade and trademark of the association under whose rules it is produced, and a mark of mill identification. Lumber shall be of sound stock, thoroughly seasoned, kiln dried to a moisture content not exceeding 15 percent.

3. Exposed surfaces of wood which are to be painted shall be free from defects or blemishes that will show after the second coat of paint is applied.

4. All lumber for nailers, furring, and blocking shall be seasoned No. 1 Dimension of Common pine, fir, or spruce, S4S.

5. Materials not specifically listed shall be of an accepted grade dictated by good practice.

B. WOOD PRESERVATION TREATMENT:

1. The nailers, blocking, sills, and similar items encased in or in contact with concrete, masonry, or the ground shall be pressure treated with a pentachlorophenol preservative solution. The pentachlorophenol shall meet the requirements of the American Wood-Preserver's Association, AWPA Standard P-8, "Standards for Oil-Borne Preservatives." The solvent carrier shall meet the requirements of AWPA Standard P-9 "Standard for Hydrocarbon Solvents for Oil-Borne Preservatives." The preservative solution shall be equivalent to five percent of pure pentachlorophenol.

2. The treatment shall be applied in accordance with AWPA Standard C-2 (lumber, timber, etc.), C-9 (plywood) or C-28 (lumber treated before laminating). Penetration of pentachlorophenol shall be determined using the penta check method, Section 5, AWPA Standard A-3. Retention of pentachlorophenol shall be a minimum of 0.40 pounds per cubic foot of wood for inground exposures. The treating company shall furnish a notarized certificate of treatment that indicates all pertinent details of the treatment.

3. Before the preservative treatment is applied, the lumber to be treated shall be sawed to exact lengths required, and bored ready for use in the work so far as practicable, in order to reduce to a minimum cutting or boring of lumber after treatment. Only lumber of the same kind and approximately the same size and seasoning shall be treated in any one charge. All surfaces of treated lumber cut after treatment shall receive two heavy brush coats of pentachlorophenol solution before the lumber is placed in the work.

PART 3 - EXECUTION

3.01 CONSTRUCTION:

A. Work shall be erected plumb, true and square.

B. Coordinate delivery and erection of prefabricated components. Field applied items shall be installed in accordance with good trade practices. Cutting and carpentry for other trades shall be performed. Cut ends of lumber previously treated with preservative specified shall be brushcoated with the same material.

C. Except as otherwise indicated on the design drawings, fasteners for roof nailers and for other wood members used as nailers or anchorage material shall be the equivalent of 1/2-inch diameter bolts at 2'-6" o.c. for 2-inch material, and 3/8-inch diameter bolts at 2'-0" o.c. for 1-inch material. Wood members in general shall be fastened to masonry with masonry nails, power-driven fasteners, or bolts in expansion shields, except where otherwise indicated.

D. Minimum length of nails shall be twice the thickness of wood being fastened.

E. Furring, blocking, nailers, and similar items shall be provided wherever required for the support, proper erection, fastening, or installation of carpentry or other materials, and as shown on the drawings.

F. Roofs require wood nailing strips and/or curbs at eaves, edges, walls, roof openings, etc., for proper securing of metal flanges. Nailers and/or curbs must be securely and firmly attached to the adjacent deck or concrete.

G. Nailers that serve as insulation vents shall have 1/2-inch vent hole openings 18-inches on center before installation. If wood nailers with vent holes are installed before the vapor barrier, then the vapor barrier shall not cover the holes when installed.

END OF SECTION

SECTION 07 54 19
POLYVINYL-CHLORIDE (PVC) ROOFING

1.1 SUMMARY

A. Full removal of existing roofing system for preparation of new membrane roof system. Removal work includes removal of existing roofing system down to bare decking, including flashings, roof ballast, walkway surfacing, roofing membrane, protection board, roof insulation, thermal barriers, vapor retarder, and related roofing components.

B. Furnish and install the following:
1. Pressure preservative treated solid wood and plywood blocking required for the work of this Section 07 54 19.
2. Fully adhered polyvinyl chloride (PVC) sheet roofing system.
3. Overlayment (protection) board beneath membrane.
4. Roof insulation as part of roof system, provided under this Section.
5. Thermal barrier below insulation.
6. Vapor barrier.
7. Flashing at all penetrations through the roofing system and at all materials which abut roofing system.
8. Building expansion joints occurring in roofing system.
9. Roof edging.
10. Roof Drain lifting and coordination with Plumber Contractor.

C. Clean-out all existing roof drains.

D. Provide walkways in places of traffic leading from roof access points (ladders, stairs, doorways) to, and around rooftop mechanical equipment.

E. Provide manufacturer’s pre-construction and final inspection as specified herein. These inspections are to be included in the base bid; additional inspections, or work incurred as a result of the final inspection shall be without additional cost to the Owner.
1. Work of this Section additional includes providing Owner assistance in the preparation and submittal of roof installation acceptance certification as may be necessary in connection with fire and extended insurance coverage of roofing and associated work.

1.2 RELATED REQUIREMENTS

A. Section 07 62 00 - SHEET METAL FLASHING AND TRIM: Metal flashing, trim, gravel stops, scuppers, and downspouts.

B. Section 07 71 00 – ROOF SPECIALTIES – Other roof related items not specified in this Section 07 54 19.

C. Section 07 92 00 - JOINT SEALANTS: Sealant other than those specified in this Section 07 54 19.

D. Division 23 - HEATING, VENTILATING AND AIR CONDITIONING: Prefabricated curbs for roof mounted mechanical equipment.

1.3 REFERENCES

A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. The standards referenced herein are included to establish recognized minimum quality only. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. Equivalent quality and testing standards will be acceptable, subject to their timely submission, review and acceptance by the Engineer.
   1. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.
   2. ASTM D4434 / D4434M - Poly(Vinyl Chloride) Sheet Roofing.
   3. FM: Roof Assembly Classifications and Loss Prevention requirements I-28 and I-29S.
   4. FM 4470 - Corrosion Resistance Testing.
   5. All applicable federal, state and municipal codes, laws and regulations for fire- resistance roof ratings.

B. Inclusionary References: The following reference materials are hereby made a part of this Section by reference thereto:
   1. American Society of Civil Engineers, ASCE-7 - Minimum Design Loads for Buildings and Other Structures.
   2. NRCA - Roofing and Waterproofing Manual, Latest edition.
   3. Roof System Manufacturer’s published Technical Specifications, Bulletins and Advisories.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. General: Coordinate the work of this Section with the respective trades responsible for installing interfacing and adjoining work for proper sequence of installation, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.

B. Scheduling:
   1. Notify manufacturer's representative 48 hours in advance for deck acceptance. Plan the lay-up of roofing membrane with respect to deck slope; avoid situations where excessive drainage could pass into completed roofing.
   2. The Roofing applicator shall maintain communication with roofing manufacturer’s representative to inform of progress and to schedule period sample testing.

1.5 SUBMITTALS

A. Submit the following under provisions of Section 01 33 23 SUBMITTALS:
   1. Literature: Manufacturer's product data sheets, specifications, performance data, physical properties and installation instructions for each item furnished hereunder.
      a. Manufacturer’s written and notarized certification that roofing membrane furnished for project has been treated with specified “dirt-repellent” acrylic coating.
      b. Material Safety Data Sheets for products submitted.
   2. Manufacturer's specimen warranties: Provide sample copies of manufacturers' actual warranties for all materials to be furnished under this Section, clearly defining all terms, conditions, and time periods for the coverage thereof.
   3. Review statement: Written statement, signed by the roofing applicator, stating that the Contract Drawings have been reviewed by an agent of the roofing system manufacturer; accompanied by a pre-installation written statement from the manufacturer that the selected roof system is proper, compatible, and adequate for the application shown.
      a. Provide certification from roofing manufacturer that system meets all identified code requirements.
      b. The roofing applicator will notify the Engineer and Owner in writing if the existing conditions when exposed are in conflict with the Contract Documents for the proper application of the selected roofing system or the warranty requirements.
   4. Project roofing superintendent’s resume and project experience list for similar installations.
   5. Shop drawings:
      a. Setting plans for insulation, showing types of insulation, thickness and direction of slopes.
      b. Fully dimensioned 1/4-inch scale plans of roof. Indicate on plans, major areas of patching existing roofing and all areas of new roofing. Plans shall show changes in level, key locations of details, all roof penetrations, roof slopes and direction of slope. Indicate on plans any areas of proposed staging and material storage on roof.
      c. Large scale design details, minimum of 1-1/2 inch per foot scale, showing perimeter flashing conditions and penetrations. Details shall show dimensions of actual measurements taken at the project and reflect actual conditions; manufacturer’s standard preprinted details will not be accepted as substitute for shop drawings.
   6. Verification samples:
      a. Provide 8-1/2 by 11 inch samples of roofing membrane and membrane flashing materials.
      b. Provide 12 inch long samples of membrane batten.
      c. Provide 12 inch long samples of each metal flashing type.
      d. Furnish additional samples are requested by the Engineer.
B. Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS:
   1. Manufacturer’s field quality control reports of field inspections, including, revised “as-built” shop drawings and manufacturer’s final punch list.
   2. Manufacturer’s warranties: Include coverage of materials and installation.

1.6 QUALITY ASSURANCE

A. General:
   1. The manufacturer's authorized technical representative shall provide a final inspection at the completion of the project to insure, that the project has been completed in accordance with the manufacturer's requirements. Upon approval and acceptance of the project, furnish to Owner, implemented manufacturer's warranty certification.
   2. Submit Manufacturer's field quality control reports of field inspections, including, revised "as-built" shop drawings and manufacturer's final punch list.
   3. All roofing shall be as described in this Section and shall be provided and approved by the roof system manufacturer. Any materials not manufactured or provided by manufacturer shall have written approval from the manufacturer stating the materials are acceptable and are compatible with the other materials and systems required.
   4. Notify the Engineer where conflicts apply between referenced standards and existing materials, and existing methods of construction.

B. The roof system manufacturer's technical specifications, bulletins and advisories shall be considered a part of this specification and should be used as a reference for specific application procedures and recommendations. Where a conflict does exist between the manufacturer's written specifications and those procedures specified in this Section, the more stringent requirements meeting the Manufacturer's minimum requirements for the provided warranty shall apply.

C. Sole Source: Obtain products required for the Work of this Section from a single manufacturer, or from manufacturers recommended by the prime manufacturer of roofing system.

D. Qualifications:
   1. Roofing manufacturer: Minimum of 10 years documented experience demonstrating previously successful work of the type specified herein.
   2. Installer/Applicator: trained and authorized by product manufacturer for installation of specified system.
      a. Minimum of 5 years documented experience demonstrating previously successful work of the type specified herein.

1.7 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in manufacturer's original, unopened containers or packages with labels and package seals intact and legible.

B. Store all materials in accordance with the manufacturer's recommendations. Store rolled goods on clean, raised platforms. Store other materials in dry areas, protected from water and direct sunlight.

C. Do not expose stored curable roofing materials and accessories, including uncured flashing, adhesives, sealants and pourable sealer, to a constant temperature in excess of 80 degrees Fahrenheit.

D. Provide continuous protection of stored materials against deterioration for duration of project.

E. Store insulation on dunnage and completely cover with a water-resistant breathable material. Provide weights to prevent wind damage to insulation.

F. Distribute any materials stored on roof levels for immediate use to prevent concentrated loads that would impose excessive strain on deck or structural members. Protect roof stored materials to prevent displacement by the wind and protect from exposure to inclement weather and sun.

G. Damaged material: Remove any damaged or contaminated materials from job site immediately, including materials in broken packages, or show other evidence of damage, unless Engineer specifically authorizes correction thereof and usage on project.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Do not remove existing roofing when weather conditions threaten the integrity of the building contents or intended continued occupancy.

B. Apply roofing in dry weather; do not install roofing in inclement weather or when precipitation is predicted with greater than 20 percent possibility.

C. Do not apply roofing membrane to damp or frozen deck surface.

D. Apply roofing in ambient temperature approved by roof system manufacturer.

1.9 WARRANTY

A. Manufacturer’s Warranty: Deliver to the Owner upon completion of the work of this Section, a conditional warranty for the roofing system, on the work of this Section agreeing to promptly repair the roofing as necessary to prevent penetration of water through it.
   1. Warranty shall cover product quality, performance, and workmanship for a period of 20 years.
   2. Warranty shall include total roofing system, insulation and membrane flashings.
   3. Warranty shall provide coverage for maximum peak gust for specified wind speed.

B. Applicator’s special warranty: Applicator shall supply Owner with a separate 2 year workmanship warranty or bond. In the event any work related to roofing, flashing, or metal is found to be within the Applicator warranty term, defective or otherwise not in accordance with Contract Documents, the Applicator shall repair that defect at no cost to Owner. Applicator's warranty obligation shall run directly to Owner.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: To establish a standard of quality, design and function desired, Drawings and specifications have been based on Sika Sarnafil Inc., Canton, MA.
   1. Fully adhered roofing: Sika Sarnafil, Inc., "G410 Energy Smart" system.

B. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
   1. Bond Cote Corporation, Pulaski, VA.
   2. Duro-Last Roofing, Inc., Saginaw, MI.
   3. Sika Sarnafil Inc., Canton, MA.

2.2 SYSTEM DESCRIPTION

A. Fully Adhered polyvinyl chloride (PVC) roofing system, including insulation and substrate, shall meet Underwriters Laboratories, Inc. Fire Hazard Classification "Class A" roof.

B. Regulatory Requirements: Refer to applicable building codes for roofing system installation requirements and limitations. When a conflict exists, the more restrictive document will govern.

C. Performance Requirements
   1. Design roofing system for ASCE-7-10 peak wind speed of 117 miles per hour.

2.3 ROOFING MATERIALS

A. Membrane: 0.080 inch thick glass-fiber-fabric-reinforced plasticized polyvinyl chloride (PVC) conforming to ASTM D-4434 (latest edition), Type II, Grade 1, equal to Sika Sarnafil type "G410" membrane.
   1. Sheet width: Nominally 6 feet wide sheets (full-width sheets).
   2. Roofing membrane shall have conform to the following minimal properties:

Property	ASTM Test Method	Resultant Value
Tensile Strength:	D-638	1500 lbf.
Tear Strength:	D-1004	10 lbf./in.
Breaking Strength:	D-751	270 lbf./in.
Elongation:	D-638	20 percent, MDxCD
Seam Strength:	D-638	80 percent of breaking strength.
Heat Aging, Tensil Strength	D-638	Retaining 95 percent of tensile strength for heat aged at 176 degrees F. for 7 days.

3. Roof Membrane Color: Manufacturer's 'Bright White" surface color, having the following characteristics:
    a. Initial reflectivity: 0.83
    b. Initial emissivity: 0.90.
    c. Initial Solar reflective index (SRI): 104.

B. Flashing membrane: 0.060 inches thick (1.2 mm), plasticized PVC, fiberglass reinforced, ASTM D-4434, Type II, Grade 1. having a minimal tensile strength of 1600 psi when testing in compliance with ASTM D-638.
1. Color to match roofing membrane.

C. Coated metal flashing: PVC laminated to 25 gage steel, with a zinc coating supplied by the hot-dip process conforming to ASTM A525 or A526, A90 or G90 coating weight standard equal to Sanaclad.
1. Prefabricated edge metal.

D. Securement discs:
1. Discs: 26 gage 3 inch square SAE 1010 steel with a AZ 55 galvalume coating, punched on center for securement of membrane.
2. Fasteners: #12 corrosion-resistant fastener to attach insulation boards to metal decking with a modified buttress thread, and shank diameter of approximately 0.168 inch (4 mm) and a thread diameter of approximately 0.214 inch (5 mm). The driving head has a diameter of approximately 0.435 inch (11 mm) with a #3 Phillips recess for positive engagement.

E. Cant Strips, tapered edge strips and flashing accessories: Types recommended by manufacturer of polyvinyl chloride material, provided at locations indicated and at locations recommended by manufacturer, including adhesive tapes, flashing cements, and sealants.

2.4 OVERLAYMENT (PROTECTION) BOARD

A. Overlayment (Protection) board: 1/4 inch thick complying with ASTM C 1177 and FM 4450, Class I, nonstructural glass mat faced, noncombustible, water-resistant treated gypsum core panel.
1. Acceptable manufacturers and products: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
    a. CertainTeed Corporation, Valley Forge PA., product: "GlasRoc Roof Board"
    b. Georgia-Pacific Building Products, Atlanta, GA, product: "DensDeck Roof Board".
    c. United States Gypsum Company, Chicago, IL, product: "Securock Glass- Mat Roof Board".

2.5 ROOFING INSULATION

A. General: Insulation shall be approved by the roof manufacturer, and shall be UL listed and FM approved.
1. Roof insulation is included as a system component under the specified "Total System" warranty

and therefore shall either be furnished by the roofing manufacturer or be otherwise in compliance with the requirements of the roof system warranty

B. Acceptable manufacturers: Subject to acceptance of roofing manufacturer and the following specification requirements:
   1. Atlas Roofing Corporation, Atlanta, GA.
   2. The Dow Chemical Co., Midland, MI.
   3. Hunter Panels, Portland ME.
   4. Johns Manville Roofing System, Denver, CO.
   5. Carlisle Syntec, Carlisle PA.
   6. Firestone Building Products Co., LLC, Indianapolis, IN.

C. Polyisocyanurate foam insulation manufactured with HCFC-free blowing agent and bonded to glass fiber reinforced facers on top and bottom surfaces during the manufacturing process. Insulation shall conform to property requirements of ASTM C1289, Type II.
   1. Thickness as indicated on Drawings.
   2. Density: 2.0 pounds per cubic foot (ASTM D-1622).
   3. Compressive strength: 20 psi (ASTM D1621).
   4. Moisture vapor transmission: Less than 1 perm (ASTM E-96).
   5. Water absorption: Less than 1 percent per volume (ASTM C209).
   6. Provide factory-tapered insulation system as required to meet elevations and slopes shown on drawings or as required by membrane manufacturer, which ever is more stringent. Provide cants and crickets at drains as necessary.

2.6 VAPOR BARRIER

A. Vapor barrier: Sarnafil product: “Sarnavap-Self-Adhered Vapor Retarder”. A 32 mil thick composite sheet consisting of a high-density polyethylene grid laminated between two layers of polyethylene film bonded to SBS modified bitumen, and self- adhesive on the underside.
   1. Primer: Sarnafil product “Sarnavap-Self-Adhered Primer” is required for non- metal decks.
   2. At metal decks provide manufacturer’s recommended galvanized metal plate attached to deck, spanning flutes at conditions where vapor barrier membrane has an end lap between flutes.

2.7 WOOD BLOCKING AND NAILER MATERIALS

A. Pressure preservative treated solid lumber for blocking, nailers and curbs as indicated or required: Hem Fir, Douglas Fir, Eastern Spruce, Eastern Hemlock, or Southern Pine, surfaced dried stud or utility grade. Wood members shall be of sizes indicated on the Drawings or of the same size as the members being braced.
   1. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.
   2. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

B. Pressure preservative treated plywood for unspecified exterior applications (including plywood blocking, nailers, and backing for roofing and flashing work) : APA graded B-C, Exposure 1, EXT, Group 1 species, 5 ply/5 layer plywood, touch-sanded, thickness as indicated on approved shop drawings.

C. Pressure Preservative Treatment (PT):
1. General: Treated wood products shall be produced by a single treatment plant, fully licensed by the chemical manufacturers, and conforming to the requirements specified herein.
   a. Toxicity and Environmental Quality:
      1) Products containing chromium will not be permitted.
      2) Products containing arsenic will not be permitted.
   b. Kiln dry all treated lumber and plywood to the following maximum moisture content after treatment.
      1) Lumber: 19 percent.
      2) Plywood 15 percent.
      3) Discard pieces with defects which might impair quality of work.
   c. Quality marks: Each piece of lumber and plywood shall be permanently affixed with a quality mark, containing the following information:
      1) Identification of the inspection agency.
      2) Standard to which material was treated.
      3) Identification of the treating plant.
      4) Preservative treated wood shall include: Retention and end use for which product is suitable.
2. Pressure preservative treated wood. Designated as “PT”
   a. Chemical Manufacturer: Subject to compliance with the requirements specified herein, Products which may be incorporated in the work include:
      1) Osmose, Inc., Griffin GA., product “NatureWood”.
      2) Universal Forest Products, Inc., Grand Rapids MI., product “ProWood ACQ”.
      3) Viance, LLC., Charlotte, NC., product “Preserve”
   b. Treatment: Ammoniacal Copper Quaternary Compound (ACQ), arsenic-free and chromium-free chemical “ACQ Preservative” in accordance with AWPA Standards. Apply the preservative in a closed cylinder by pressure process in accordance with AWPA Standard C15.
      1) Minimum preservative retention for floor plates, framing, lumber and plywood above ground use: 0.25 pounds per cubic foot (4.0 kg/m3) of ACQ chemical, in accordance with AWPA UC1, UC2, UC3A, and UC3B, or NER-643 as appropriate.
      2) Minimum preservative retention for framing, lumber and plywood in contact with water, ground, concrete and masonry: 0.40 pounds per cubic foot (6.4 kg/m3) of ACQ chemical, in accordance with AWPA UC4A, UC4B, UC4C, or NER-643 as appropriate.
      3) Minimum preservative retention for lumber and plywood in permanent wood foundations: 0.60 pounds per cubic foot (9.6 kg/m3) of ACQ chemical, in accordance with AWPA UC4B, or NER-643.

c. Fixation of Chemical: Treated wood shall not be shipped from treatment plant until fixation of the preservative has occurred in the wood.

2.8 ACCESSORIES

A. Fasteners:
1. For roofing system components: Steel fastener with fluorocarbon coating, complying with FM 4470 corrosion resistance test.. Minimum thread diameter 0.22 inches and minimum shank diameter of 0.172 inches, as recommended by roofing manufacturer. Nail type fasteners are not permitted.
2. For ACQ pressure preservative treated (PT) wood: Flat head type 304 or 316 stainless steel only, wood screws and carriage bolts, of the appropriate sizes for specified wind loading. Aluminum, galvanized steel, and coated metal fasteners are prohibited with PT wood.

B. Flat securement bars: 1 inch wide, aluminum or galvanized steel bar or extruded aluminum, 1/8 inch thickness, pre-punches at 12 inches on center; bar shall have a G90 coating (steel).

C. Insulation fastening plates, minimum 3 inches square.

D. Wind uplift securement bars: 14 gage hot-galvanized dipped U shaped bar, 1 inch wide by 1/8 inch wall thickness, prepunched at 12 inches on center.

E. Adhesive: Roofing manufacturers contact adhesive.

F. Roof metal: As required by manufacturer’s shop drawings.

G. Walkway surfacing: Polyester reinforced polyvinyl chloride embossed membrane 0.096 inches (2.4mm) thick.

H. Sealant: Single component gun-grade moisture-cured polyurethane-based, non-sag elastomeric sealant. Meets Federal specification TT-S-00230C, Type II, Class A. Meets ASTM C- 920, Type S, Grade NS, Class 35, use T, NT, O, M, G, I; with a minimum movement capability of +35/-35 percent, equal to Sika, product “Sikaflex 1a”., in manufacturer's standard colors as selected by the Engineer.

I. Miscellaneous materials: Best grade or quality as furnished or approved by the roofing manufacturer for the specific application.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.

B. Verify edge nailers, curbs and penetrations are in place prior to roofing, so that the roof system can be installed as continuously as possible.

C. Verify the roof deck, and related surfaces are clean, smooth, flat, free of depressions, waves, or projections, properly sloped to drains, and suitable for installation of roof system.

D. Verify deck surfaces are dry and free of snow or ice.

E. Any condition requiring correction or completion shall be corrected or completed prior to the installation of the roofing system. Notify Contractor of unacceptable conditions.

F. Do not proceed until defects are corrected.

G. Verify sizing of existing roof drain plumbing.

H. Beginning of installation means acceptance of substrate and site conditions.

3.2 PREPARATION

A. Carefully broom clean substrate immediately prior to roofing application.

B. Where surface joints at roof and wall substrates exceed 1/4-inch width, fill flush with surface with pourable sealer or insulating foam before proceeding with the installation.

3.3 EMERGENCY MATERIALS AND PROCEDURES

A. Maintain continuous temporary protection prior to and during installation of new roofing system. Do not leave unfinished roof areas uncovered over-night or during inclement weather.
   1. Provide temporary protective sheeting over uncovered deck surfaces.
   2. Turn sheeting up and over parapets and curbing. Retain sheeting in position with weights or temporary fasteners.
   3. Provide for surface drainage from sheeting to existing drainage facilities.
   4. Do not permit traffic over unprotected or repaired deck surface.

B. Maintain on site equipment and materials necessary to apply emergency temporary coverage in the event of sudden storms or inclement weather.

C. Do not install more insulation than can be covered by roofing system in the same workday. Do not apply more roofing than can be properly fastened and sealed in the same workday. Ensure that water does not flow beneath any completed sections of the roofing system, provide temporary closures.

D. Roofing Subcontractor is fully responsible for all damage due to water penetration occurring during the Work of this Section.

3.4 INSTALLATION – GENERAL

A. The entire work of this Section shall be performed in accordance with the best standards of practice relating to trades involved.

B. Follow local, state and federal regulations, safety standards and codes. When a conflict exists, the more restrictive document shall govern.

C. Follow insurance underwriter's requirements acceptable for use with specified products or systems.

D. Review all special conditions, such as at projections, at connections to sheet metal gravel stops, flashings, and similar materials with the Roofing Manufacturer, submit the Roofing Manufacturer's recommendations and details to the Designer for approval.

E. Special Cautions:
1. Do not use oil-based or plastic roof cement.
2. Do not subject polymeric materials to contact with petroleum, grease, oil, solvents, vegetable or mineral oil, nor animal fat. Prevent contact with hot pipes, and ducts.
3. Cements and bonding adhesive contain petroleum distillates and are extremely volatile and flammable. Avoid breathing vapors and do not use near fire or flame.
4. Ensure that welding and bonding surfaces are dry during installation.

3.5 INSTALLATION - ROOF NAILERS AND BLOCKING

A. General: Provide anchorage for nailers as required for roof and edging to obtain specified wind loading requirements.
1. Secure nailers and blocking to metal deck with electro-galvanized screws at not greater than 12 inch on center spacing, extending a minimum of 3/4-inch below deck.
2. Secure nailers and blocking to wood substrates with electro-galvanized screws at not greater than 12 inch on center spacing, extending a minimum of 1-1/2 inch into board substrates and 3/4 inches into sheet materials.

B. When building up layers of nailers and blocking, fully secure each layer to at least the one below, alternating location of fasteners, spacing at 12 inches on center. Provide fasteners in lengths to penetrate through more than one substrate layer of blocking. Stagger locations of butt ends of boards, such that no two joints are "lined up".

C. Ensure finished height of nailers is same as top surface of roof insulation within 1/4- inch, plus or minus.

3.6 INSTALLATION – VAPOR BARRIER

A. Ensure that concrete substrates have cured for at least 28 days, and have a relative humidity moisture content acceptable to roof manufacturer.

1. Do not install when it is raining or snowing, or over wet/humid surfaces
2. Substrate surfaces shall be clean and dry.

B. Install vapor barrier primer prior to installation of self-adhered vapor barrier over substrates for 100 percent of roofing surface. Comply with manufacturer's minimum ambient and surface application temperature requirements. Apply primer by brush, roller or spray at coverage rates recommended by manufacturer for substrate surface to receive primer. Permit primer to fully dry prior to application of self-adhered vapor barrier. Apply self-adhered vapor barrier over cured primer, starting at the bottom of the slope. Unroll vapor barrier onto the substrate without adhering for alignment. Overlap each preceding sheet by 3 inches (75 mm) lengthwise following the reference line and by 6 inches (150 mm) at each end. Stagger end laps by at least 12 inches (300 mm). Do not immediately remove the silicone release sheet.
1. On metal decks use a galvanized steel plate (6 inch width minimum) secured to roof deck to support the membrane end lap between metal flutes ensuring a complete end lap seal.

C. Once sheets are aligned, peel back a portion of the silicone release sheet and press the membrane onto the substrate for initial adherence. Hold vapor barrier, tight and peel back the release sheet by pulling diagonally.

D. Use a 75 pound (34 kg) roller to press vapor barrier down into the substrate including the laps. Finish by aligning the edge of the roller with the lower end of the side laps and rolling up the membrane. Do not cut the membrane to remove air bubbles trapped under the laps. Squeeze out air bubbles by pushing the roller to the edge of the laps.

3.7 INSTALLATION – INSULATION

A. Install only as much insulation as can be covered with roofing membrane and completed before the end of the day's work, or before the onset of inclement weather.

B. Place the constant thickness insulation of first layer and the subsequent tapered insulation to the required slope pattern and cants for drainage, in accordance with manufacturer's instructions.

C. Neatly fit insulation to all penetrations, projections, and nailers. Loosely butt edges and ends of insulation with gaps not greater than 1/4 inch.

D. Secure insulation to substrate with mechanical anchors of type and spacing indicated by membrane manufacturer; but in no case provide less than one anchor per 4 square feet of surface area, or less anchorage than required by FM "Loss Prevention Data Sheet 1-28".

3.8 INSTALLATION - MEMBRANE

A. General: Begin application at the highest point of the highest roof level and work to the lowest point. Proceed in a work sequence to minimize construction traffic on completed areas of roofing.

B. Apply membrane and adhesives in accordance with manufacturer's instructions.

C. Roll out membrane, free from wrinkles or tears. Inspect sheet for defects as it is being rolled out. Place sheet into place. Align sheet with previous sheet to obtain a lap width of not less 4-1/2 inches.

D. Make cutouts in membrane for protrusions such that when the skirts on the factory fabricated accessories, when welded to the deck membrane, will cover the cutouts. Fasten around cutouts with approved fasteners.

E. Clean and dry welding joint areas of both membrane sheets. Weld membrane as recommended by manufacturer without wrinkles and voids. Apply pressure to the lap to ensure contact.

F. Heat weld skirt of membrane accessories and flashing. Welded seams shall be 3 inches wide minimum using machined welding equipment, and 4 inches with hand welding equipment. Make a close and visual inspection for the full length of each field weld.
   1. Inspect all lap edges, repair all unsealed areas, voids and fishmouths.

G. Provide additional membrane securement at expansion joints, curbs, skylights, and similar roof top penetrations, at interior wall and penthouse perimeters, and at any angle change which exceeds 2 inches in on horizontal foot.
   1. Install 2 inch diameter Cadmium or Fluorocarbon steel seam fastening plates, 3 inches to 6 inches from inside and outside corners where additional membrane securement is required and where recommended by roofing manufacturer. Space fastening plates not greater than 12 inches on center.
   2. Weld polyvinyl chloride flashing over installed fastening plates as recommended by roofing manufacturer, and in no case provide flashing of less than 6 inches in width and at ends of flashing, provide a minimum 2 inch space from edge of plate.

H. Extend membrane up can’t strips and a minimum of 8 inches onto vertical surfaces.

I. Install termination bars with screw fasteners located 6 or 12 inches on center. Install roofing manufacturer’s recommended sealant along top and bottom edges of termination bar.

J. Walkway Protection: Install walkway membrane at locations shown and where required from roof access points to all roof-mounted equipment.
   1. Clean roofing membrane and attach heat weld walkway pads, to roof, on center with each other in manner as recommended by manufacturer.

3.9 CLEANING

A. In areas where finished surfaces are soiled by work of this section, consult manufacturer of surfaces for cleaning advice and conform to their instructions.

B. Repair or replace defaced, or disfigured finishes caused by the work of this Section.

3.10 PROTECTION

A. Provide special protection or avoid traffic on completed work. Contractor is responsible to restore to original condition, or replace, work and roofing materials damaged by work of other trades.

END OF SECTION

SECTION 07 62 00
SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.01 SUMMARY

A. Furnish and install the following:
   1. Aluminum flashing.
   2. Formed brake-metal work.
   3. Sealant in conjunction with sheet metal work specified herein.

1.02 RELATED REQUIREMENTS

A. Section 06 10 00 - ROUGH CARPENTRY: Wood blocking, nailers.

B. Section 07 54 19 – POLYVINYL CHLORIDE (PVC) ROOFING – PVC membrane roofing and edge conditions.

C. Section 07 92 00 - JOINT SEALANTS: Sealant and backing material not specified herein.

D. Flashing sleeves and collars for mechanical and electrical items protruding through roofing: By respective trade sections furnishing same.

1.03 REFERENCES

A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section. The standards referenced herein are included to establish recognized minimum quality only. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. Equivalent quality and testing standards will be acceptable, subject to their timely submission, review and acceptance by the Engineer.
   1. ASTM B 209 - Specification for Aluminum Alloy, Sheet and Plate.
   2. ASTM B 221 - Specification for Aluminum Extrusions.
   3. FS QQ-A-250d - Aluminum and Aluminum Alloy, Plate and Sheet.

B. Inclusionary References: The following reference materials are hereby made a part of this Section by reference thereto:
   1. SMACNA - Architectural Sheet Metal Manual 7th Edition (January 2012), referred to herein as “Sheet Metal Manual”.
   2. NRCA – National Roofers Council Association, 2018 Edition

1.04 SUBMITTALS

A. Information and Review Submittals: Submit the following under provisions of Section 01 33 23 - SUBMITTALS:

1. Literature: Manufacturer's data sheets for each metal type and accessories furnished hereunder, include material specifications, performance data, physical properties and finishes.
2. Certification: Provide certifications that materials and systems comply with the specified requirements for the use indicated.
3. Shop drawings:
    a. Fully dimensioned large scale design details showing material profiles, splices, flashing terminations and other jointing details, fastening methods and installation details. Indicate material type, sizes, and weights or gages. Indicate extent of adjacent work specified under other Sections of the Specifications.
    b. Fully detail methods of relieving stresses due to thermal movement, including sealing of expansion seams.
    c. All details bearing dimensions of actual measurements taken at the project.
4. Selection Samples:
    a. Metal sample chips, indicating Manufacturer's full range of finish colors for factory finishes available for selection by Engineer.
    b. Manufacturer's sample boards for sealant colors.
5. Verification Samples:
    a. 12 inch long samples of formed fascia, gutters and downspouts.

B. Closeout Submittals: Submit the following under provisions of Section 01 78 00 – PROJECT CLOSEOUT.

1. Manufacturer’s warranties: Include coverage of materials and installation and resultant damage from failure of installation to resist penetration of moisture.

1.05 QUALITY ASSURANCE

A. Company specializing in fabrication and installation of sheet metal flashing work with minimum 5 years documented experience.

B. Flashing and sheet metal applicator, with a minimum of 5 years documented experience demonstrating previously successful work of the type specified herein, and approved by product manufacturer.

1.06 DELIVERY, STORAGE AND HANDLING

A. Store preformed and prefinished material to prevent twisting, bending, or abrasion, and to provide ventilation. Slope metal sheets to ensure drainage. Prevent contact with materials during storage which may cause discoloration, staining, or damage.

1.07 SEQUENCING AND SCHEDULING

A. Coordinate the installation of flashings and sheet metal work with the various trades responsible for installing interfacing materials, and install the work at appropriate times so as not to delay the progress of related work.

1.08 WARRANTY

A. Provide the following warranties under provisions of Section 01 78 00 – PROJECT CLOSEOUT.

1.09 EXTRA MATERIALS

A. Provide sufficient quantity of each color finish coat material, for field touch-up work after erection, and pack the additional coating materials with the components to be furnished hereunder.

B. Clearly label and package extra materials securely to prevent damage.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Aluminum flashing: FS QQ-A-250d sheet aluminum, mill finish, having a minimum thickness as specified herein below, for the applications indicated:
   1. General exposed-to-weather flashings and trim: 0.050 inch thick
   2. Flashing thicknesses for specific conditions:
      a. Roof penetrations: 0.032 inch thick.

2.02 ACCESSORIES

A. Nails shall not be smaller than Nº 2 of 12 stub gauge (1.109 inches), with large flat heads, and of sufficient length to penetrate the wood nailers a minimum of 7/8-inch. Nails shall be stainless steel.

B. Screws: Stainless steel wood screws, of sizes most appropriate for the specific application, and equipped with soft neoprene washers.

C. Joint Sealer: Low modulus single component gun-grade polyurethane sealant, non-sagging, conforming to FS TT-S-000227E, Type II, Class A, and ASTM C 920, Type S, Class 12-1/2, Grade NS, use NT,M, A and O with a minimum movement capability of ±25 percent, equal to the following:
   1. Mameco International, Inc., product “Vulkem 116”.
   2. Sika Corp., Lyndhurst NJ; product, “Sikaflex”.
   3. Sonneborn Building Products Inc., Minneapolis MN.; product,

"Sonolastic NP1".

4. Tremco, Beachwood OH.; product, "Dymonic".
5. Pecora Corporation, Harleysville PA.; product "Dynatrol I".

2.03 FLASHING FABRICATION - GENERAL

A. Form flashings as required, or to profiles indicated on the Drawings, to protect materials from physical damage and shed water.

B. Form sections square and accurate to profile, in maximum possible lengths, free from distortion or defects detrimental to appearance or performance. To the greatest extent applicable, fabricate sheet metal components in shop, and thoroughly clean all joints on both sides of the sheet metal work.

C. Fabricate cleats and starter strips of same material as sheet.

D. Form pieces in longest practical lengths, with flat lock seams. Hem exposed edges on underside 1/4 inch, miter and seam corners.

E. Fabricate corners from one piece with minimum 18 inch long legs, solder for rigidity, seal with sealant.

2.04 FINISHES

A. Aluminum exposed trim and any other aluminum indicated for enamel or color finish: Shop-applied polyvinylidene fluoride enamel finish system equal to PPG Industries, Product: "Duranar", applied as follows, in the selected colors.

1. Prime all surfaces with a corrosion resistant, epoxy-based primer compatible with finish coating, minimum 2.0 mils dry film thickness, fully oven-cured.
2. Provide a finish coating of polyvinylidene fluoride enamel on all exposed surfaces, including all exposed screws, fastenings, with a minimum coating of
3. 1.0 to 1.3 mills. dry film thickness.
4. Provide a clear top coating of polyvinylidene fluoride enamel on all exposed surfaces, including all exposed screws, fastenings, with a minimum coating of
5. 1.0 to 1.3 mills. dry film thickness.
6. Ensure that all coatings, proposed to be applied hereunder, are compatible with the receiving substrate material for each condition, thoroughly clean, and treat aluminum by chromate process.

B. Aluminum components not indicated for enamel or color finish: Mill finish.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify roof openings, curbs, pipes, sleeves, ducts, or vents through roof are solidly set,

cant strips and reglets in place and nailing strips located.

B. Beginning of work shall constitute acceptance of the conditions of the surfaces to which this work is to be applied.

3.02 PREPARATION

A. Field measure site conditions prior to fabrication.

B. Install starter and edge strips, and cleats before starting installation.

C. Install surface mounted reglets true to lines and levels. Seal top of reglets with sealant.

D. Insert flashings into reglets to form tight fit. Secure in place with plastic wedges at maximum of 8 inches on center. Seal flashings into reglets with sealant.

E. Secure flashings in place using concealed fasteners. Use exposed fasteners only in locations where approved by Engineer.

F. Cleat and seam all joints. Apply plastic cement compound between metal flashings and felt flashings, asphalt shingle roofing or asphalt roll roofing.

G. Fit flashings tight in place. Make corners square, surfaces true and straight in planes, and lines accurate to profiles.

H. Seal all metal joints watertight.

I. During the installation of work of this Section, protect the work of other trades against undue soilage and damage by the exercise of reasonable care and precautions. Repair or replace any work so damaged and soiled.

3.03 FLASHING INSTALLATION - GENERAL

A. Except as otherwise shown on the reviewed shop drawings or specified herein, the workmanship of sheet metal work, method for forming joints anchoring, cleating, provisions for thermal movement, shall conform to the standard details and recommendations of the sheet metal producer and those of producer organizations and research institutions and associations concerning the sheet metal used, in addition to the standards and details set forth in the referenced materials specified this Section.

B. Face nailing will not be permitted, concealed cleating or other concealed method must be used to attach sheet metal work to structure.

C. Ensure that fastenings do not exceed 8 inches on centers. Use flat head fasteners throughout, and seal all fastener heads after installation thereof.

D. Fill all slip joints and overlapping surfaces in the assembly with specified sealant

material, removing all excess sealant material from the prefinished surfaces immediately, to prevent staining the finish.

3.04 CLEANING

A. Daily clean work areas by sweeping and disposing of debris.

B. Upon completion of the work of this Section in any given area, remove tools, equipment and all rubbish and debris from the work area; leave area in broom-clean condition.

END OF SECTION

SECTION 07 92 00

JOINT PROTECTION

PART 1 - GENERAL

1.01 WORK INCLUDED:

A. This section covers the sealing of joints designated on the drawings or specified herein, including but not limited to, concrete to concrete, masonry to concrete, structural steel to concrete, structural steel to masonry, and any other metal surfaces butting to another metal, concrete or masonry.

B. The above-mentioned joints shall be sealed even if not called out on the drawings.

C. Seal beneath threshold and other items required to be set in caulking compound shall be by the trade installing the item.

1.02 RELATED WORK:

A. Section 05 12 33, STRUCTURAL STEEL

B. Section 07 62 00, SHEET METAL FLASHING AND TRIM

C. Section 08 11 00, METAL DOORS AND FRAMES

1.03 REFERENCES:

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

American Society for Testing and Materials (ASTM)

ASTM C920	Specification for Elastomeric Joint Sealant
ASTM C 1193	Standard Guide for Use of Joint Sealants
ASTM D1667	Specification for Flexible Cellular Materials – Vinyl Chloride Polymers and Copolymers (Closed-cell Foam)

United States of America Standards Institute (USA)

USA 116.1 Standard Specification for Polysulfide-Base Sealing Compounds for the Building Trade

B. When reference is made to one of the above standards, the revisions in effect at the time of bid opening shall apply.

1.04 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF GENERAL SPECIFICATIONS, SUBMIT THE FOLLOWING:

A. Six sets of manufacturer's literature of the materials of this section shall be submitted to the Engineer for review.

1.05 DELIVERY, STORAGE, AND HANDLING:

A. Materials shall be delivered to the site in the original, unopened, factory-sealed containers, bearing the manufacturer's label fully identifying the material and the producing company.

B. Handle materials with care. Do not dump from trucks or delivery vehicles nor handle in any manner likely to cause damage.

1.06 QUALITY ASSURANCE:

A. Materials shall not be applied in wet weather or to wet or damp surfaces. No work shall be performed when temperature is below 40 degrees Fahrenheit. Surfaces shall not be caulked until thirty days after completion of concrete, masonry work, or patching, whichever is later. At least three good drying days shall immediately precede application. Application shall in each case be in accordance with the instructions of the manufacturer of the material, except as modified herein.

B. Surrounding areas which are not to be coated shall be completely protected from spray, spattering, or dripping, using drop cloths or other protective measures, as required. Spillage or dripping which occurs shall be immediately and completely removed, leaving no stain. Solvents or cleaning methods shall be those recommended by the manufacturer of the material being used.

C. Furnish the service of a competent field representative of the approved manufacturer of the sealant. The field representative shall be present at the work site prior to any mixing of components to instruct on application and inspection of procedures and to inspect the finish or the prepared surfaces prior to application of the sealant. The representative shall make at least one additional visit to the site as the work progresses and shall report on each visit to the Contractor and the Engineer, advising as to whether the application is being performed in accordance with this specification and the printed instructions of the manufacturers.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:

A. Sealants and primers for use with sealants shall be as manufactured by J.B. Fred Kuhls, Brooklyn, New York; Minwax Co., Inc., New York, New York; Dewey and Almy Chemical Division of W.R. Grace & Co., Cambridge, Massachusetts; Sonneborn Building Products, New York, New York; or an approved equal product.

2.02 MATERIALS:

A. Sealants

1. Sealants shall be non-staining materials conforming to the requirements of United States of America Standards Institute "Standard Specification for Polysulfide-Base Sealing Compounds for the Building Trade", USA 116.l. Compound shall be Class A (self-leveling), or Class B (non-sag), as applicable in each case for the joint to be caulked. Color of sealant shall match as closely as possible the color of the surrounding materials, and when used adjacent to masonry work the compound shall match the color of the mortar in the masonry joints. Precise color shall in all cases be subject to the approval of the Engineer.

B. Joint Cleaner

1. Non-corrosive and non-staining type, recommended by sealant manufacturer and compatible with joint forming materials.

C. Primer

1. Primer shall be non-staining type as recommended by the manufacturer of the sealant.

D. Back-Up Material

1. Back-up material for sealer shall be a non-staining type oakum, treated to prevent rot, or shall be a non-staining, compressible, closed-cell joint filler of polyvinyl chloride, neoprene vinyl, or a similar inert and permanent back-up material approved in advance by the Engineer. Back-up materials containing oil or grease and materials which are not compatible with the primers and caulking compound shall not be used. Tremco Joint Backing and Dow Corning "Ethafoam" are approved back-up materials.

E. Williams Tilt-up Compound by Williams Distributors, Inc. Silcoseal 77 by Nox-Crete Incorporated or equal.

PART 3 - EXECUTION

3.01 EXAMINATION:

A. Verify that substrate surfaces and joint openings are ready to receive work.

B. Verify that joint backing and release tapes are compatible with sealant.

3.02 PREPARATION:

A. Where recommended by the manufacturer of the sealant, primer shall be used before sealant is applied. Copper to be in contact with sealant shall be primed with five-pound cut shellac or as recommended by the sealant manufacturer, before sealant material is applied. Aluminum, stainless steel, and other materials shall have any protective film removed using a cloth dampened with Toluol, Xylol, or other suitable solvent.

3.03 APPLICATION:

A. Sealant shall be mixed and applied in accordance with the manufacturer's printed directions. No materials shall be added to the compound.

B. Joints and spaces to be caulked shall be clean, dust-free, and dry. Mortar droppings, construction debris, and other foreign matter shall be removed from the joint before it is caulked. Raking out excess mortar in masonry and similar joints which are to be caulked shall be performed by the trade responsible for installing the mortar.

C. The joint or space to be sealed shall be packed tight with oakum or other approved filler materials, leaving a space approximately square in cross-section, and in no case deeper than half of its width, to receive the caulking compound. Filler materials shall be sufficiently wider than the joint in which they are used to provide adequate resistance when sealant material is being gunned into the joint.

D. Sealant shall be applied with a gun, using a nozzle of proper size to fit the joint width, and shall be forced into the joints with sufficient pressure to expel all air and fill the joint solid. Superficial pointing of joints with a skin bead will not be accepted. Sealant shall be uniformly smooth and free from wrinkles, and shall have a slightly concave joint profile when dry. Intersections of beads shall form neat miters. Sealant at edges of the joint shall be flush with the edges of the adjacent surfaces. Excess sealant material shall be removed. Improperly filled or finished joints shall be raked out and resealed.

E. Sealant depth shall not exceed one-half of joint width.

F. Particular care shall be taken not to soil adjacent surfaces. Spillage or excess material shall be removed immediately, leaving no stain. Masking tape shall be used as required to protect surrounding surfaces and prevent staining. Masking tape shall be removed

immediately after tooling of the sealant. Adjacent surfaces soiled by operations under this section shall be cleaned to equal their condition before the start of the caulking work.

G. Spaces left between walls and elements of roof shall be filled with back-up material inserts and then caulked on both sides.

END OF SECTION

SECTION 08 11 00

METAL DOORS AND FRAMES

PART 1 - GENERAL

1.01 WORK INCLUDED:

A. This Section covers overhead rollup doors, hollow metal doors, panels, and pressed steel frames, complete.

B. Finish hardware is furnished under Section 08 71 00 HARDWARE for installation under this section.

1.02 RELATED WORK:

A. Section 07 92 00, JOINT PROTECTION

B. Section 08 71 00, DOOR HARDWARE

C. Section 09 90 00, PAINTING

1.03 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF GENERAL SPECIFICATIONS, SUBMIT THE FOLLOWING:

A. Six sets of manufacturer's literature of the materials of this section shall be submitted to the Engineer for review.

B. Six sets of door schedules showing door sizes and types, frames sizes and types, shall be submitted to the Engineer for review.

1.04 DELIVERY AND STORAGE:

A. Work shall be coordinated with the hardware supplier who will provide templates for mortised hardware to the door manufacturer.

B. Materials included in this section shall be delivered in perfect condition and shall be protected from damage during storage and construction periods and until acceptance of the building.

C. Doors shall be stored in an upright position under cover on the building site on wood sills or on floors in a manner that will prevent rust and damage.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. Exterior Swing Doors

1. Exterior swing doors shall conform to the following requirements:

a. Exterior metal doors shall be extra heavy duty full flush seamless doors, 1-3/4-inch thick unless otherwise indicated.

b. Door faces shall be 16 gauge cold rolled stretcher leveled steel.
c. Vertical steel rib stiffeners shall be 20 gauge, one piece, spaced at 6-inches.

d. Lock rail shall be one-piece full height 14 gauge channel continuously welded to face sheet.

e. Hinge rail shall be one piece full height 12 gauge channel continuously welded to face sheet.

g. Lock edge shall be beveled (1/8-inch in 2-inches).

h. Hardware reinforcements shall be compatible to the specified hardware and shall meet the minimum requirements below:

1) Overhead holders - 12 gauge channel
2) Closures - 12 gauge channel
3) Rim panics - 14 gauge
4) Checks and pivots - 7 gauge

i. All spaces between ribs shall be insulated with fiberglass insulation.

j. Exterior doors shall be by Republic Builders Products, McKenzie, TN, or approved equal.

C. Interior Doors

1. Interior metal doors shall be full flush seamless doors, 1-3/4-inches thick, unless otherwise indicated.

2. Door faces shall be 18 gauge cold-rolled stretcher leveled steel.

3. Doors shall be stiffened and insulated with a solid slab of expanded polystyrene foam permanently bonded to the inside of each face skin.

4. Lock rail shall be one piece full height 14 gauge pressed channel.

5. Hinge rail shall be one piece, full height 14 gauge pressed channel formed and tapped for hinges.

6. Both lock and hinge rail edge of door shall be welded, filed and ground smooth.

7. Top and bottom of doors shall have 16 gauge steel closure channels.

8. Lock edge shall be beveled (1/8-inch in 2-inches).

9. Hardware reinforcements shall be suitable to the specified hardware and shall meet the minimum requirements below:

   a. Overhead holders - 12 gauge channel
   b. Rim panics - 14 gauge
   c. Checks and pivots - 7 gauge

10. Interior doors shall be by Republic Builders Products, McKenzie, TN, or approved equal.

D. Pressed Metal Frames

1. Frames shall be fabricated to suit the wall type.

2. Frames shall be fabricated of 16 gauge cold rolled steel for openings up to and including 3'0" x 7'2" in size, and of 14 gauge cold rolled steel for larger openings.

3. Joints shall be die mitered with integral tabs for reinforcement and interlocking of the jambs to the head.

4. Frames shall be set up and welded.

5. Frames shall be mortised, reinforced and drilled and tapped for all mortise finish hardware.

6. Frames shall be reinforced for surface mounted hardware, with drilling and tapping to be done in the field by the Contractor.

7. Mortised cutouts shall have metal plaster guards.

8. Hardware reinforcements shall be compatible to hardware specified and shall meet the following minimum requirements:

   a. Hinge - 7 gauge x 1-5/8-inch x 10-inch
   b. Lock Strike - 14 gauge x 1-5/8-inch x 4-inch
   c. Closer - 12 gauge x contour of head x 16-inch

9. Frames shall have fixed, adjustable or stud anchors as required by wall conditions. Anchors shall be galvanized 14 gauge corrugated steel with dimensions as recommended by the manufacturer.

10. Frames at doors shall be supplied with adhesive rubber silencers, 3 on the strike jamb for single doors and 2 per head for double doors.

11. Framing for transom and sidelights shall be provided with beads to accept glass. Screw holes shall be pre-drilled in both frames and bead.

E. Metal Panels

1. Panels shall be 1-3/4-inches thick and fabricated of 18 gauge cold rolled stretcher leveled steel.

2. Panels shall be insulated with a solid slab of expanding polystyrene foam bonded to the inside of each face skin.

3. Edges shall be reinforced with 14 gauge channels.

F. Shop Priming

All metal doors, panels and frames shall receive a degreaser phosphate treatment and one baked on coat of alkyd phenolic primer.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Frames shall be erected plumb and true, and shall be braced during construction until the attached anchors are built into the masonry system, or until there is no danger of movement.

B. Door frames shall be grouted to masonry using portland cement.

C. Doors shall be fitted with hardware, accurately hung, and adjusted for proper and smooth operation.

D. Hardware shall be mounted in accordance with the hardware manufacturer's instructions with the fasteners supplied by the hardware manufacturer.

E. Doors to be adjusted for equal gap all around and at meeting of double doors. Final approval shall be by Engineer.

F. Thresholds shall be set in non-hardening caulking compound in a method approved by the threshold manufacturer. Screw holes and joints with other materials shall be sealed with caulking compound.

END OF SECTION

SECTION 08 71 00

DOOR HARDWARE

PART 1 - GENERAL

1.01 WORK INCLUDED:

A. This Section covers hardware for hollow metal and wood doors complete.

B. Installation of hardware is included under the door section for which the hardware is supplied.

1.02 RELATED WORK:

Section 08 11 00, METAL DOORS AND FRAMES

1.03 SYSTEM DESCRIPTION:

A. Cylinder locks, including padlocks, shall be grand master keyed as required by the Engineer. Cylinders shall be removable core type. Three change keys shall be furnished with each lock, and each shall have the change number stamped thereon. Six master keys shall be furnished for each master set furnished. Keying shall be confirmed with the Owner.

B. Construction cores shall be installed in locks for use during construction.

C. Adequate arrangements for providing construction security without risking the integrity of the final locks will be acceptable, subject to the prior approval of the Engineer.

1.04 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF GENERAL SPECIFICATIONS, SUBMIT THE FOLLOWING:

A. Six copies of manufacturer's printed literature illustrating clearly each proposed hardware item shall be submitted to the Engineer for review.

B. Six copies of the finish hardware schedule shall be submitted within 15 days of award of contract to the Engineer for review.

C. Three copies of the inspection report of the manufacturer's hardware representative shall be submitted to the Engineer.

D. If required by the Engineer, a sample of each item of hardware the Contractor proposes to use shall be submitted to the Engineer not later than ten days after requested. Such samples will be returned to the Contractor after acceptance of the completed hardware installation.

1.05 PACKAGING AND DELIVERY:

A. Finish hardware shall have the screws, bolts, fastenings, and other necessary accessories wrapped in paper and packaged in the same package with the item of hardware. Packages shall be legibly and accurately labeled to indicate the hardware contained and the part of the work for which it is intended.

B. Templates and schedules shall be furnished as required to manufacturers of doors and frames to permit proper preparation to receive the finish hardware.

C. Hardware shall be delivered in the order required, and full delivery completed in ample time to permit the application within the time required for the completion of the project.

D. Hardware required for application in the shop of a subcontractor shall be delivered directly to that shop. The balance of the material shall be delivered to the Contractor at the building site.

1.06 WARRANTY:

A. The hardware subcontractor shall guarantee hardware furnished under this section to be, and remain, free from defects of any kind as to material and workmanship for a period of one year from the date of acceptance of the project. During the guarantee period, the hardware subcontractor shall repair or replace all defective work within 7 days following his receipt of written notice that defects exist. The guarantee need not cover items damaged by abuse.

B. Closers shall be subject to the terms of the above guarantee, but for a period of 5 years.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:

Catalog numbers for the hardware listed in the hardware schedule are from the following manufacturers. Equal products approved by the Engineer will be acceptable:

Hardware Item	Manufacturer
Hinges	Stanley
Locksets	Sargent
Cylinders	Corbin

Closers	Yale
Holders Overhead	Yale
Flush Bolts	Ives
Exit Bolts	Sargent
Padlocks	Corbin
Weatherstripping	Reese
Thresholds	Reese

2.02 MATERIALS:

A. General Requirements

1. Doors scheduled to be labeled fire doors shall have Underwriters' Laboratories, Inc., approved labeled hardware as necessary to achieve the fire rating required for the door. The entire opening shall conform with the requirements of an Underwriters' Laboratories, Inc., Test Laboratory Report.

2. Hardware shall be supplied with screws, bolts, nuts and other fastenings required for attaching the hardware. These shall be the same material and finish as the hardware item to which they pertain.

3. The hardware specified herein designates the type and quality of the hardware desired. Hardware shall be best grade, entirely free from imperfections in manufacture and finish. Qualities, weights, and sizes specified herein are the minimum that will be accepted. The brand of hardware furnished shall be equivalent to that listed.

B. Hinges

Hinges shall be permanently factory lubricated. Exterior hinges shall have non-removable, non-corrosive pins. Hinges for doors more than 36-inches wide shall be heavy-gage, with 4 ball bearings. All hinges shall be ball bearing type.

C. Kickplates and Pushplates

1. Kickplates and pushplates shall be US l8 gage stainless steel. Edges shall be slightly rounded or beveled. Holes shall be accurately drilled and counter-sunk, for oval-head screws. Kickplates shall be 8-inches high. Kickplate width shall equal width of door, less 1-1/2-inches for single doors and less l-inch for pair of doors. Pushplates shall be 4-inches x l6-inches.

D. Threshold And Weatherstripping

1. Exterior doors, other than aluminum entrance doors, shall have thresholds and weatherstripping.

2. Weatherstrip for pairs of doors shall be installed on all frames and mullions, to contact both edges and top of each leaf.

3. Fasteners for thresholds shall be stainless steel machine screws and tampins.

4. Weatherstripping called out in door schedule for installation on interior door shall be soundstripping. Soundstripping shall be similar to weatherstripping, except that at door sill there shall be an automatic door bottom installed in lieu of threshold.

E. Locksets

1. Locksets and latchsets for hollow metal doors shall be heavy-duty mortise type, with cast lever handles or knobs and roses. Locksets and latchsets shall be by the same manufacturer.

2. Cylinders for aluminum entrance doors shall be supplied under this section. Visible parts shall have same finish as that of door.

F. Door Closers

1. Closers for both exterior and interior doors shall be the product of one manufacturer and shall match in design.

2. Construction shall be rack and pinion, with compression spring. The closer body shall be made of close-grained, nonporous cast iron.

3. Closing speed, latching speed, and backcheck shall be controlled by separate, concealed, key-operated valves.

4. Closers shall have a nonferrous metal cover, attached to closer body.

5. Sizes shall be as recommended by the manufacturer. Mounting brackets and arm style (parallel or standard) shall be as required to suit job conditions.

G. Overhead Holders

1. Overhead holders shall be made of extruded bronze, each with an encased shock absorber.

2. Holders shall be sized in accordance with manufacturer's recommendations.

3. Overhead holders shall be surface type, with heavy extruded bronze or brass channel, secured to the door with flush, dual-head hex nuts and slotted oval-head through-bolts.

H. Door Stops

1. Each leaf of each door shall have a stop or stop and holder. Wall stops shall be furnished where practicable and where conditions will allow. Floor stops may be supplied where wall stops cannot be used. Where neither wall stops nor floor stops are applicable or would be a hazard to personnel or subject to damage from wheeled traffic, stops shall be in the form of overhead holders.

2. Mounting of floor stops shall be adapted to height, special conditions (such as undercut doors), thresholds, etc. Floor stops at carpet shall be base riser type.

3. Wall stops shall be cast bronze or brass, with proper attachment for wall conditions. Floor stops shall be cast bronze or brass, attached by means of tampin shields and stainless steel flat-head machine screws.

4. Door stops are required for every door.

I. Padlocks (Exterior Storage Area Pair of Doors)

1. Padlocks shall be supplied and installed as required by the Engineer. The grand masterkey shall open these padlocks.

2. Padlocks shall have a stainless steel shackle and a removable cylinder and shall be manufactured by Schlage, Corbin or approved equal.

PART 3 - EXECUTION

3.01 INSTALLATION:

Installation of hardware is included in the door section for which the hardware is supplied.

3.02 QUALITY CONTROL:

A. After hardware has been installed, the manufacturer's representative for locks, closers, and holders shall inspect the installation and ascertain that locks are properly secured, keyways correctly positioned, and that knobs and latches are functioning properly. Door closers and holders shall be inspected for proper attachment and correct tension. An inspection report, in triplicate, shall be forwarded to the Engineer before final inspection of the building.

B. Before final acceptance of the work, defective, damaged or missing hardware shall be replaced.

3.03 HARDWARE SCHEDULE:

The hardware sets in the following schedule represent the hardware for one opening (single or pair of doors) except for stops, pushplates and kickplates, and the quantities of each set required. Location of each hardware item on the door shall be conventional, except as otherwise noted herein.

HW1

3 pair Hinges	FBB661 5 by 4 1/2 by N.R.P. US32D
1 Lockset	7721EG US32D
1 Set Flush Bolts	458B32D
2 Holders	594H by TMS US32D
1 set Weatherstrip	DS78
2 Door Bottoms	TL7A Aluminum
1 Threshold	T145A Aluminum

HW2

1 1/2 Hinges	FBB191 STD 4 1/2 by 4 1/2 US26D
1 Lockset	7704 EG US32D
1 Holder	601 by TMS US26D

END OF SECTION

SECTION 09 90 00

PAINTING

PART 1 - GENERAL

1.01 WORK INCLUDED:

A. This Section covers field painting and coating of new and existing surfaces, complete. Shop painting of metal items is specified under the applicable item.

B. A schedule listing the various types of surfaces to be painted and the types of paints to be applied is included herein.

C. Unless otherwise indicated, the following items shall not be painted:

1. Labels on equipment, such as Underwriters' Laboratories and Factory Mutual, equipment identification, performance rating, and name or nomenclature plates.

2. Moving parts of operating units, exposed bolt threads, mechanical and electrical parts, such as valve and damper operators, linkages, sensing devices, motor and fan shafts.

3. Electrical conduit unless mounted on painted or finished surfaces or exposed in a finished room.

4. Structural steel not exposed to view, and other parts of buildings also not exposed to view.

5. Stainless steel.

6. Concrete.

7. Plumbing fixtures.

8. Fiberglass and polyethylene storage tanks.

9. Uninsulated PVC piping (to be banded only)

* 10. Factory prefinished architectural components.

* 11. Electrical panels and cabinets factory finish painted.

* Except for touch-up painting when required

1.02 RELATED WORK:

A. Section 05 12 33, STRUCTURAL STEEL

B. Section 05 50 00, MISCELLANEOUS METALS

C. Section 08 11 00, METAL DOORS AND FRAMES

1.03 SYSTEM DESCRIPTION:

A. The term "paint" as used herein includes emulsions, enamels, paints, stains, varnishes, sealers, and other coatings, organic or inorganic, whether used as prime, intermediate, or finish coats.

B. The Contractor shall do a complete painting job throughout the work in accordance with generally approved modern practices for work of high quality. Unless otherwise specified, all materials and surfaces customarily painted shall be given not less than one shop coat and two field coats or one prime coat and two finish coats, regardless of whether or not the surface to be painted is specifically mentioned.

C. Paints containing lead shall not be used.

D. To ensure a satisfactory painting job it is essential that the paints applied in the shop and in the field be mutually compatible. The Contractor shall determine what shop paints have been used and shall verify that field applied paints are compatible therewith.

E. The colors of finish coatings shall be selected by the Engineer from color chips submitted by the Contractor for review. The color selection shall be in the form of a schedule indicating the colors to be used on the various surfaces. The colors used in the final work shall be in accordance with the color schedule and shall match the selected color chips.

F. All coating systems used for potable water applications shall be previously approved by the National Sanitation Foundation (N.S.F.) in accordance with Standard 61. Evidence of such approval shall be an approval letter from N.S.F. listing the submitted materials.

G. Paints submitted shall meet all Federal and State E.P.A. regulations pertaining to volatile organic compounds (VOC) compliance.

1.04 REFERENCES:

A. The following standards form a part of these specifications, and indicate the minimum standards required:

American Society for Testing and Materials (ASTM)

ASTM F1869 Moisture Vapor Emission Rate Using Anhydrous Calcium Chloride

1.05 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF GENERAL CONDITIONS, SUBMIT THE FOLLOWING:

A. Six (6) sets of manufacturer's literature of proposed paints shall be submitted to the Engineer for review.

B. Six (6) sets of the painting schedule shall be submitted to the Engineer for review.

C. Three (3) sets of color chips shall be submitted to the Engineer for selection of colors.

1.06 DELIVERY AND STORAGE:

A. Paint shall be delivered to the site in the manufacturer's sealed containers. Each container shall bear the manufacturer's label, listing the brand name, type and color of paint, and instructions for thinning. Thinning shall be done only in accordance with directions of the manufacturer. Job mixing or job tinting may be done when approved by the Engineer and for preparing sample colors.

B. Painting materials shall be stored and mixed in a single location designated by the Engineer for this purpose. The Contractor shall not use any plumbing fixture or pipe for mixing or for disposal of any refuse. He shall carry all necessary water to his mixing room, and shall dispose of all waste outside of the building in a suitable receptacle. The Contractor will be held responsible for any damage done due to failure to observe these precautions.

C. The paint storage area shall be kept clean at all times, and any damage thereto or to its surroundings shall be repaired. Any oily rags, waste, etc., shall be removed from the building every night, and every precaution shall be taken to avoid danger of fire.

D. Heat must be provided in the storage area if paints are to be stored during winter months. The temperature shall be maintained above 40 degrees F. at all times.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. PAINT SCHEDULE:

Except as otherwise indicated, all paint used shall be of the type listed in the schedule below, by Tnemec Company, Inc., or equivalent paints by Sherwin-Williams Company, International Paints, or other approved paint fully equal to paint manufactured by the above named companies. No brand other than those named will be considered for approval unless the brand and type of paint proposed for each item in the following painting schedule are submitted in writing to the Engineer, along with sufficient data supported by certified tests.

PAINT SCHEDULE

Key		Tnemec	Note 1
AGE	Acryli Gloss Enamel	1029 Enduratone	3.5
APE	Acrylic Polyurethane	73 Endura-Shield Enamel	3.0
ABF	Cementitious Block Filler	130 Envirofill	80-100 s.f./gal
BO	Bleaching Oil	Note 5	
CEE	Catalyzed Epoxy	L69F Epoxoline II	4.0
CEM	Catalyzed Epoxy Mastic	27 WB Typoxy	Note 3
CEP	Catalyzed Epoxy Primer	L69F Epoxoline	3.0
EMC	Epoxy Modified Cement	218 Mortar-Clad	Fill/Surface
EP	Epoxy-Polyamide (thinned 30% #4 thinner)	FC 22 Pota-pox	25-30
EPW	Water-based Epoxy Primer	151 Elasto-Grip	1.0-1.5
HGV	High Gloss Varnish		Note 2
HSE	High Solids Epoxy (Minimum 69%)	L69 Epoxy	6.0
MA	Modified Acrylic	115 Uni-bond	3.0
MAE	Modified Acrylic Elastomer	156 Envirocrete	6.0-8.0
MCU	Moisture Cured Urethane	Series 1 - Omnithane	2.5-3.0
MPE	Modified Polyamine Epoxy	Series 435 - Permaglaze	15-20 mils
NE	Novolac Epoxy	282 Tneme-Glaze	7.5

PAINT SCHEDULE

Key		Tnemec	Note 1
PEF	Polyamine Epoxy Finish	280 Tneme-Glaze	6.0-8.0
PEP	Polyamine Epoxy Primer	201 Epoxoprime	6.0-8.0
PVA	PVA Sealer	151 Elasto Grip	0.75-1.5
PWC	Potable Water Coating	Series FC 22 Pota Pox	25-30
SA	Silicone Aluminum	39-1261 (Note 4)	1.5
VB	Vapor Barrier	262 Elasto Shield	50-100
WP	Wood Primer	151 Elasto-Grip	1.0-1.5
WS	Wood Sealer	Note 2	-
Z	Zinc-Rich Primer	90G-1K97 Tneme-Zinc	2.5

Notes
1: Minimum Dry Film Thickness/Coat (mils)
2: Furnished by reputable manufacturer and acceptable to the Engineer.
3: Shall be used as a tie-coat between incompatible paints @ 3.0-4.0 mils.
4: This paint is suitable for temperatures up to 1200ºF and must be final cured at 400ºF for one hour.
5: Bleaching oil is a translucent gray paint stain with a chemical additive to enhance the natural bleaching tendencies of cedar shingles.

B. PAINTING SCHEDULE:

Paint shall be applied in accordance with the paint key listed on the following schedule and defined in the preceding Paint Schedule:

Item	Field Coats		
	1st	2nd	3rd
Walls:			
Existing Interior concrete masonry units	ABF	HSE	HSE
Existing Interior concrete designated to be painted, to include top and outside of all concrete containment curbs	HSE	HSE	--
Floors:			
Existing Concrete floors designated to be painted	PEP	PEF	PEF
Ceilings and Walls:			

Item	Field Coats 1st	2nd	3rd
Exposed galvanized metal deck/bar joists, wet spaces^	CEE		
Exposed exterior structural steel canopy framing and supports	*Z	CEE	APE
Exposed electrical conduit, conduit fittings, outlet boxes	Same as adjacent wall or ceiling		
Hot ferrous metal surface	SA	SA	--
Doors and Frames:			
Interior hollow metal doors, frames and panels	AGE	AGE	--
Exterior hollow metal doors	AGE	AGE	--

* Spot Prime
***For existing, painted masonry walls, use EPW primer, followed by two coats of MAE.
^ If galvanized metal is provided with a light top coat sealer, light brush blast surface preparation is required prior to first field coat

B. SPARE PAINT:

1. Furnish to the Owner one unopened gallon of each type and color of paint used on the work.

2. Furnish both components for each type and color of epoxy paints used on the work.

PART 3 - EXECUTION

3.01 SURFACE PREPARATION:

A. Before any surface is painted, it shall be cleaned carefully of all dust, dirt, grease, loose rust, mill scale, old weathered paint, efflorescence, etc. All necessary special preparatory treatment shall then be applied. Where required, imperfections and holes in surfaces to be painted shall be filled in an approved manner.

B. Cleaning and painting shall be so programmed that dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.

C. Surfaces which have been cleaned, pretreated, or otherwise prepared for painting, shall be painted with the first field coat as soon as practicable after such preparation has been

completed, but in any event prior to any deterioration of the prepared surface.

D. Wood shall be sanded to a smooth and even surface and then dusted off. Before priming wood that is to be painted, shellac shall be applied to all knots, pitch and sapwood. After priming or stain coat has been applied, nail holes and cracks shall be thoroughly filled with plastic wood or putty. For natural finish work, putty shall be colored to be imperceptible in the finished work.

E. Exposed nails and other ferrous metal or surfaces to be painted with water-thinned paint shall be spot primed with aluminum.

F. Cracks and holes in masonry and concrete surfaces to be painted shall be filled with patching material recommended by the coating's manufacturer. Surfaces shall be clean and dry before painting. All efflorescence, grease, oil, etc., shall be removed before painting, and all loose, crumbling material shall be removed by vigorous wire brushing over entire surface, followed by removal of all dust. All high areas on masonry and concrete surfaces such as mortar daubs, mortar ridges at joints, and ridges at form joints in concrete shall be removed.

G. All nonferrous metal surfaces to be painted shall be cleaned of all dirt, grease, oil and other foreign substances uniformly profiled per SSPC SP 7.

H. All galvanized surfaces to be painted shall be brush blasted to create a uniform surface profile per SSPC SP7.

I. Before application of the first full field coat, abraded areas of all non-galvanized ferrous metal items having shop coats shall be touched up with paint of the type indicated on the Painting Schedule.

J. All items of equipment such as motors, pumps, instrumentation panels, electrical switchgear, and similar items, that have been given shop coats, paint filler, enamel or other treatment customary with the manufacturer, shall have, after installation, all scratches and blemishes touch up prior to application of the first field coat. Factory prefinished items not to be field painted shall be touched up with matching paint to repair any areas damaged during installation.

K. Concrete floors that are to receive epoxy coating shall be brush blasted or shot blasted per SSPC SP #13 and ICRI Surface Profile requirements per the coating manufacturer (Blastrack). Check for excessive moisture migration per ASTM F1869, Moisture Vapor Emission Rate Using Anhydrous Calcium Chloride. Test results not to exceed 3 lbs per 1,000 square feet in one 24-hour period.

L. Hardware accessories, machine surfaces, plates, lighting fixtures, and similar items in place prior to cleaning and painting, and not intended to be painted, shall be removed

during painting operations and repositioned upon completion of each area or shall otherwise be protected.

3.02 APPLICATION:

A. Paint shall be used and applied as recommended by the manufacturer without being extended or modified, and with particular attention to the correct preparation and condition of surfaces to be painted.

B. Paint shall be applied only within the temperature range recommended by the manufacturer. Painting of surfaces when they are exposed to the sun shall be avoided.

C. Paint shall not be applied to wet or damp surfaces and shall not be applied in rain, snow, fog, or mist, or when the relative humidity exceeds 85 percent.

D. No paint shall be applied when it is expected that the relative humidity will exceed 85 percent or that the air temperature will drop below 40ºF within 18 hours after the application of paint. Dew or moisture condensation should be anticipated and if such conditions are prevalent, painting shall be delayed until midmorning to be certain that the surfaces are dry. Further, the days painting should be completed well in advance of the probable time of day when condensation will occur, in order to permit the film an appreciable drying time prior to the formation of moisture.

E. All paint shall be applied under favorable conditions by skilled painters and shall be brushed out carefully to a smooth, even coating without run or sags. Enamel shall be applied evenly and smoothly. Each coat of paint shall be allowed to dry thoroughly, not only on the surface but also throughout the thickness of the paint film before the next coat is applied. Finish surfaces shall be uniform in finish and color, and free from flash spots and brush marks. In all cases, the paint film produced shall be satisfactory in all respects to the Engineer.

F. Exposed nails and other ferrous metal or surfaces to be painted with water-thinned paints shall be spot primed with aluminum paints.

G. In order to provide contrast between successive coats, each coat shall be of such tint as will distinguish it from preceding coats.

H. The Contractor shall not only protect his work at all times, but shall also protect all adjacent work and materials by the use of sufficient drop cloths during the progress of his work. Upon completion of the work, he shall clean up all paint, spots, oil, and stains from floors, glass, hardware, and similar finished items.

I. Paint shall be applied so as to obtain coverage per gallon and the dry film thickness recommended by the manufacturer. Dry film thickness readings shall be taken to ensure that required thicknesses have been achieved. The Contractor shall record in a manner

satisfactory to the Engineer, the quantities of paint used for successive coats on the various parts of the work.

J. Spraying with adequate apparatus may be substituted for brush application of those paints and in those locations for which spraying is suitable.

K. If paints are thinned for spraying, the film thickness after application shall be the same as though the unthinned paint were applied by brush. That is, the addition of a thinner shall not be used as a means of extending the coverage of the paint, but the area covered shall be no greater than the area that would have been covered with the same quantity of unthinned paint.

L. Blast cleaned metal surfaces shall be coated immediately after cleaning, before any rusting or other deterioration or contamination of the surface occurs. Blast cleaned surfaces shall be coated not later than 8 hours after cleaning under ideal conditions or sooner if conditions are not ideal.

M. The use of carbon dioxide or carbon monoxide emitting heaters is not permitted during the painting operation. Only indirect hot-air systems shall be permitted.

3.03 PIPING IDENTIFICATION:

A. After painting, filtration system piping shall be identified by stenciling using the same specified paint as used on the pipes. Stenciling shall be of wording and color selected by the Engineer and sized as follows:

Outside Diameter of Pipe or Covering	Size of Legend Letters
3/4-inch to 1-1/4-inch	2-inch
1-1/2-inch to 2-inch	3/4-inch
2-1/2-inch to 6-inch	1-1/4-inch
8-inch to 10-inch	2-1/2-inch
Over 10-inch	3-1/2-inch

B. Arrows shall indicate direction of flows. Where "a" is equal to 3/4 of outside diameter of pipe or covering, the arrow shaft shall be 2 "a" long by 3/8 "a" wide. The arrow head shall be an equilateral triangle with sides equal to "a." Maximum "a" dimension shall be 6-inches.

C. Where pipe passes through a wall, use pipe markers and directional arrows on each side of the wall.

D. Use pipe markers and directional arrows every 50 feet along continuous pipe lines.

E. Use a pipe marker and directional arrow at each rise and "T" joint.

F. When using directional arrows, point arrowhead away from pipe markers and in direction of flow. If flow can be in both directions, use a double-headed directional arrow.

G. The Engineer will assist in determining pipe content and direction of flows.

3.04 CLEANUP:

A. The Contractor shall at all times keep the premises free from accumulation of waste material and rubbish caused by his employees or work. At the completion of the painting, he shall remove all of his tools, scaffolding, surplus materials, and all of his rubbish from and about the buildings and shall leave his work "broom clean" unless more exactly specified.

B. The Contractor shall also, upon completion, remove all paint where it has been spilled, splashed, or splattered on all surfaces, including floors, fixtures, equipment, furniture, glass, hardware, etc., leaving the work ready for inspection.

END OF SECTION

SECTION 13 00 00

SUMMARY OF WORK FOR FILTRATION SYSTEMS

PART 1 – GENERAL

1.01 WORK INCLUDED

A. Provide and include all shop drawings for the design of the filtration system for submittal.

B. Lay out filtration system; benchmark and exact location by General Contractor.

C. Trenching and backfill as required for filtration system piping.

D. Furnish and install prefabricated main drains, inlets, and recirculation systems. All systems shall be VGB compliant. (Specified in Section 22 51 00).

E. Furnish and install filtration and chemical treatment equipment, including fittings, piping, and valves as required for fully operable systems. (Specified in Section 22 51 00.)

F. Furnish and install pumps, piping, and valves as required for operation of circulation system. (Specified in Section 22 51 00.)

G. Furnish and install backwash tank.

H. Provide all necessary sleeves, openings, or other penetrations in equipment room walls, pump pits, settling tanks, etc.; and closure of same required for construction work.

I. Furnish start up chemicals, test and balance the Bathing Beach in accordance to State and Local standards prior to acceptance by the Town.

J. Contractor shall protect the filtration system, chemical treatment, and electrical equipment during construction.

1.02 RELATED WORK

A. The following Sections contain work that relates to this Section.

1. SECTION 03 48 00 – PRECAST CONCRETE BACKWASH TANK & STRUCTURES

2. SECTION 22 51 00 – FILTRATION SYSTEM EQUIPMENT

3. SECTION 23 48 00 – UV DISINFECTION

1.03 WORK PERFORMED UNDER OTHER SECTIONS
(Not By Filtration System Contractor (FSC).)

A. Site access for heavy equipment.

B. Benchmark and exact filtration system.

C. All machine excavation and backfill for main drain, return and fill piping, pipe trenches, and backwash tanks, - as shown on the Plans. Disposal of excavated material. General Contractor to furnish any required backfill material.

D. All base and sub-base material for filtration system; compaction; and all compaction testing and soil testing.

E. Demolition of filtration system area, grading, and any other area preparation required prior to the start of construction.

F. Construction and backfill of all foundations, equipment room walls, footings, backwash tanks, valve vaults and sumps as required for construction work.

G. General construction work not included in Filtration System Specifications in this section.

H. The Plumbing Contractor shall provide fresh water piping in to filter room, including back flow prevention device, shut-off valve, and hose bib; floor drains; and waste water connection from filter. Install solenoid valve(s), water connection to cylinder-operated valves.

I. Provide access to filter room for filter access.

J. All electrical connections shall be by the Electrical Contractor; the FSC shall provide the filter, pumps, motors, solenoids, relays, water level probes (with housing), motorized valves, etc., as shown on Plans. All controls – including starters, shall be provided and installed by Electrical Contractor; the Electrical Contractor shall install and wire all electrical equipment furnished by the FSC and shall provide all disconnect switches as indicated or required by code. Chemical feeders shall be electrically interlocked with filter pump.

K. The Electrical Contractor shall ground the all equipment in accordance with the National Electrical Code and all local Codes and Ordinances.

L. Provide all construction utilities, water, electric heat, or cold weather protection.

1.04 QUALITY ASSURANCE

A. Design Standards

Within the limits of constraints imposed by existing conditions, it is intended that the work of this contract shall comply with the following requirements:

1. American National Standards for Public Swimming Pools – ANSI/APSP-1 2014

2. Massachusetts State Health Code

3. National Electrical Code, Article 680

4. National Sanitation Foundation Standards for Swimming Pool Equipment. (N.S.F.)

5. State of Massachusetts Building Code

6. Virginia Graeme Baker Pool and Spa Safety Act VGB 2008

7. NSF/ANSI Standard 50 – Equipment for Swimming Pools, Spas, Hot Tubs and Recreational Water Facilities

8. United States Department of Justice – Americans with Disabilities Act (ADA)

B. Experience Qualifications: Work shall be performed by or under direct supervision of Contractor with 5 years' experience in construction and equipping of public pools or similar project work. Submit list of 5 public pool projects or similar project work, completed at least five years, for which pool contractor was responsible for constructing a similar project for public use.

C. Installation of Filtration System and Equipment: Filtration system equipment and system shall be installed by a Contractor experienced in swimming pool work and licensed or approved by manufacturer to ensure installation and performance in accordance with manufacturer's warranties and guarantees.

1.05 SUBMITTALS

A. Shop Drawings: Submit coordinated structural steel shop drawings, showing types of anchors and method of anchoring fixed equipment. Provide rough-in information interfacing mechanical and electrical work and accurately dimensioned locations for sleeves, inserts, and anchors to be cast into concrete and installed into the building structure. Contractor shall submit on all materials

to be supplied in the construction of this project, certifications, and resumes as stated in each section. Unless otherwise mentioned, the Contractor shall submit (6) copies of shop drawing submittals to the Engineer for review.

B. Certification: Submit complete equipment list and duplicate copies of certificate from equipment manufacturer, properly attested, with statement that materials meet requirements of Contract Documents. Submit certificate for approval before doing any work.

C. Product Data: Submit six (6) sets of manufacturer's data for operating equipment, valves, piping, drains, and equipment. Include roughing-in information for mechanical and electrical work. Product data shall be job specific. Generic submittals will be rejected.

D. Maintenance Data: Shall be submitted in accordance with specification section 01 92 13, OPERATION AND MAINTENANCE MANUALS.

E. Contract Documents: Drawings are diagrammatic in part and are meant to indicate general arrangement of systems and equipment. Information shown on plans but not on Sections or schedules and vice-versa, shall be provided as if expressly required on both. It is not intended that Contract Documents indicate every fitting offset, line or component necessary for particular suppliers' system; but it is intended that systems and equipment supplied shall be complete and operational, whether or not shown or specified. Specified items may in fact be disapproved during Submittal Review if they do not form part of a complete system. Contractor shall submit to the Engineer their proposed piping and equipment layout.

F. Health Department: Contractor shall be responsible for submittal and cost of submissions to regulatory agencies including: Massachusetts State Health Department and any other agencies having jurisdiction.

G. Permits: Contractor shall be responsible for obtaining and paying for all permits, inspections, licenses and certificates required for work under this Section.

1.06 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver material in manufacturer's original, unopened containers and crates with all labels intact and legible.

B. Deliver materials in sufficient time and quantity to allow continuity of work and compliance with approved construction schedule.

C. Handle materials in a manner to prevent damage.

D. Store all materials on clean raised platforms with weather protective covering when stored outdoors. Provide continuous protection of materials against damage and deterioration.

E. Remove damaged materials from site.

1.07 GUARANTEES

A. Provide standard written manufacturers' guarantees in the Owner's name for materials furnished under this Section where such guarantees are offered in the manufacturers' published product data.

B. Furnish written warranty for materials and workmanship of systems installed under this Section against defect in materials and workmanship for 1 year.

C. The Contractor warrants to the Owner that materials and equipment furnished under the Contract will be of good quality and new unless otherwise required or permitted by the Contract Documents, that the Work will be free from defects not inherent in the quality required or permitted and that the Work will confirm with the requirements of the Contract Documents. Work not conforming to these requirements, including substitutions not properly approved and authorized may be considered defective. The Contractor's warranty excludes remedy for damage or defect caused by abuse, improper or insufficient maintenance, improper operation or insufficient maintenance, improper operation, modification not executed by the Contractor or the Owner; the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment. All warranties shall be for a period of one year from the date of Substantial Completion unless otherwise specified.

D. The Contractor shall agree to repair or replace any Work at no cost to the Owner, upon written notification from the Owner within the warranty period. Prorated warranties are not acceptable.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Products of particular manufacturers have been specified to establish a standard of quality and performance.

B. Proposals, including list of manufacturers and itemized products for other systems, will be reviewed by Engineer to determine their comparability to scope and quality required by Contract Documents.

C. All equipment furnished hereunder shall be by manufacturers with at least 5 years' experience in the fabrication and installation of the item specified with at least 10 installations on projects similar in scope to this project.

PART 3 – EXECUTION

3.01 TESTING AND INSPECTION

A. Piping: Test piping to 35-psi hydrostatic pressure before placement of covering concrete slabs. Pressure shall remain on piping until the commissioning of the filtration equipment.

B. Water for testing will be provided by Owner.

C. Contractor shall coordinate inspector services for all concrete and steel reinforcing.

END OF SECTION

SECTION 22 51 00

FILTRATION SYSTEM EQUIPMENT

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Furnish and install complete mechanical system as indicated on the drawings and as specified herein, including:

1. The complete water filtration systems shall include the media, filter tank, internal collection and distribution system, automatic backwash system, vent, sight glass, face piping and valves, pumps and motors, chemical feed and control equipment.

2. Furnish and install backwash tank and equipment, fittings, hatches, ladders, float valves and isolation valves as required to plumb system fittings, drains, and features through backwash tank to pump.

3. Furnish and install skimmers and main drains.

4. Furnish and install auto-fill systems, bonding (grounding) connections to sanitary systems.

5. Furnish and install pipe, fittings and valves as required to connect chemical treatment equipment to filtration system.

6. Furnish and install pipe fittings and valves as required to plumb fittings, drains, inlets, fill and drain systems and skimmers to recirculation, filter and backwash.

7. Furnish and install Schedule 80 PVC pipe and fittings for all piping unless otherwise stated.

8. Furnish and install all chemical feeders, storage tanks and chemical analyzers.

B. Final testing and demonstration to Owner.

C. Provide system start up and operator training by a certified manufacturer's representative. Operator training shall occur until the owner is satisfied with the training.

1.02 RELATED WORK

A. The following divisions contain work that relates to this section:

1. SECTION 13 00 00 - SUMMARY OF WORK FOR FILTRATION SYSTEMS

2. DIVISION 26 – ELECTRICAL

1.03 QUALITY ASSURANCE

A. Special attention is directed to the materials, design standards and performance characteristics described in the bidding documents and shown on the Drawings. They establish standards of function, dimension, appearance, durability, design, operational efficiency and performance, and overall quality required of the filter systems. In order to assure that each item of equipment performs in conjunction with all other system components, the Owner requires that the filter manufacturer be a single source of supply for all the items of equipment as listed and described within the complete Section 13 00 00. The Owner and Engineer may reject any system not meeting any or all of the specific performance requirements herein.

B. Only suppliers/manufacturers who have established a proven record of performance with at least five (5) years of sand filter fabrication shall be acceptable. System shall be fabricated and fully assembled in a Certified Manufacturing Plant. Filters must have proven filtration performance demonstrated by at least ten (10) swimming pools operating at least one year under normal loading conditions, which have consistently operated at least 25 days between media replacement or cartridge cleaning. Prime bidders are cautioned that the manufacturers' stock pressure sand filtration systems will be approved only if such system, in fact, meets all the material and performance requirements specified herein.

C. The filter system shall meet all State and local Health code requirements.

D. Due to the specialized nature of the work and products herein, the installation Supervisor of the Manufacturer shall be required to have a minimum of three (3) years of filtration installation experience and show at least five (5) installations of public-use pool filtration systems in successful operation for a least two (2) years.

1.04 REFERENCES

A. American National Standards Institute/National Spa and Pool Institute (ANSI/NSPI) ANSI/NSPI 1 - American National Standard for Public Swimming Pools.

B. American National Standards Institute/American Society of Mechanical Engineers (ANSI/ASME) A112.19.8 - Suction Fittings for Use in Swimming Pools, Wading Pools, Spas, and Hot Tubs, Includes Addenda A.

C. ASTM International (ASTM)

1. D1784 - Standard Specification for Rigid Polyvinyl chloride (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.

2. D1785 - Standard Specification for Polyvinyl Chloride (PVC) Plastic Pipe, Schedules 40, 80, and 120.

3. D2564 - Standard Specification for Solvent Cements for Polyvinyl chloride (PVC) Plastic Piping Systems.

4. D2855 - Standard Practice for Making Solvent-Cemented Joints with Polyvinyl chloride (PVC) Pipe and Fittings.

D. International Association of Plumbing and Mechanical Officials (IAPMO).

E. National Fire Protection Association (NFPA) 70 - National Electric Code.

F. National Sanitary Foundation/American National Standards Institute (NSF/ANSI) Standard 50 - Circulation System Components and Related Materials for Swimming Pools, Spas/Hot Tubs.

1.05 SUBMITTALS

In accordance with requirements of General Specifications, submit the following:

A. Submittals for Review

1. Product Data: Manufacturer’s descriptive data, specifications and installation instructions for:

a. Piping

b. Main Drains and Skimmers

c. Filters

d. Pumps and Strainers

e. Variable Frequency Drives (VFD)

f. Chemical controller, Disinfection feeder, and pH feeder

g. Valves

h. Gauges, Thermometers, Control Panels and Flow Meters

i. UV Treatment

j. Any permanent component on this system.

2. Performance Criteria: For products specified by performance criteria only, document conformance with design calculations or past performance records with list of previous installations and contact information.

B. Quality Control Submittals

1. Certificates of Compliance: Submit certification that filtration system complies with requirements of applicable codes, ordinances, rules, and regulations, ANSI/NSPI 1, and ANSI/ASME A112.19.8.

C. Closeout Submittals

1. Operation and Maintenance Data: Include data for filtration system equipment, and warranty information. Contractor shall supply four (4) complete Operation and Maintenance manuals for all products supplied in this project. The manuals shall be project specific, any general Operation and Maintenance manuals shall be rejected.

2. Maintenance manual shall have a complete system diagrams displaying the valve number, valve function, on specific system, and how to operate the system opening and closing valves.

3. Warranties

4. Owner's Certificate of Instruction

1.06 DELIVERY, STORAGE AND HANDLING

A. Store filtration system components off ground and protect with waterproof covering.

B. Protect piping and accessories from exposure to ultraviolet and from contact with chemicals that could cause damage or deterioration.

1.07 WARRANTIES:

A. Furnish filter and related items manufacturer's limited 1 year warranty against defective materials and workmanship, starting on the date of Substantial Completion.

PART 2 - PRODUCTS

2.01 EQUIPMENT

A. Bottom Inlets

1. Sumps shall be fabricated of high density resin. Sumps shall be fitted with waterproofing flanges, hydrostatic relief valves with collection pipes and tamper proof PVC cover grates. All Fittings should be of non-corrosive materials. Maximum opening of grates shall be 3/8-inch with total open areas as required to accommodate specified flow rate at velocity not to exceed 1.5 F.P.S. Load bearing capacity of grating as installed shall be at least 200 pounds per square foot.

2. Open area of grates shall be of 8.10 square inches pre inlet. Grates shall be manufactured by Hayward, Model WG1054AVPAK2 or approved equal.

B. Skimmers

1. Skimmers shall custom stainless steel skimmer systems manufactured in accordance with contract documents.

2. Each skimmer shall be supplied with one (1) extra strainer basket.

3. Material shall be manufactured from 316 Stainless Steel

C. High Rate Sand Filter

1. Provide the filter system. The filter system shall be high rate sand filter with capacity of 885 gallons per minute, providing 30.4 square feet filter area, when operating at a filtration application rate not to exceed 14.56 gallons per minute per square foot of filter area, per filter. The filter system shall be two (2) model no. 60120SHFFG Sand Filters manufactured by Neptune-Benson, or approved equal.

2. The filter shall include the media.

3. System shall be fabricated and fully assembled at the manufacturer's plant for pressure testing and dimensional verification. System shall be knocked

down for shipping purposes in subassemblies for minimum field assembly. Internal manifold and lateral piping shall be factory installed and shipped in place.

4. Access to the tank shall be provided by a 14-inch by 18-inch manhole with a two (2) bolt, four (4) point yoke. Manhole seal shall be complete with one (1) piece ¼-inch neoprene gasket and positioned so that internal pressure from the filter will augment the seal. Externally mounted bolt-on covers will not be accepted.

5. Drain out system shall consist of one (1) ¾-inch fiberglass coupling mounted to the tank bottom. Each coupling shall be fitted with a slotted PVC sand retainer. Air relief connection shall be one (1) ¾-inch coupling provided on top of the tank. Bulkhead fittings will not be accepted.

6. Each filter tank shall be equipped with the necessary flanges and connections for the internal and external piping. Connections shall be comprised of 1-inch minimum thickness fiberglass flanges with ANSI standard 150 lb. bolt pattern. Connections requiring bolt-thru hardware will not be accepted.

7. The resin used shall be a commercial grade, premium corrosion resistant vinylester that has been evaluated in a laminate by test in accordance with ASTM C-581 in service comparable to the intended service and recommended for this service by the manufacturer. Other generic types of resin such as isophthalics or general purpose polyester resins shall not be acceptable.

8. Ultraviolet absorbers shall be added to the exterior surface for improved exterior resistance.

9. Chopped strand mat shall be constructed from commercial grade E- type glass strands bonded together using a binder. The strands shall be treated with a sizing that is chemically compatible with the resin system used. Continuous roving shall be a commercial grade of E-type glass fiber with a sizing that is chemically compatible with the resin system used.

10. The inner surface exposed to the corrosive environment shall be followed with a layer composed of vinylester resin, reinforced only with non-continuous glass fiber strands applied to a minimum thickness of 0.100-inches. The combined thickness of the inner surface and interior layer shall be 0.110 to 0.130-inches and in no case less than 0.100-inches.

11. The exterior laminate shall consist of filament winding and unilateral construction so as to create a modulus of elasticity to maintain no more than 0.1-percentstrain in any direction.

12. Resin used in these layers shall be Hetron 922 incorporating a Cobalt/MEKP cure system as recommended by the manufacturer.

13. The filter tank shall be suitable for 50-pounds per square inch working pressure, hydrostatically tested to 1.1 times the working pressure and designed with a 4:1 safety factor.

D. Filter Piping – Internal

1. The upper and lower internal distribution system shall be a horizontal header/lateral arrangement. The headers shall be Schedule 80 PVC construction, capped on one end and flanged on the other end. Lateral connections shall be spaced no more than 6-inch on the centers and shall be 1½-inch FPT connections.

2. Underdrain laterals shall consist of 1½-inch Schedule 80 PVC pipe with 0.012-inch machined double slotted openings on 1/8-inch centers. Machined openings shall be designed to retain all media particles as small as 0.30-millimeter particle size. Molded or drilled openings or retainer screens will not be acceptable. Each lateral shall be fabricated complete with a socket cap on one end and male adapter on the other. Both fittings to be solvent welded to the slotted pipe. Laterals shall be fitted with a rubber 0-ring to allow for proper positioning of the machined openings.

3. Upper laterals shall consist of 1½-inch Schedule 80 PVC pipe with ½-inch wide machine slotted openings on 1 ¼-inch centers. Upper laterals shall be designed and sized at the factory so as to provide uniform distribution and unrestricted flow during filter and backwash cycles. Laterals shall be fitted with a rubber 0-ring to allow for proper positioning of the machined openings.

4. All hardware in wetted areas shall be T304L stainless steel or non- metallic.

E. Filter External Piping

1. External face piping shall be 8-inch Schedule 80 PVC pipe and fittings. Flanges shall be located so as to allow for easy dismantling of face piping. All fittings shall be solvent cemented.

2. Piping shall be drilled and tapped where necessary to accommodate gauge tubing connectors.

3. All valves 3-inch – 12-inch shall be constructed with cast aluminum ASTM S12A housing and fully coated with Rilsan on all interior and exterior surfaces. Internal components include EPDM resilient lining, Rilsan coated

ductile iron disc and T304 stainless steel shaft. Valves 14-inch and larger shall be constructed with cast iron housing epoxy coated and with nylon coated ductile iron disc.

4. Standard accessory items shall include sight glass rated for 50 psi with polycarbonate glass, remote mounted gauge panel with two 4½-inch diameter pressure gauges, ¼-inch petcocks, ¼-inch poly vent tubing with PVC compression adapters.

F. Face Piping

1. External face piping shall be Schedule 80 PVC pipe and fittings. All fittings, including 10-inch and 12-inch sizes shall be molded type. Fabricated or fiberglass wrapped fittings will not be acceptable. Flanges shall be located so as to allow for easy dismantling of face piping. All fittings shall be solvent cemented.

2. Piping shall be drilled and tapped where necessary to accommodate gauge tubing connectors.

3. All valves 3 – 12-inch shall be constructed with cast aluminum ASTM S12A housing and fully coated with Rilsan on all interior and exterior surfaces. Internal components include EPDM resilient lining, Rilsan coated ductile iron disc and T304 stainless steel shaft. Valves 14-inch and larger shall be constructed with cast iron housing epoxy coated and with nylon coated ductile iron disc. Unless otherwise specified, all nuts and bolts shall be stainless steel with stainless steel washers to be used when secured to PVC flanges.

4. Standard accessory items shall include sight glass rated for 50 pounds per square inch with polycarbonate glass, remote mounted gauge panel with two 4½-inchdiameter pressure gauges, ¼-inch petcocks, ¼-inch poly vent tubing with PVC compression adapters.

5. Face piping shall be fully factory assembled, knocked down and crated for shipment. The warranty of the face piping shall be provided by the filter manufacturer. Field gluing or assembly of the face piping by anyone other than the filter manufacturer will not be accepted.

6. Face piping arrangement shall be as indicated on the drawings.

G. Media

1. Gravel support media of a hard coarse aggregate with a subangular grain shape with a particle size of 1/8-inch x ¼-inch shall be used on the inside of the bottom head to the elevation where the filter media commences. The specific gravity shall not be less than 2.5. Support media shall be placed by hand to avoid damage to the underdrain system and leveled before the addition of the upper layer of filter media. Concrete underfill is not recommended. Support gravel shall be delivered and stored in 100 pound bags (approximately one cubic foot) for ease of handling and elimination of possible contamination. Media shall be free from minerals which may precipitate onto mechanical room surfaces.

2. Sand shall be a carefully selected grade of hard, uniformly graded silica material. Media shall be naturally rounded particles of silica or milled angularly shaped particles of silica quartz. Sand shall have a particle size between .45mm and .55 mm.(#20). No more than 1.5% shall be allowed to pass through a #40 sieve (.0164-inch). Uniformity coefficient shall not exceed 1.53. Specific gravity to be not less than 2.5. Filter shall contain a minimum bed depth of 11-inch. Systems which do not provide a minimum 11-inch bed depth will not be acceptable. Sand shall be delivered and stored in 100 pound bags (approximately one cubic foot) for ease of handling and elimination of possible contamination. Media shall be free from minerals which may precipitate onto mechanical room surfaces.

3. Each filter tank shall be provided with the following:

   $^{1}/_{8}$-inch x ¼-inch gravel 25 cu.ft. per tank
   .45 - .55 sand 95 cu.ft per tank

H. Filter System Packaging

1. All filter piping and valves shall be factory assembled and knocked down into sub-assemblies for shipment.

2. The components shall be carefully packaged in a totally enclosed wooden crate to prevent damage during transport.

I. Pressure Gauges

1. Provide pressure gauge for pump discharge mounted on panel attached to filter tank. Gauge(s) shall be at least 2 ½-inches in diameter, calibrated in psi for 0 to 60. Provide gauge cock and pressure tubing. Provide pressure gauge installed at pump discharge with rubber fitting.

J. Vacuum Gauges

Provide compound gauge for pump suction port. Gauge(s) shall be at least 2 ½-inches in diameter. Gauge shall be calibrated to 30-inches hg vacuum and 0 to 60 psi.

K. Backwash Sight Glass

1. Backwash sight glass shall be furnished for installation on backwash line. Gauge body shall be of all bronze construction with a 1 1/2-inch male threaded connector for mounting on backwash line.

L. Filter Vent

1. A vent valve shall be furnished for installation at top of each filter tank.

M. Flowmeter

1. Flowmeter shall be installed in the filtered water return line to the Reservoir Beach. Flowmeter shall be GF Signet 2537 , paddlewheel flow meter providing a 4-20 mA signal. Flowmeter shall be digital with electronic read out to connect to chemical controller. Flowmeter shall be manufactured by GF Signet or approved equal.

N. Filter Pumps

1. The Filter pump shall be two (2), 30 HP, Model No. EL 6E2 by Marlow or approved equal. Each pump shall deliver 885 GPM at 78 TDH. Pump shall have a 3 phase, 208-volt motor. Pump shall have an integral strainer. Provide spare strainer basket.

2. Motors:

a. Totally enclosed, fan-cooled (TEFC) or open drip-proof (ODP), with hygroscopic insulation, service factor 1.15, insulation Class F, sized to operate at full load and speed, designed for continuous operation.

b. Motor starter with current interrupter overload.
c. Combination motor starters: Hand-off auto switch and positive overload heater coil; as manufactured by Furnas, Square D, or Westinghouse.

d. Electrical enclosures: NEMA 4x type, suitable for surface mounting.

3. Filter pumps shall be vibration isolated. The pumps shall be mounted on a ¼-inch thick stainless steel plate and neoprene pads shall be placed between the stainless steel plate and the floor. Neoprene pads shall be equivalent to the Mason Industries Type Super W Pads. The pads shall be sized to provide minimum 0.15-inch static deflection under the weight of the pump.

4. All pumps shall be electrically interlocked with the chemical controller and system flow meter.

O. Fill Pumps

1. The fill pump shall be a 3 HP, Model No. XFK-12 by Pentair or approved equal. Each pump shall deliver 150 GPM at 55 TDH. Pump shall have a 3 phase, 208-volt motor. Pump shall have an integral strainer. Provide spare strainer basket.

2. Motors:

   a. Totally enclosed, fan-cooled (TEFC) or open drip-proof (ODP), with hygroscopic insulation, service factor 1.15, insulation Class F, sized to operate at full load and speed, designed for continuous operation.

   b. Motor starter with current interrupter overload.
   c. Combination motor starters: Hand-off auto switch and positive overload heater coil; as manufactured by Furnas, Square D, or Westinghouse.

   d. Electrical enclosures: NEMA 4x type, suitable for surface mounting.

3. Filter pumps shall be vibration isolated. The pumps shall be mounted on a ¼-inch thick stainless steel plate and neoprene pads shall be placed between the stainless steel plate and the floor. Neoprene pads shall be equivalent to the Mason Industries Type Super W Pads. The pads shall be sized to provide minimum 0.15-inch static deflection under the weight of the pump.

4. All pumps shall be electrically interlocked with the chemical controller and system flow meter.
5.

P. Chemical Treatment Equipment

1. Automatic Analyzer and Chemical Feed Controller: Furnish and install a fully integrated water chemical analyzer and feed controller CAT5000 as manufactured by Hayward, or approved equal. The chemical feed controller shall be equipped with options of filter pump control, flow monitoring, Ethernet/internet, remote control, water level control, chemical control and temperature control.

    a. The chemical controller shall be connected to a dedicated Ethernet cord. The Contractor shall furnish and install all necessary software required to run a monitoring system remotely.

2. Chlorine Feed Systems

    a. The chlorine feed systems shall be a model 85M5 feeder manufactured by Stenner. Chemical feeder shall be electrically interlocked with the filter pump.

    b. A common bulk chlorine tank shall be used to feed chlorine and store chlorine. Tank shall be a Model No ICT-550, 550 Gallon double wall polyethylene tank. Contractor shall coordinate the penetrations into the tank.

    c. The chlorine feed shall be N.S.F. listed.

    d. The chlorine connection outside the building shall be housed by a polyethylene box with a lockable hatch.

Q. pH Feed Systems

1. Unit shall be a single tank regulator CO_2 Metering system and take nominal 800-psi pressure from direct reading pressure gauges. Manufactured by Hayward, or approved equal. Unit shall be tank mountable and shall connect to CO_2 bulk tank by 3/16-inch I.D. braided tubing rated for not less than 1000 psi. Discharge from unit shall be through thick wall 3/8-inch OD polyethylene tubing to the feed unit.

2. CO_2 from the pressure-reducing valve shall be brought to the feed unit in thick wall 3/8-inch OD polyethylene tubing. Feed system shall include 120 volt AC solenoid operated valve for remote on/off control of CO_2 feed. CO_2 feed unit shall also include rate adjusting flow meter scaled from 0-30 SCFH and have a pressure rating of 100 psi.

3. CO_2 from feed unit shall be injected through ½-inch NPT fitting. Unit shall cause CO_2 to be totally diffused and made to go fully into solution without evidence of CO_2 bubbling at any point where water is open to atmosphere.

Unit must be equipped with a check valve to prevent the flow of water into the feed unit.

4. CO_2 bulk storage tank shall be 750 lbs with a pressure regulator and epoxy coating. Shall be Model No. Carbo-mizer 750, manufactured by Lincoln Aquatics or approved equal.

5. CO2 tank shall be provided with an exterior fill station with an enclosure. The fill station shall be supplied in conjunction with the tank system.

R. Eyewash

1. Provide eyewash Model No. 7500 by Hawes or approved equal.

2. Eyewash shall be wall mounted in the filter room.

S. Fill System Drain

1. Make-up water shall be suctioned from the Arlington Reservoir through a main drain grate 39-518, as manufactured by Lincoln Aquatics, or approved equal. The main drain grate shall be a 12-in by 12-in square grate that complies with ANSI/APSP 16-2011 and NSF 50-2008 unblockable requirements.

2.02 VARIABLE FREQUENCY DRIVES (VFDs)

A. VFD will be installed with each filter pump installed in this project. Each VFD shall match the horsepower of the pump motor, voltage, and phase. The pump shall have factory installed disconnects and bypass variable frequency drive for motor protection and thermal overload protection, voltage and surge limitation, integrated hand / off / auto switch with manual bypass.

1. VFD shall have a factory installed digital display screen. Display screen shall display the motor operating parameters (HZ, Volts, and amps).

2. VFD enclosure shall be a NEMA 4x enclosure, frame sized to horse power.

3. VFD shall be manufactured by Schneider Electric or approved equal.

2.03 PIPING

A. Valves and Piping

1. Piping: All materials and equipment shall be new, of best quality for the purpose intended, and shall be clearly marked with the manufacturer's name and nameplate, date, or stamp and rating. As far as practicable, materials and equipment shall be one manufacturer.

2. Polyvinyl Chloride Pipe and Fittings

    a. Provide Class 12454 B polyvinyl chloride pipe for all pipes used for distributing chemical solutions. All pipes shall be Schedule 80.

    b. Provide solvent weld type fittings for all chemical solutions distribution systems except for the lime solution system. A heavy duty industrial grade PVC solvent cement shall be used.

    c. CPVC Schedule 80: Type 1, normal impact, NSF approved for solvent welding applications, for exposed piping. CPVC piping shall be used for the heating loop from the supply filtered effluent line to the heat exchanger and the heated effluent return from the heat exchanger back to the filtered effluent line.

3. Flexible connectors:

    a. All connections between the chemical proportional feed pumps and the rigid PVC pipe shall be of flexible plastic hose.

    b. The hose shall consist of polyester braided reinforced tubing with a minimum rating of 150 psi.

    c. All materials, hardware components, and accessories shall be corrosion resistant. They shall be 316 stainless steel, fiberglass, high density resin, or PVC.

4. Cement: ASTM D2564.

5. Provide check and ball valves as required by same Hayward.

    a. Gate valves three inch (3-inch) and larger shall be PVC stainless steel mounted non-rising stem. Valves shall have flanged ends and shall be designed for a minimum water working pressure of 150 lbs. per square inch.

    b. Butterfly Valves: Butterfly valves shall be EPDM seated with PVC disc and stainless steel shaft for chlorinated water service. Furnish hand wheel/gear operators on all valves 8-inch and larger and valves indicated as throttle valve service.

c. Check Valves: Provide a corrosion resistant body, EPDM seated wafer type valve with bronze plates and shaft.

d. All valves 3-inch and larger shall be ASAHI EPDM butterfly valves or Hayward industrial PVC valves or approved equal.

e. All valves 3-inch and smaller shall be Spears True Union or approved equal.

6. Valve connections: Suitable for connection of adjoining pipe; of pipe size values.

7. Hangers and supports: Sized to project conditions. Shall be stainless steel, or FRP, installed with stainless steel hardware.

8. All pipes shall be vibration isolated with a ½-inch thick neoprene pad between the strap and the pipe.

9. All valves shall be tagged and numbered with a 2-inch polyethylene identification tag coordinated into the O&M at the conclusion of the project.

10. All piping shall be identified with pipe labeling. Piping shall be marking indicating the direction of flow, and what vessel the filtered water is coming from. Labels shall be polyethylene pipe identification, shall be snap on and secured to the associated piping. Pipe labels shall be manufactured by Seton, or approved equal. Stickers or permanent marker shall be rejected.

2.04 Control and Power Wiring

1. Control wiring shall be a minimum of #10 wire, or per manufacturer's requirements.

2. Control wiring shall be placed in a ¾-inch PVC conduit.

2.05 Backwash Pump & Panel:

1. The backwash pump shall be a 1 HP, Model No. LEH 103M by Liberty or approved equal. Pump shall have a 3 phase, 208-volt motor.

2. Backwash pump panel shall me mounted on the exterior of the building with a beacon on the top, and accept (3) float control panel, SP1-SSC3B240 manufactured by Weil or approved equal. Exterior shall be a NEMA 3R panel.

3. Provide stainless steel rails and lift out cable for easy pump access.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install equipment and system in accordance with manufacturer's instructions and approved shop drawings.

B. Set equipment on secure foundations.

C. Make piping joints in accordance with ASTM D2855.

D. Support overhead piping and at connections to valves, pumps, and equipment.

E. Install electrical components in accordance with NFPA 70.

3.02 FIELD QUALITY CONTROL

A. Water Treatment

1. Submit chemical analysis of source water supply showing:

a. Total alkalinity in PPM.

b. Calcium hardness in PPM.

c. Chlorine in PPM.

d. pH.

e. Iron and Phosphorus.

2. Treat and balance water just prior to Substantial Completion.

a. Establish total alkalinity of 80 to 150 PPM and calcium hardness of 175 to 250 PPM.

b. Balance water to local health code requirements.

c. Contractor shall furnish all balancing chemical and labor to balance and maintain the Reservoir Beach water prior to acceptance by the Board of Health.

3.03 ADJUSTING

A. Adjust filtration system for proper operation through all cycles.

3.04 CLEANING

A. Clean equipment, and related surfaces.

3.05 DEMONSTRATION

A. Demonstrate proper operation and maintenance of filtration system to Owner.

3.06 TESTING

A. All piping shall be pressured tested to 35 psi, for duration of 3 hours. The test shall be witnessed by the Owner, or Owner Representative. If the test fails, the repair must be performed, and a new test shall be performed. Pressure shall be maintained on the piping until the system is commissioned.

3.07 PROTECTION, MANUALS AND INSTRUCTIONS

A. Protection: The Contractor shall use whatever methods are required to protect equipment from deterioration during remainder of the construction period.

B. Manuals and Instructions: Start up, test, and operate the completed system to verify its performance in compliance with Contract Documents, and to meet approval of governing authorities. Coordinate Reservoir Beach-filling schedule with work of other Sections and, after finish work is cured, circulate and treat water until Owner accepts installation.

1. Provide complete operating and maintenance manuals for filtration system and equipment.

2. After approval of submission of manuals, instruct Owner’s personnel in the operation, use and maintenance of the entire installation and each operating element, for a total of 16 hours with selected manufacturers' training representatives. Final acceptance will not be made until training is complete to Owner’s satisfaction.

3. Provide Warning Rules and Regulations sign as required by Federal, State, OSHA, and Local code, and Health Codes.

4. Provide four (4) packages of items above.

5. Contractor shall operate the filtration system until acceptance by the Town and approval by Engineer and the Health Department. This includes cleaning, monitoring and balancing the Reservoir Beach.

END OF SECTION

SECTION 23 48 00

ULTRAVIOLET DISINFECTION

PART 1 – GENERAL

1.01 SUMMARY

A. It is the intent of these specifications that the Arlington Reservoir Beach water be routinely monitored and treated by UV sterilization in the range of 220nm to 400nm to kill bacteria, viruses, molds and their spores and to continuously remove chloramines. The concentration of free chlorine residual shall at all times meet the requirements of the State authority having jurisdiction over the Reservoir Beach.

B. The method of monitoring and treatment specified and shown on the drawings is intended as the basis for receiving bids. It is not the intent of these specifications to limit competition. The base proposal must be on furnishing equipment as specified; however, a bidder may at his option offer a substitution. *The bidder is cautioned that any substitution must meet the quality and operational requirements of these specifications*. Any proposed UV system must have a UL listing on the complete system, and be listed under NSF Standard 50 latest edition including cryptosporidium inactivation. Any substitute system shall have Health Department approval for this project prior to being offered.

C. The UV system offered under these specifications shall have been used for a minimum of ten years in swimming pool applications and the bidder must supply a list of at least ten satisfactory installations with contact names and telephone numbers.

D. Related Sections:

SECTION 13 0 000 – SUMMARY OF WORK FOR FILTRATION SYSTEMS

SECTION 22 51 00 – FILTRATION SYSTEM EQUPMENT

DIVISION 26 – ELECTRICAL

1.02 QUALITY ASSURANCE

A. All equipment supplied under this section shall conform to ANSI/AWWA F110-12, AWWA Standard for Ultraviolet Disinfection Systems for Drinking Water.

B. All material specified under this section shall be provided from the same manufacturer.

1.03 SUBMITTALS

In accordance with requirements of the General Specifications, submit the following:

A. Electronic Submission for manufacturer's literature of the materials of this section shall be submitted to the Engineer and Construction Manager for review.

1.04 DELIVERY, STORAGE AND HANDLING

A. Each container shall bear an unbroken seal, test number and label of the manufacturer upon delivery at the site. Unlabeled materials will be rejected and shall be removed from the site and replaced with approved-labeled materials at no additional cost to the Owner.

B. Deliver materials to site and install work under this Section in ample time to avoid delay in job progress and at such times as to permit proper coordination of the various parts.

C. Store UV system under tarps to protect from oil, dirt and sunlight.

1.05 GUARANTEES

A. The equipment shall be warranted in writing that when operated and maintained according to the manufacturer's operating instructions provided and accepted, it will perform in complete accord with these specifications. All components (excluding the UV arc tube) shall have a limited warranty to be free from defects in workmanship and materials for a period of 12 months from date of Substantial Completion. UV arc tubes shall be warranted to operate for 8000 hours when operated continuously. A continuously operated UV arc tube that fails prior to 8000 hours of operation shall be replaced free of charge. Intermittently operated UV arc tubes (>1 on/off cycle per day) will be replaced free of charge should failure occur prior to 2000 hours and prorated between 2000 and 4000 hours. All warranty replacements shall be FOB point of shipment.

B. Any claims under this warranty must be made on a timely basis, in writing, to the manufacturer.

PART 2 – PRODUCT

2.01 DESIGN CONDITIONS

A. The UV system shall be provided for the following design and operating conditions:

1. Filtration System: 1770 GPM: ECF-340-12V, three phase, 430v power. NEMA 4x Cabinet required.

B. Design UV Dose

1. The system shall be designed to deliver a Reduction Equivalent Dose (RED) of 600 J/m^2 based on the end of lamp lifetime (70% of specified new lamp output according to NSF).
2. Headloss through the UV system shall not exceed 2 psi under design flow conditions.
3. Power consumption of the Filtration UV system shall not exceed 3 kW. Systems not meeting this requirement shall not be acceptable.
4. System shall comprise one (1) duty reactor.

2.2 UV SYSTEM GENERAL:

A. UV systems shall be manufactured by evoQUA or approved equal.
B. The manufacturer shall be qualified and experienced in the supply of similar equipment. Manufacturer shall have at least 5 years of experience in supplying and delivering closed vessel UV systems with medium-pressure UV lamps used for water treatment applications.
C. The manufacturer shall have a minimum of 100 fully operating systems using technology identical in all aspects (i.e., medium-pressure UV lamps) to that being proposed.
D. The ultraviolet disinfection system shall be installed by the contractor and tested and commissioned by the UV manufacturer or its authorized representative as specified in this section. Other medium pressure UV systems for consideration must submit full set of installation drawings, reference list, and certified testing data showing the system meets the minimum requirements of this specification. All material must be submitted 30 days prior to bid. Systems not submitting 30 days prior to bid shall not be considered.

2.3 REACTION CHAMBER:

A. The UV reactor shall be a welded construction, manufactured from 316L stainless steel of a thickness of no less than 2mm. The UV reactor shall be passivated.
B. The UV reactor shall be designed to handle a maximum operating pressure of 150 psi and shall be fully assembled and then hydro tested to 1.5 times the design pressure in the factory prior to shipment.
C. The UV reactor shall have a flow-through design with lamps oriented perpendicular to water flow. U-flow, Z-flow or other flow configurations where system water flow is parallel to the lamp(s) shall not be accepted.
D. The UV reactor shall have end-cap safety switches that automatically switch off the UV lamps to prevent exposure to UV radiation should the end-caps be removed.
E. The UV reactor shall be provided with two (2) cleaning ports.
F. The UV reactor shall be designed such that the operating personnel at the plant can change the lamps without draining the reactor.
G. The UV reactor shall have a temperature sensor to prevent over-temperature events.

2.4 UV LAMPS:

A. Lamps shall be medium-pressure mercury UV lamps. The medium-pressure mercury UV lamps must be provided with ceramic lamp ending for cooling and proper lamp positioning inside the quartz sleeve.
B. The emission of the medium-pressure UV lamps into the water must have a wide range of wavelengths in the range of 200 to 400 nm.
C. The system must incorporate a mechanical switch in which to disable power to the lamps should the chamber be opened while in use. Systems not incorporating such device will not be accepted. For safety purposes for operating personnel, if upon field inspection the referenced switch is not present one shall be installed and supplied at the contractor's expense. If the system is not capable of accepting such a safety device the system shall be replaced at no additional cost to the Owner.
D. Each lamp will be capable of producing a minimum output of effective UV energy in the wavelength range of 200 - 400 nm, following a 100-hour burn-in period. Low-pressure, low-output and low-pressure, high-output UV lamps shall not be permitted due to the increase in quantity of lamps required.
E. The filament shall be significantly rugged to withstand shock and vibration.
F. The lamp bases shall be resistant to UV and ozone.
G. The UV lamps shall be guaranteed for 8,000 hours of operation, prorated after 1,000 hours.
H. The lamp output shall not fluctuate at all due to water temperature variations.
I. Lamps must be powered by chokes. Electronic ballasts are not acceptable since they limit the distance between the chamber and the power supply to 13 feet to operate effectively and must be replaces every two – three years.

2.5 QUARTZ SLEEVES

A. Each UV lamp assembly shall consist of a UV lamp enclosed in an individual quartz sleeve, with both ends appropriately sealed using an O-ring with sealing screw.
B. The UV lamp sleeve shall be a single piece of cleat used quartz circular tubing open at both ends.
C. The quartz sleeve shall be rated for an initial minimum UV transmittance (254 nm, 1 mm) of 86%.
D. The electrical connections to the lamp assembly shall be made at both sides of the lamps with a single wire connection in an easy to operate plug-in terminal.
E. The lamp assembly shall allow all of the following to be easily achieved by an operator for maintenance purposes: (a) Access to the lamp connections without removing or disconnecting any cables and without the use of special tools. (b) Disconnection of lamp power cable only, without removing the UV lamp or the lamp assembly from the reactor. (c) Easy lamp positioning due combined cooling and centering ceramics on the lamp.

2.6 UV INTENSITY SENSOR

A. The UV intensity sensor shall be selective only to the electromagnetic spectrum specific to UV light (200-400 nm). UV light outside the 200-400 nm range shall not be measured. The sensor shall be designed with an accuracy of ± 5%.
B. The measured intensity shall be displayed on the operator interface (HPC-II) as an absolute value in W/m².
C. The UV intensity sensor connection must be realized with a two (2) wire 4 - 20 mA connection with watertight connector on top of the sensor housing.
D. The UV sensor must be absolute calibrated by the producer. UV sensors or sensor signal display modules that require recalibration after installation (a) new UV lamp(s) (after 100 burn in hours) are not acceptable. UV sensors of which the output signal or display system UV intensity can be "field calibrated" are not acceptable. The UV intensity display must be able to provide a read-out in absolute units being "W/m²".

2.7 UV STRAINER

A. The UV system must be provided with a downstream strainer to protect against the remote possibility of lamp /quartz breakage traveling downstream.
B. The strainer must be cleanable without removal from the piping system.
C. The strainer must be operable either manually, electrically or pneumatically to clean it.
D. The electrical or pneumatic operation must be able to be integrated with the filtration control system and/or the UV control system

2.8 CONTROL PANEL

A. The control panel shall house all power distribution and control hardware.
B. The control panel shall be designed to operate with power feed as required.
C. The control panel enclosure shall be painted sheet steel NEMA 12 rated for indoor installation.
D. The control panel enclosure shall be located in an ambient temperature-controlled environment where the maximum temperature does not exceed 104° F (40° C).
E. The control panel must be cooled by an independent forced-ventilation system and the air in- and outlet openings must be protected by dust filters.
F. The temperature inside the control panel must be monitored by a built-in temperature sensitive device.
G. The cable length distance between the control panel and the UV reaction chamber shall be 33 feet.
H. The control panel must include a GFI device with a sensitivity of 30 mA for personal and system protection.
I. Local over-current protection shall be provided by the contractor.

2.9 CONTROL AND INSTRUMENTATION

A. Lamp Power Control and UV Intensity Pacing shall be included as standard.
B. The UV intensity shall be continuously monitored. As the intensity varies with lamp age, water quality or fouling of the quartz sleeve, the lamp power shall be automatically adjusted to maintain sufficient, microbiological safe operation in the most economical way.
C. All control hardware and software shall be contained within the control panel.
D. The unit shall be furnished with two temperature high limit switches. One shall monitor water temperature inside the reactor with visual alarm on high limit temperature. The second shall monitor the reactor chamber wall temperature and shall shut off the unit should temperature exceed high limit settings by manufacturer.
E. The UV system shall be monitored and controlled by UV controller included with the system.

2.10 OPERATOR INTERFACE

A. The operator interface unit shall be integral with the controller.
B. The unit shall be menu driven and shall display the following system information when prompted:

1. UV lamp operating hours per power level and per lamp (if more than one (1) lamp is used)
2. UV intensity in W/m^2 or %
3. Flow in USGPM (measured by an external online flowmeter provided by others)
4. UV lamp ON/OFF switching
5. Water temperature in °F or °C
6. Average Calculated Dose in mj/cm2

2.11 CLEANING SYSTEM

A. Each UV system must have an automatically operated mechanical cleaning system for the quartz sleeve(s).
B. The automatically operated cleaning mechanism must have one (1) special UV resistant Viton rubber cleaning ring mounted in a Teflon cleaning ring holder per quartz sleeve. The cleaning ring holder must be mounted in a stainless steel plate which is connected to the rod or axis that operates the cleaning action. Only one (1) cleaning ring per quartz sleeve may be used; systems with more cleaning rings per quartz sleeve will have a disturbed hydraulic pattern inside the reaction chamber and shall not be acceptable.
C. The automatic cleaning system shall monitor wiper position by measuring revolutions of the wiper shaft position. Systems utilizing limit switches shall not be acceptable.
D. Each UV reaction chamber shall be provided with the necessary connections to

connect a chemical cleaning system. Systems that do not include chemical cleaning connections on the treatment chamber shall not be acceptable.

E. During the duration of a cleaning action no UV alarm or warning signal shall be activated if the cleaning mechanism passed the UV sensor position. Chemical cleaning must be done when the system is passed to prevent the chemicals from entering the Reservoir Beach.

2.12 SPARE PARTS

A. The following spare parts and safety equipment shall be supplied, per unit:

1. One (1) complete set of replacement lamps.
2. One (1) Quartz sleeves including O-rings.
3. One (1) complete set of replacement Viton wiper rings.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Installation of the equipment shall be in accordance with the contract drawings, manufacturer's engineering drawings, and instructions.

3.02 SUPPLIER'S SERVICES

A. The start-up technician shall certify to the Engineer that all equipment is properly installed, and that the plant operators have been instructed on proper operation and maintenance procedures.

B. Field services by the UV manufacturer or its authorized representative shall consist of the following:

1. Installation supervision: One (1) full day (8 hours) on site (1 trip)
2. Start-up, field testing and operator training: One (1) full day (8 Hours) on site (1 trip)

END OF SECTION

SECTION 26 00 50

ELECTRICAL WORK - GENERAL PROVISIONS

PART 1 - GENERAL

1.01 WORK INCLUDED:

A. The Contractor shall furnish all labor, materials, equipment and incidentals required to make ready for use the complete electrical systems as shown on the Drawings and as specified hereinafter.

B. In conjunction with other sections of Division 26, the work shall include but not be limited to furnishing and installing the following:

1. Primary and Secondary Services
2. Transformers
3. Lighting Fixtures
4. Disconnect switches
5. Grounding System
6. Handholes
7. Bonding materials
8. Cabinets
9. Panelboards
10. Raceways
11. Feeder and Branch Circuit Conductors
12. Hangers and Supports
13. Solderless Lugs and Connectors

14. Conduit and wire for equipment and controls furnished under other divisions of the specifications, when shown on the electrical plans.

C. Make all necessary connections at "packaged" equipment furnished under other sections and Divisions of these specifications.

D. Make all connections to equipment and devices furnished under Division 26 and other sections of these specifications except as otherwise specified.

E. Connect process and instrumentation cables furnished with field-mounted equipment under other sections and Divisions of these specifications.

F. It is the intent of these specifications that the electrical system shall be suitable in every way for the service required. All material and all work which may be reasonably implied as being incidental to the work of this section shall be furnished at no extra cost to the Owner.

1.02 RELATED WORK:

A. The Contractor's attention is directed to the General Conditions, Supplementary Conditions.

B. Excavation and backfilling required for underground electrical work is included under Division 2.

C. Concrete work and reinforcing for electrical equipment pads are included under Division 3.

1.03 CODES, INSPECTIONS, PERMITS AND FEES:

A. All material and installations shall be in accordance with the latest edition of the Massachusetts Electrical Code (527 CMR 12.00) and all applicable local codes and ordinances.

B. Obtain all necessary permits and pay all fees for permits and inspections.

1.04 INTERPRETATION OF DRAWINGS:

A. The Drawings are not intended to show exact locations of conduit runs.

B. Each three-phase circuit shall be run in a separate conduit unless otherwise shown on the Drawings.

C. Unless otherwise noted and/or approved by the Engineer all conduits shall be installed exposed.

D. Where circuits are shown as "home-runs" all necessary fittings and boxes shall be provided for a complete raceway installation.

E. Any work installed contrary to or without review by the Engineer shall be subject to change as required by the Engineer, and no extra compensation will be allowed for making these changes.

F. The locations of equipment, shown on the drawings are approximate only. Exact locations shall be as determined by the Engineer during construction. Obtain in the field all information relevant to the placing of electrical work and in case of any interference with other work, proceed as required by the Engineer and furnish all labor and materials necessary to complete the work in an acceptable manner.

G. Circuit layouts are not intended to show the number of fittings, or other installation details. Furnish all labor and materials necessary to install and place in satisfactory operation all power, lighting and other electrical systems shown. Additional circuits shall be installed wherever needed to conform to the specific requirements of the equipment.

H. All connections to equipment shall be made as required and in accordance with the approved shop and setting drawings.

1.05 SUBMITTALS:

In accordance with requirements of general specifications, submit the following:

A. Complete shop drawings shall be submitted for but not limited to the following equipment: panelboards, service cabinets, load centers, conduit and wire.

B. The manufacturer's name, product designation or catalog number, descriptive literature and data shall be submitted for the following material and equipment:

1. Conduit
2. Boxes and fittings
3. Wires, cables and appurtenances
4. Service cabinets
5. Wiring devices and appurtenances
6. Circuit breakers
7. Panelboards
8. Grounding Equipment

9. Control devices and stations

C. Prior to submittal, all shop drawings shall be checked for accuracy and conformance to contract requirements. Shop drawings shall bear the date checked and shall be accompanied by a statement that the shop drawings have been examined for conformity to the specifications and drawings. This statement shall also list all discrepancies with the specifications and drawings. Shop drawings not so checked and noted shall be returned.

D. The Engineer's review shall be only for conformance with the design concept of the project and compliance with the specifications and drawings. The responsibility of, and the necessity of, furnishing materials and workmanship required by the specifications and drawings which may not be indicated on the shop drawings is included under the work of this section.

E. The responsibility for all dimensions to be confirmed and correlated at the job site and for coordination of this work with the work of all other trades is also included under the work of this section.

1.06 MANUFACTURER'S SERVICES:

Furnish manufacturer's services for testing and start-up when required.

1.07 ELECTRIC SERVICES:

A. The electric utility serving this project is Eversource.

B. Service to building will be as shown on the drawings.

C. The electric utility will furnish and install the primary cables, transformer, and meter.

D. Make all arrangements with the electric utility for obtaining services and pay all fees and charges by the electric utility for the service installation.

E. All work and material for the service shall be in accordance with the requirements of the electric utility.

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PART 2 - PRODUCTS

2.01 MATERIALS:

A. The materials used in all systems shall be new, unused and as hereinafter specified. All materials, where not specified, shall be of the very best of their respective kinds. Samples of materials or manufacturer's specifications shall be submitted for review as required by the Engineer.

B. Materials and equipment used shall be Underwriters' Laboratories, Inc. listed.

C. Electrical equipment shall at all times during construction be adequately protected against mechanical injury or damage by water. Electrical equipment shall not be stored out-of- doors. Electrical equipment shall be stored in dry permanent shelters. If any apparatus has been damaged, such damage shall be repaired at no additional cost. If any apparatus has been subject to possible injury by water, it shall be thoroughly dried out and put through such special tests as required by the Engineer or shall be replaced at no additional cost to the Owner.

D. The Contractor's attention is directed to the requirements of the various sections of division 26 for additional product specifications.

2.02 MANUFACTURER'S NAMEPLATES:

A. All equipment shall have the manufacturer's name, address, model or type designation, serial number and all applicable ratings clearly marked thereon in a location which can be readily observed after installation. The required information may be die-stamped into the surface of the equipment or may be marked on durable nameplates permanently fastened to the equipment.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Provide and place all sleeves for conduit penetrations through floors, walls, partitions, etc. Locate all necessary slots and inserts for electrical work and place in form before concrete is poured.

B. Equipment shall be kept upright at all times. When equipment has to be tilted for ease of passage through restricted areas during transportation, the manufacturer shall be required to brace the equipment suitably, to ensure that the tilting does not impair the functional integrity of the equipment.

3.02 RECORD DRAWINGS:

As the work progresses, legibly record (red line) all field changes on a set of project contract drawings. Prior to Substantial Completion of the project, submit the red lined prints to the Engineer for use in preparation of the record drawings.

3.03 TESTS AND ADJUSTMENTS:

A. Test all systems furnished under Division 26 and repair or replace all defective work. Make all necessary adjustments to the systems and equipment and instruct the Owner's personnel in the proper operation of the systems and equipment.

END OF SECTION

SECTION 26 00 61

ELECTRICAL BONDING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. All of the Contract Documents, including General and Supplementary Conditions and Division 1, General Requirements, are hereby made a part of the work of this Section. Where paragraphs of this Section conflict with Division 1, the more stringent requirements shall govern.

B. All work shall comply with all federal, state and local codes and any other authorities having jurisdiction including any special requirements of the Owner or Architect.

C. Furnish all labor, materials, and equipment necessary to complete all work as shown on drawings and specified. This work is to include but not limited to the following: furnish and install splash pad bonding grid, wire and bonding to splash pad equipment as indicated on contract drawings.

1.02 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 1 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

B. Additional division 26 sections as applicable.

C. Reference Drawings: The Work of this Section is shown on the Contract Drawings.

1.03 REFERENCES

A. All work shall conform to the 2017 (NEC) National Electrical Code, Massachusetts Electric Code, and all Federal, State and Local Codes as applicable.

B. NEC Article 680 Swimming Pools, Fountains, and Similar Installations applies to

this work.

C. All products shall be UL listed.

1.04 QUALITY ASSURANCE

A. Demonstrate the correct operation of all installed equipment and circuits to the satisfaction and requirements of the engineer.

PART 2-PRODUCTS

2.01 WIRE

A. Aluminum conductors shall not be used.

B. Single conductors shall be bare copper.

2.02 SPLICES

A. Where splices are required, provide using one of the two following methods:

B. Compression connectors of approved pattern

C. Exothermic welded connections.

D. Provide approved manufacturers watertight splice kits to insulate all splices.

2.03 IDENTIFICATION

A. Underground buried electric wire marking tape shall be heavy-duty 0.0045", metal detection tape, 2" wide supplied in continuous lengths up to 1000'. Tape shall have red with black lettering, continuously duplicated, wording equal to "CAUTION BURIED ELECTRIC LINE BELOW".

PART 3 - EXECUTION

3.01 COORDINATION

A. Coordinate for connection of all reinforcing steel and splash pad equipment bonds before surface is applied.

B. Coordinate installation of splash pad bonding at beginning of project. Electrician

must be present to perform his work before concrete is applied.

3.02 UNDERGROUND WIRES OUTSIDE OF PAD PERIMETER

A. Provide red marking tape buried 6" to 10" below surface indicating any buried bond wires below that extend beyond me perimeter of the pad.

3.03 INSTALLATION

A. Furnish and install any Code required ground rods.

B. Contractor to provide #8 CU bond wire for pad steel, any metal drains, splash pad equipment and all other metallic components within 5’-0” as prescribed in NEC article 680.

C. Provide and install 600volt bonding conductors throughout the bonding system with connection to each item of equipment, etc. No conductors shall be exposed above the deck.

D. Bonding conductors shall be continuous, where ever possible.

E. Insulate any splices with approved insulation kit and makeup water tight to protect from corrosion and maintain the integrity of the splice.

END OF SECTION

SECTION 26 05 19

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Copper wire rated 600 V or less.
2. Connectors, splices, and terminations rated 600 V and less.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.03 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

PART 2 - PRODUCTS

2.01 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. Alpha Wire Company.
2. American Bare Conductor.
3. Belden Inc.
4. Okonite Company (The).
5. Southwire Company.

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 B 3 for bare annealed copper and with ASTM B 8 for stranded conductors.

E. Conductor Insulation:

1. Type RHH and Type RHW-2: Comply with UL 44.
2. Type THHN and Type THWN-2: Comply with UL 83.
3. Type XHHW-2: Comply with UL 44.

2.02 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, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. 3M Electrical Products.
2. AFC Cable Systems; a part of Atkore International.
3. Hubbell Power Systems, Inc.
4. O-Z/Gedney; a brand of Emerson Industrial Automation.
5. Thomas & Betts Corporation; A Member of the ABB Group.

C. Jacketed Cable Connectors: For steel and aluminum jacketed cables, zinc die-cast 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

3.01 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.

3.02 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Service Entrance: Type XHHW, USE single conductors in raceway.

B. Exposed Feeders: Type THHN-THWN, single conductors in raceway

C. Exposed Branch Circuit: Type THHN-THWN, single conductors in raceway.

D. Underground Feeders and Branch Circuits: Type UF multiconductor cable.

3.03 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 26 05 33 "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.

3.04 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 un-spliced conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 12-inches of slack.

3.05 IDENTIFICATION

A. Identify and color-code conductors and cables.

B. Identify each spare conductor at each end with identity number and location of other end of conductor and identify as spare conductor.

3.06 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies.

END OF SECTION

SECTION 26 05 26

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes grounding and bonding systems and equipment.

B. Section includes grounding and bonding systems and equipment, plus the following special applications:

1. Underground distribution grounding.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.03 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans showing dimensioned as-built locations of grounding features specified in "Field Quality Control" Article.

B. Qualification Data: For testing agency and testing agency's field supervisor.

C. Field quality-control reports

1.04 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1. Plans showing as-built, dimensioned locations of grounding features specified in "Field Quality Control" Article, including the following:
   a. Ground rods.
   b. Grounding arrangements and connections for separately derived systems.

2. Instructions for periodic testing and inspection of grounding features at grounding connections for separately derived systems based on NETA MTS.

a. Tests shall determine if ground-resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if values do not.
b. Include recommended testing intervals.

1.05 QUALITY ASSURANCE

A. Testing Agency Qualifications: Certified by NETA.

PART 2 - PRODUCTS

2.01 SYSTEM DESCRIPTION

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. Comply with UL 467 for grounding and bonding materials and equipment.

2.02 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Burndy; Part of Hubbell Electrical Systems.
2. ERICO International Corporation.
3. Harger Lightning & Grounding.
4. O-Z/Gedney; a brand of Emerson Industrial Automation.
5. SIEMENS Industry, Inc.; Energy Management Division.
6. Thomas & Betts Corporation; A Member of the ABB Group.

2.03 CONDUCTORS

A. Retain "Insulated Conductors" Paragraph below to require one of two preferred conductor materials permitted by NFPA 70; delete to allow Contractor to use any material that complies with Code. See "Grounding Products" Article in the Evaluations for discussion on alternative materials.

B. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

C. Bare Copper Conductors:

1. Solid Conductors: ASTM B 3.
2. Stranded Conductors: ASTM B 8.
3. Tinned Conductors: ASTM B 33.
4. Bonding Cable: 28 kc mil, 14 strands of No. 17 AWG conductor, ¼-inch in diameter.
5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/-inches wide and 1/16-inch thick.

D. Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 by 4-inches in cross section, with 9/32-inchholes spaced 1-1/8-inches apart.

2.04 CONNECTORS

A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.

B. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

C. Bus-Bar Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

D. Beam Clamps: Mechanical type, terminal, ground wire access from four directions, with dual, tin-plated or silicon bronze bolts.

E. Cable-to-Cable Connectors: Compression type, copper or copper alloy.

F. Conduit Hubs: Mechanical type, terminal with threaded hub.

G. Ground Rod Clamps: Mechanical type, copper or copper alloy, terminal with hex head bolt.

H. Service Post Connectors: Mechanical type, bronze alloy terminal, in short- and long-stud lengths, capable of single and double conductor connections.

I. Signal Reference Grid Clamp: Mechanical type, stamped-steel terminal with hex head screw.

J. Straps: Solid copper, copper lugs. Rated for 600 A.

PART 3 - EXECUTION

3.01 APPLICATIONS

A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.

B. Underground Grounding Conductors: Install bare copper conductor.

1. Bury at least 24-inches below grade.

C. Grounding Bus: Install in electrical equipment enclosure and elsewhere as indicated.

1. Install bus horizontally, on insulated spacers 2-inches minimum from wall, 6-inches above finished floor unless otherwise indicated.
2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down; connect to horizontal bus.

D. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground Connections: Welded connectors except as otherwise indicated.

3.02 GROUNDING AT THE SERVICE

A. Equipment grounding conductors and grounding electrode conductors shall be connected to the ground bus. Install a main bonding jumper between the neutral and ground buses.

3.03 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:

1. Feeders and branch circuits.
2. Lighting circuits.
3. Receptacle circuits.

3.04 INSTALLATION

C. 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.

D. 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 bonding so vibration is not transmitted to rigidly mounted equipment.
3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.

3.05 FIELD QUALITY CONTROL

A. "Perform tests and inspections" Paragraph below to require Contractor to perform tests and inspections.

B. Tests and Inspections:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
3. Test completed grounding system at service disconnect enclosure grounding terminal. Make tests at ground rods before any conductors are connected.

    a. Measure ground resistance no fewer 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.

4. Prepare dimensioned Drawings locating each test well, ground rod and ground-rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location and

include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

C. Grounding system will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

E. Report measured ground resistances that exceed the following values:

1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10ohms.

F. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Engineer promptly and include recommendations to reduce ground resistance.

END OF SECTION

SECTION 26 05 33

RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal conduits and fittings.
2. Nonmetallic conduits and fittings.
3. Metal wireways and auxiliary gutters.
4. Nonmetal wireways and auxiliary gutters.
5. Surface raceways.
6. Boxes, enclosures, and cabinets.
7. Handholes and boxes for exterior underground cabling.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.

PART 2 - PRODUCTS

2.1 METAL CONDUITS AND FITTINGS

A. Metal Conduit:

1. 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:

a. AFC Cable Systems; a part of Atkore International.
b. Allied Tube & Conduit; a part of Atkore International.
c. Anamet Electrical, Inc.
d. Opti-Com Manufacturing Network, Inc (OMNI).
e. O-Z/Gedney; a brand of Emerson Industrial Automation.

2. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

3. GRC: Comply with ANSI C80.1 and UL 6.
4. ARC: Comply with ANSI C80.5 and UL 6A.
5. IMC: Comply with ANSI C80.6 and UL 1242.
6. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.

    a. Comply with NEMA RN 1.
    b. Coating Thickness: 0.040-inch, minimum.

7. EMT: Comply with ANSI C80.3 and UL 797.
8. FMC: Comply with UL 1; zinc-coated steel or aluminum.
9. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.

B. Metal Fittings: Comply with NEMA FB 1 and UL 514B.

1. 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:

    a. AFC Cable Systems; a part of Atkore International.
    b. Allied Tube & Conduit; a part of Atkore International.
    c. Anamet Electrical, Inc.
    d. FSR Inc.
    e. O-Z/Gedney; a brand of Emerson Industrial Automation.

2. Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

3. Fittings, General: Listed and labeled for type of conduit, location, and use.
4. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 1203 and NFPA 70.
5. Fittings for EMT:

    a. Material: Steel.
    b. Type: Setscrew.

6. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.
7. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040-inch, with overlapping sleeves protecting threaded joints.

C. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 NONMETALLIC CONDUITS AND FITTINGS

A. Nonmetallic Conduit:

1. 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:

    a. AFC Cable Systems; a part of Atkore International.
    b. Anamet Electrical, Inc.
    c. FRE Composites.
    d. RACO; Hubbell.
    e. Thomas & Betts Corporation; A Member of the ABB Group.

B. Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1. ENT: Comply with NEMA TC 13 and UL 1653.
2. RNC: Type EPC-40-PVC, or type EPC-80-PVC as noted complying with NEMA TC 2 and UL 651 unless otherwise indicated.
3. LFNC: Comply with UL 1660.

C. Nonmetallic Fittings:

1. 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:

    a. AFC Cable Systems; a part of Atkore International.
    b. Anamet Electrical, Inc.
    c. Arnco Corporation.
    d. FRE Composites.
    e. RACO; Hubbell.

2. Fittings, General: Listed and labeled for type of conduit, location, and use.

3. Fittings for ENT and RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.
4. Fittings for LFNC: Comply with UL 514B.
5. Solvents and Adhesives: As recommended by conduit manufacturer.

2.3 METAL WIREWAYS AND AUXILIARY GUTTERS

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. B-line, an Eaton business.
2. Hoffman; a brand of Pentair Equipment Protection.
3. MonoSystems, Inc.
4. Square D.

B. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1 unless otherwise indicated, and sized according to NFPA 70.

1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

2.4 BOXES, ENCLOSURES, AND CABINETS

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. Crouse-Hinds, an Eaton business.
2. Erickson Electrical Equipment Company.
3. Hoffman; a brand of Pentair Equipment Protection.
4. Hubbell Incorporated.

B. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.

C. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

D. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, aluminum, Type FD, with gasketed cover.

E. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.

F. Metal Floor Boxes:

1. Material: Cast metal.

2. Type: Fully adjustable.
3. Shape: Rectangular.
4. Listing and Labeling: Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

G. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb. Outlet boxes designed for attachment of luminaires weighing more than 50 lb shall be listed and marked for the maximum allowable weight.

H. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

I. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum with gasketed cover.

J. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

K. Device Box Dimensions: as required for the use.

L. Gangable boxes are prohibited.

M. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 1 with continuous-hinge cover with flush latch unless otherwise indicated.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
2. Nonmetallic Enclosures: Plastic.
3. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.

N. Cabinets:

1. NEMA 250, Type 1 or Type 3R 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.
6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.5 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

A. General Requirements for Handholes and Boxes:

1. Boxes and handholes for use in underground systems shall be designed and identified as defined in NFPA 70, for intended location and application.
2. Boxes installed in wet areas shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel, fiberglass, or a combination of the two.

1. 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:

    a. Armorcast Products Company.
    b. NewBasis.
    c. Oldcastle Enclosure Solutions.
    d. Oldcastle Precast, Inc.
    e. Quazite: Hubbell Power Systems, Inc.

2. Standard: Comply with SCTE 77.
3. Configuration: Designed for flush burial with closed bottom unless otherwise indicated.
4. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
5. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
6. Cover Legend: Molded lettering, "ELECTRIC." or per appropriate system.
7. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.

C. Fiberglass Handholes and Boxes: Molded of fiberglass-reinforced polyester resin, with frame and covers of hot-dip galvanized-steel diamond plate.

1. 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:

    a. Armorcast Products Company.
    b. NewBasis.
    c. Nordic Fiberglass, Inc.
    d. Oldcastle Precast, Inc.
    e. Quazite: Hubbell Power Systems, Inc.

2. Standard: Comply with SCTE 77.
3. Configuration: Designed for flush burial with closed bottom unless otherwise indicated.

4. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
5. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
6. Cover Legend: Molded lettering, "ELECTRIC." or per appropriate system.
7. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed Conduit: GRC.
2. Concealed Conduit, Aboveground: GRC.
3. Underground Conduit: RNC, Type EPC-40-PVC, direct buried or concrete encased as indicated on plans.
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 3R.

B. Indoors: Apply raceway products as specified below unless otherwise indicated. All raceways shall be installed exposed on wall and ceilings.

1. Exposed, Not Subject to Physical Damage: RNC.
2. Exposed, Not Subject to Severe Physical Damage: RNC.
3. Exposed and Subject to Severe Physical Damage: GRC.

4. Concealed in Ceilings and Interior Walls and Partitions: RNC.
5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
6. Damp or Wet Locations: RNC.
7. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 in damp or wet locations.

C. Minimum Raceway Size: 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. Comply with NEMA FB 2.10.
2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating

after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.

3. EMT: Use setscrew, steel fittings. Comply with NEMA FB 2.10.
4. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

E. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.

F. Install surface raceways only where indicated on Drawings.

G. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F.

3.2 INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.

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. Arrange stub-ups so curved portions of bends are not visible above finished slab.

D. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12-inches of changes in direction.

E. Support conduit within 12-inches of enclosures to which attached.

F. 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. Secure raceways to reinforcement at maximum 10-foot intervals.
2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
3. Arrange raceways to keep a minimum of 2-inches of concrete cover in all directions.
4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.
5. Change from ENT to GRC before rising above floor.

G. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

H. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.

I. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.

J. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch trade size and insulated throat metal bushings on 1-1/2-inch trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.

K. 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. Cap underground raceways designated as spare above grade alongside raceways in use.

L. Surface Raceways:

1. Install surface raceway with a minimum 2-inch radius control at bend points.

M. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces.

N. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where an underground service raceway enters a building or structure.
3. Where otherwise required by NFPA 70.

O. Expansion-Joint Fittings:

1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F and that has straight-run length that exceeds 25 feet.
2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:

a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F temperature change.
b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.
c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F temperature change.

3. Install fitting(s) that provide expansion and contraction for at least 0.00041-inch per foot of length of straight run per degree F of temperature change for PVC conduits.
4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

P. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72-inches of flexible conduit for recessed and semi-recessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

1. Use LFMC in damp or wet locations subject to severe physical damage.
2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.

Q. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.

R. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

S. Locate boxes so that cover or plate will not span different building finishes.

T. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

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 Section 31 20 00 "Earth Moving" for pipe less than 6-inches in nominal diameter.
2. Install backfill as specified in Section 31 20 00 "Earth Moving."

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 Section 31 20 00 "Earth Moving."
4. Install manufactured duct elbows for stub-up at poles and equipment and at building entrances through floor unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.
5. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through floor.

    a. Couple steel conduits to ducts with adapters designed for this purpose and encase coupling with 3-inches of concrete for a minimum of 12-inches on each side of the coupling.
    b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of 60-inches from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.

3.4 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.

B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.

C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1-inch above finished grade.

D. Install handholes with bottom below frost line.

E. Field-cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.5 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies.

3.6 PROTECTION

A. Protect coatings, finishes, and cabinets from damage and deterioration.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION

SECTION 26 24 16

PANELBOARDS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Lighting and appliance branch-circuit panelboards.

1.02 DEFINITIONS

A. MCCB: Molded-case circuit breaker.

B. SPD: Surge protective device.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of panelboard.

B. Shop Drawings: For each panelboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details.
2. Detail enclosure types including mounting and anchorage, environmental protection, knockouts, corner treatments, covers and doors, gaskets, hinges, and locks.
3. Detail bus configuration, current, and voltage ratings.
4. Short-circuit current rating of panelboards and overcurrent protective devices.
5. Include evidence of NRTL listing for SPD as installed in panelboard.
6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
7. Include wiring diagrams for power, signal, and control wiring.

1.04 INFORMATIONAL SUBMITTALS

A. Panelboard schedules for installation in panelboards.

1.05 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.06 FIELD CONDITIONS

A. Service Conditions: NEMA PB 1, usual service conditions, as follows:

1. Ambient temperatures within limits specified.
2. Altitude not exceeding 6600 feet.

1.07 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

2.01 PANELBOARDS COMMON REQUIREMENTS

A. Fabricate and test panelboards according to IEEE 344 to withstand seismic forces.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with NEMA PB 1.

D. Comply with NFPA 70.

E. Enclosures: Surface -mounted, dead-front cabinets.

1. Rated for environmental conditions at installed location.

a. Indoor Dry and Clean Locations: NEMA 250, Type 3R.
b. Outdoor Locations: NEMA 250, Type 3R.

2. Height: 84-inches maximum.

3. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box. Trims shall cover all live parts and shall have no exposed hardware.
4. 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.

F. Incoming Mains Location: Top or Bottom.

G. Phase, Neutral, and Ground Buses: Hard-drawn copper, 98 percent conductivity.

H. Conductor Connectors: Suitable for use with conductor material and sizes.

1. Material: Hard-drawn copper, 98 percent conductivity.
2. Main and Neutral Lugs: Mechanical type, with a lug on the neutral bar for each pole in the panelboard.
3. Ground Lugs and Bus-Configured Terminators: Mechanical type, with a lug on the bar for each pole in the panelboard.

I. Future Devices: Panelboards shall have mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

J. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals. Assembly listed by an NRTL for 100 percent interrupting capacity.

2.02 PERFORMANCE REQUIREMENTS

A. Retain "Seismic Performance" Paragraph for projects requiring seismic design. Model building codes and ASCE/SEI 7 establish criteria for buildings subject to earthquake motions. Verify requirements of authorities having jurisdiction.

B. Seismic Performance: Panelboards shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

C. Surge Suppression: Factory installed as an integral part of indicated panelboards, complying with UL 1449 SPD Type 2.

2.03 POWER PANELBOARDS

D. Power panelboards, as specified in this article, fall under requirements of "Distribution Panelboards" in NEMA PB 1.

E. 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. Eaton.
2. General Electric Company; GE Energy Management - Electrical Distribution.
3. Square D; by Schneider Electric.

F. Panelboards: NEMA PB 1, distribution type.

G. Doors: Secured with vault-type latch with tumbler lock; keyed alike.

1. For doors more than 36-inches high, provide two latches, keyed alike.

H. Mains: Circuit breaker.

I. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes 125 A and Smaller: Plug-in circuit breakers or Bolt-on circuit breakers.

J. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes Larger than 125 A: Bolt-on circuit breakers.

2.04 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Panelboards, as specified in this article, comply with requirements of "Lighting and Appliance Branch-Circuit Panelboards" in NEMA PB 1.

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. Eaton.
2. General Electric Company; GE Energy Management - Electrical Distribution.
3. SIEMENS Industry, Inc.; Energy Management Division.
4. Square D; by Schneider Electric.

C. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

D. Mains: Circuit breaker.

E. Branch Overcurrent Protective Devices: Plug-in or Bolt-on circuit breakers, replaceable without disturbing adjacent units.

F. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

2.05 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

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. Eaton.
2. General Electric Company; GE Energy Management - Electrical Distribution.
3. SIEMENS Industry, Inc.; Energy Management Division.
4. Square D; by Schneider Electric.

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.

2.06 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: Directory card inside panelboard door, mounted in metal frame with transparent protective cover.

EXECUTION

3.01 INSTALLATION

D. Comply with NECA 1.

E. Install panelboards and accessories according to NECA 407.

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.

H. Make grounding connections and bond neutral for services and separately derived systems to ground. Make connections to grounding electrodes, separate grounds for isolated ground bars, and connections to separate ground bars.

I. Install filler plates in unused spaces.

J. Arrange conductors in gutters into groups and bundle and wrap with wire ties.

3.02 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components.

B. Create a directory to indicate installed circuit loads; incorporate Owner's final room designations. Obtain approval before installing. Handwritten directories are not acceptable. Install directory inside panelboard door.

C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification.

D. Device Nameplates: Label each branch circuit device in power panelboards with a nameplate

3.03 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Acceptance Testing Preparation:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

C. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test for low-voltage air circuit breakers stated in NETA Acceptance Testing Specification. 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.

D. Panelboards will be considered defective if they do not pass tests and inspections.

END OF SECTION

SECTION 26 27 26

WIRING DEVICES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. GFCI receptacles.
   2. Toggle switches.
   3. Wall plates.

1.02 DEFINITIONS

A. Abbreviations of Manufacturers' Names:

   1. Cooper: Copper Wiring Devices; Division of Cooper Industries, Inc.
   2. Hubbell: Hubbell Incorporated: Wiring Devices-Kellems.
   3. Leviton: Leviton Mfg. Company, Inc.
   4. Pass & Seymour: Pass& Seymour/Legrand.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: List of legends and description of materials and process used for pre-marking wall plates.

1.04 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.05 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

PART 2 - PRODUCTS

2.01 GENERAL WIRING-DEVICE REQUIREMENTS

A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

C. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:

1. Connectors shall comply with UL 2459 and shall be made with stranding building wire.
2. Devices shall comply with the requirements in this Section.

D. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

E. Devices for Owner-Furnished Equipment:

1. Receptacles: Match plug configurations

2.02 GFCI RECEPTACLES

A. Non-feed-through-type GFCI unit shall be selected where no protection of downstream receptacles is required.

B. General Description:

1. 125 V, 20 A, straight blade, feed-through type.
2. Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, UL 943 Class A, and FS W-C-596.
3. Include indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection.

C. Duplex GFCI Convenience Receptacles:

1. 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:

a. Eaton (Arrow Hart).
b. Hubbell Incorporated; Wiring Device-Kellems.
c. Leviton Manufacturing Co., Inc.
d. Pass & Seymour/Legrand (Pass & Seymour).

2.03 TOGGLE SWITCHES

A. Comply with NEMA WD 1, UL 20, and FS W-S-896.

B. Switches, 120/277 V, 20 A:

1. Single Pole:

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) Eaton (Arrow Hart).
2) Hubbell Incorporated; Wiring Device-Kellems.
3) Leviton Manufacturing Co., Inc.
4) Pass & Seymour/Legrand (Pass & Seymour).

2.04 WALL PLATES

A. Single and combination types shall match corresponding wiring devices.

1. Plate-Securing Screws: Metal with head color to match plate finish.
2. Material for Finished Spaces: High-impact thermoplastic in finished spaces.
3. Material for Unfinished Spaces: Galvanized steel.
4. Material for Damp Locations: Cast aluminum with spring-loaded lift cover and listed and labeled for use in wet and damp locations.

B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant, die-cast aluminum with lockable cover.

2.05 FINISHES

A. Device Color:

1. Wiring Devices Connected to Normal Power System: As selected by Architect unless otherwise indicated or required by NFPA 70 or device listing.

B. Wall Plate Color: For plastic covers, match device color.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.

B. Coordination with Other Trades:

1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:

1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
4. Existing Conductors:

    a. Cut back and pigtail or replace all damaged conductors.
    b. Straighten conductors that remain and remove corrosion and foreign matter.
    c. Pig tailing existing conductors is permitted, provided the outlet box is large enough.

D. Device Installation:

1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.

2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6-inches in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles down, and on horizontally mounted receptacles to the right.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multi-gang wall plates.

H. GFCI Receptacles: Install non-feed-through-type GFCI receptacles where protection of downstream receptacles is not required.

3.02 FIELD QUALITY CONTROL

A. Test Instruments: Use instruments that comply with UL 1436.

B. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.

C. Perform the following tests and inspections:

1. Tests for Convenience Receptacles:

a. Line Voltage: Acceptable range is 105 to 132 V.
b. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
c. Using the test plug, verify that the device and its outlet box are securely mounted.
d. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

D. Wiring device will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

END OF SECTION

SECTION 31 00 00

EARTHWORK

PART 1 - GENERAL

1.01 WORK INCLUDED:

The Contractor shall make excavations of normal depth in earth for trenches and structures, shall backfill and compact such excavations to the extent necessary, shall furnish the necessary material and construct embankments and fills, and shall make miscellaneous earth excavations and do miscellaneous grading.

1.02 RELATED WORK:

A. Section 00 31 43, PERMITS

B. Section 01 11 00, CONTROL OF WORK AND MATERIALS

C. Section 01 57 19, ENVIRONMENTAL PROTECTION

D. Section 31 23 19, DEWATERING

E. Section 31 50 00, SUPPORT OF EXCAVATION

1.03 REFERENCES:

American Society for Testing and Materials (ASTM):

ASTM	C131	Test Method for Resistance to Degradation of Small Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
ASTM	C136	Method for Sieve Analysis of Fine and Coarse Aggregates.
ASTM	C330	Specification for Lightweight Aggregate for Structural Concrete.
ASTM	D1556	Test Method for Density of Soil in Place by the Sand Cone Method.
ASTM	D1557	Test Methods for Moisture-density Relations of Soils and Soil Aggregate Mixtures Using Ten-pound (10 Lb.) Hammer and Eighteen-inch (18") Drop.
ASTM	D2922	Test Methods for Density of Soil and Soil-aggregate in Place by Nuclear Methods (Shallow Depth).

Massachusetts Department of Transportation (MassDOT) Standard Specifications for Highways and Bridges.

Code of Massachusetts Regulations (CMR) 310.40.0032 Contaminated Media and Contaminated Debris

Code of Massachusetts Regulations (CMR) 520 CMR 14.00 Excavation & Trench Safety Regulation

1.04 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF GENERAL SPECIFICATIONS, SUBMIT THE FOLLOWING:

Samples of all materials proposed for the project shall be submitted to the Engineer for review. Size of the samples shall be as approved by the Engineer.

1.05 PROTECTION OF EXISTING PROPERTY:

A. The work shall be executed in such manner as to prevent any damage to facilities at the site and adjacent property and existing improvements, such as but not limited to streets, curbs, paving, service utility lines, structures, monuments, bench marks, observation wells, and other public or private property. Protect existing improvements from damage caused by settlement, lateral movements, undermining, washout and other hazards created by earthwork operations.

B. In case of any damage or injury caused in the performance of the work, the Contractor shall, at its own expense, make good such damage or injury to the satisfaction of, and without cost to, the Owner. Existing roads, sidewalks, and curbs damaged during the project work shall be repaired or replaced to at least the condition that existed at the start of operations. The Contractor shall replace, at his own cost, existing benchmarks, observation wells, monuments, and other reference points, which are disturbed or destroyed.

C. Buried drainage structures and pipes, observation wells and piezometers, including those which project less than eighteen inches (18") above grade, which are subject to damage from construction equipment shall be clearly marked to indicate the hazard. Markers shall indicate limits of danger areas, by means which will be clearly visible to operators of trucks and other construction equipment, and shall be maintained at all times until completion of project.

1.06 DRAINAGE:

A. The Contractor shall provide, at its own expense, adequate drainage facilities to complete all work items in an acceptable manner. Drainage shall be done in a manner so that runoff

will not adversely affect construction procedures or cause excessive disturbance of underlying natural ground or abutting properties.

1.07 FROST PROTECTION AND SNOW REMOVAL:

A. The Contractor shall, at its own expense, keep earthwork operations clear and free of accumulations of snow as required to carry out the work.

B. The Contractor shall protect the subgrade beneath new structures and pipes from frost penetration when freezing temperatures are expected.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. GRAVEL BORROW:
Gravel Borrow shall satisfy the requirements listed in MassDOT Specification Section M1.03.0, Type b.

B. CRUSHED STONE:

Crushed stone shall satisfy the requirements listed in MassDOT Specification SectionM2.01.

C. SAND BORROW:

Sand Borrow shall satisfy the requirements listed in MassDOT Specification Section M1.04.0.

D. PEASTONE:

Peastone shall be smooth, hard, naturally occurring, rounded stone meeting the following gradation requirements:

Passing 5/8 inch square sieve opening	-	100%
Passing No. 8 sieve opening	-	0%

E. BACKFILL MATERIALS:

1. Class B Backfill:

Class B backfill shall be granular, well graded friable soil; free of rubbish, ice, snow, tree stumps, roots, clay and organic matter; with 30 percent or less passing the No.

200 sieve; no stone greater than two-third (2/3) loose lift thickness, or six inches, whichever is smaller.

2. Select Backfill:

Select backfill shall be granular, well graded friable soil, free of rubbish, ice, snow, tree stumps, roots, clay and organic matter, and other deleterious or organic material; graded within the following limits:

Sieve Size	Percent Finer by Weight
3"	100
No. 10	30-95
No. 40	10-70
No. 200	0-10

E. SPECIAL PIPE BEDDING MATERIAL

1. The special pipe bedding material shall consist of a filter fabric installed on the trench bottom before backfilling with crushed stone as specified and as shown on the contract drawings.

F. PROCESSED GRAVEL:

1. Processed gravel shall consist of inert material that is hard, durable stone and coarse sand, free from loam and clay, surface coatings and deleterious materials. The coarse aggregate shall have a percentage of wear, by the Los Angeles Abrasion Test, of not more than 50.

2. The gradation shall meet the following requirements:

Sieve Designation	Percentage Passing
3 in.	100
1 1/2 in.	70-100
3/4 in.	50-85
No. 4	30-60
No. 200	0-10

3. The approved source of bank-run gravel material shall be processed by mechanical means. The equipment for producing crushed gravel shall be of adequate size with sufficient adjustments to produce the desired materials. The processed material shall be stockpiled in such a manner to minimize segregation of particle sizes. All processed gravel shall come from approved stockpiles.

PART 3 - EXECUTION

3.01 DISTURBANCE OF EXCAVATED AND FILLED AREAS DURING CONSTRUCTION:

A. Contractor shall take the necessary steps to avoid disturbance of subgrade during excavation and filling operations, including restricting the use of certain types of construction equipment and their movement over sensitive or unstable materials, dewatering and other acceptable control measures.

B. All excavated or filled areas disturbed during construction, all loose or saturated soil, and other areas that will not meet compaction requirements as specified herein shall be removed and replaced with a minimum 12-inch layer of compacted crushed stone wrapped all around in non-woven filter fabric. Costs of removal and replacement shall be borne by the Contractor.

C. The Contractor shall place a minimum of 12-inch layer of special bedding materials and crushed stone wrapped in filter fabric over the natural underlying soil to stabilize areas which may become disturbed as a result of rain, surface water runoff or groundwater seepage pressures, all at no additional cost to the Owner. The Contractor also has the option of drying materials in-place and compacting to specified densities.

3.02 EXCAVATION:

A. GENERAL:

1. The Contractor shall perform all work of any nature and description required to accomplish the work as shown on the Drawings and as specified.

2. Excavations, unless otherwise required by the Engineer, shall be carried only to the depths and limits shown on the Drawings. If unauthorized excavation is carried out below required subgrade and/or beyond minimum lateral limits shown on Drawings, it shall be backfilled with gravel borrow and compacted at the Contractor's expense as specified below, except as otherwise indicated. Excavations shall be kept in dry and good conditions at all times, and all voids shall be filled to the satisfaction of the Engineer.

3. In all excavation areas, the Contractor shall strip the surficial topsoil layer and underlying subsoil layer separate from underlying soils. In paved areas, the Contractor shall first cut pavement as specified in paragraph 3.02 B.1 of this specification, strip pavement and pavement subbase separately from underlying soils. All excavated materials shall be stockpiled separately from each other within the limits of work.

4. The Contractor shall follow a construction procedure, which permits visual identification of stable natural ground. Where groundwater is encountered, the size of the open excavation shall be limited to that which can be handled by the Contractor's chosen method of dewatering and which will allow visual observation of the bottom and backfill in the dry.

5. The Contractor shall excavate unsuitable materials to stable natural ground where encountered at proposed excavation subgrade, as required by the Engineer. Unsuitable material includes topsoil, loam, peat, other organic materials, snow, ice, and trash. Unless specified elsewhere or otherwise required by the Engineer, areas where unsuitable materials have been excavated to stable ground shall be backfilled with compacted special bedding materials or crushed stone wrapped all around in non-woven filter fabric.

B. TRENCHES:

1. Prior to excavation, trenches in pavement shall have the traveled way surface cut in a straight line by a concrete saw or equivalent method, to the full depth of pavement. Excavation shall only be between these cuts. Excavation support shall be provided as required to avoid undermining of pavement. Cutting operations shall not be done by ripping equipment.

2. The Contractor shall satisfy all dewatering requirements specified in Section 31 23 19 DEWATERING, before performing trench excavations.

3. Trenches shall be excavated to such depths as will permit the pipe to be laid at the elevations, slopes, and depths of cover indicated on the Drawings. Trench widths shall be as shown on the Drawings or as specified.

4. Where pipe is to be laid in bedding material, the trench may be excavated by machinery to, or just below, the designated subgrade provided that the material remaining in the bottom of the trench is not disturbed.

5. If pipe is to be laid in embankments or other recently filled areas, the fill material shall first be placed to a height of at least 12-inches above the top of the pipe before excavation.

6. Pipe trenches shall be made as narrow as practicable and shall not be widened by scraping or loosening materials from the sides. Every effort shall be made to keep the sides of the trenches firm and undisturbed until backfilling has been completed.

7. If, in the opinion of the Engineer, the subgrade, during trench excavation, has been disturbed as a result of rain, surface water runoff or groundwater seepage pressures, the Contractor shall remove such disturbed subgrade to a minimum of 12 inches

and replace with crushed stone wrapped in filter fabric. Cost of removal and replacement shall be borne by the Contractor.

8. The Contractor shall obtain a trench permit from the municipality where the trench is located prior to making any excavations of trenches (any subsurface excavation greater than three (3) feet in depth and fifteen (15) feet or less between soil walls as measured from the bottom).

9. All trenches required to be permitted must be attended, covered, barricaded, or backfilled. Covers must be road plates at least ¾-inch thick or equivalent, barricades must be fences at least 6-feet high with no openings greater than 4-inches between vertical supports and all horizontal supports required to be located on the trench-side of the fencing.

C. EXCAVATION NEAR EXISTING STRUCTURES:

1. Attention is directed to the fact that there are pipes, manholes, drains, and other utilities in certain locations. An attempt has been made to locate all utilities on the drawings, but the completeness or accuracy of the given information is not guaranteed.

2. As the excavation approaches pipes, conduits, or other underground structures, digging by machinery shall be discontinued and excavation shall be done by means of hand tools, as required. Such manual excavation, when incidental to normal excavation, shall be included in the work to be done under items involving normal excavation.

3. Where determination of the exact location of a pipe or other underground structure is necessary for properly performing the work, the Contractor shall excavate test pits to determine the locations.

3.03 BACKFILL PLACEMENT AND COMPACTION:

A. GENERAL:

1. Prior to backfilling, the Contractor shall compact the exposed natural subgrade to the densities as specified herein.

2. After approval of subgrade by the Engineer, the Contractor shall backfill areas to required contours and elevations with specified materials.

3. The Contractor shall place and compact materials to the specified density in continuous horizontal layers, not to exceed nine (9) inches in uncompacted lifts. The degree of compaction shall be based on maximum dry density as determined

by ASTM Test D1557, Method C. The minimum degree of compaction for fill placed shall be as follows:

Location	Percent of Maximum Density
Below pipe centerline	95
Above pipe centerline	92
Below pavement (upper 3 ft.)	95
Embankments	95
Below pipe in embankments	95
Adjacent to structures	92
Below structures	95

4. The Engineer reserves the right to test backfill for conformance to the specifications and Contractor shall assist as required to obtain the information. Compaction testing will be performed by the Engineer or by an inspection laboratory designated by the Engineer, engaged and paid for by the Owner. If test results indicate work does not conform to specification requirements, the Contractor shall remove or correct the defective Work by recompacting where appropriate or replacing as necessary and approved by the Engineer, to bring the work into compliance, at no additional cost to the Owner. All backfilled materials under structures and buildings shall be field tested for compliance with the requirements of this specification.

5. Where horizontal layers meet a rising slope, the Contractor shall key each layer by benching into the slope.

6. If the material removed from the excavation is suitable for backfill with the exception that it contains stones larger than permitted, the Contractor has the option to remove the oversized stones and use the material for backfill or to provide replacement backfill at no additional cost to the Owner.

7. The Contractor shall remove loam and topsoil, loose vegetation, stumps, large roots, etc., from areas upon which embankments will be built or areas where material will be placed for grading. The subgrade shall be shaped as indicated on the Drawings and shall be prepared by forking, furrowing, or plowing so that the first layer of the fill material placed on the subgrade will be well bonded to the subgrade.

B. TRENCHES:

1. Bedding as detailed and specified shall be furnished and installed beneath the pipeline prior to placement of the pipeline. A minimum bedding thickness shall be maintained between the pipe and undisturbed material, as shown on the Drawings.

2. As soon as practicable after pipes have been laid, backfilling shall be started.

3. Unless otherwise indicated on the Drawings, select backfill shall be placed by hand shovel in 6-inch thick lifts up to a minimum level of 12-inches above the top of pipe. This area of backfill is considered the zone around the pipe and shall be thoroughly compacted before the remainder of the trench is backfilled. Compaction of each lift in the zone around the pipe shall be done by use of power-driven tampers weighing at least 20 pounds or by vibratory compactors. Care shall be taken that material close to the bank, as well as in all other portions of the trench, is thoroughly compacted to densities required.

4. Class B backfill shall be placed from the top of the select backfill to the specified material at grade (loam, pavement subbase, etc.). Fill compaction shall meet the density requirements of this specification.

5. Water Jetting:

   a. Water jetting may be used when the backfill material contains less than 10 percent passing the number 200 sieve, but shall be used only if approved by the Engineer.

   b. Contractor shall submit a detailed plan describing the procedures he intends to use for water jetting to the Engineer for approval prior to any water jetting taking place.

   c. Compaction of backfill placed by water jetting shall conform to the requirements of this specification.

6. If the materials above the trench bottom are unsuitable for backfill, the Contractor shall furnish and place backfill materials meeting the requirements for trench backfill, as shown on the drawings or specified herein.

7. Should the Engineer order crushed stone for utility supports or for other purposes, the Contractor shall furnish and install the crushed stone as directed.

C. BACKFILLING UNDER BUILDINGS AND FOUNDATIONS:

Material to be used as structural fill under structures shall be special bedding material or gravel borrow, as shown on the Drawings or as required by the Engineer. Where gravel borrow fill is required to support proposed footings, walls, slabs, and other structures, the material shall be placed in a manner accepted by the Engineer. Compaction of each lift shall meet the density requirements of this specification.

D. BACKFILLING ADJACENT TO STRUCTURES:

1. The Contractor shall not place backfill against or on structures until they have attained sufficient strength to support the loads to which they will be subjected. Excavated material approved by the Engineer may be used in backfilling around structures. Backfill material shall be thoroughly compacted to meet the requirements of this specification.

2. Contractor shall use extra care when compacting adjacent to pipes and drainage structures. Backfill and compaction shall proceed along sides of drainage structures so that the difference in top of fill level on any side of the structure shall not exceed two feet (2') at any stage of construction.

3. Where backfill is to be placed on only one side of a structural wall, only hand-operated roller or plate compactors shall be used within a lateral distance of five feet (5') of the wall for walls less than fifteen feet (15') high and within ten feet (10') of the wall for walls more than fifteen feet (15') high.

3.04 DISPOSAL OF SURPLUS MATERIALS:

A. Surplus excavated materials, which are acceptable to the Engineer, shall be used to backfill normal excavations in rock or to replace other materials unacceptable for use as backfill. Upon written approval of the Engineer, surplus excavated materials shall be neatly deposited and graded so as to make or widen fills, flatten side slopes, or fill depressions; or shall be neatly deposited for other purposes as indicated by the Owner, within its jurisdictional limits; all at no additional cost to the Owner.

B. Surplus excavated material not needed as specified above shall be hauled away and disposed of by the Contractor at no additional cost to the Owner, at appropriate locations, and in accordance with arrangements made by him. Disposal of all rubble shall be in accordance with all applicable local, state and federal regulations.

C. No excavated material shall be removed from the site of the work or disposed of by the Contractor unless approved by the Engineer.

D. The Contractor shall comply with Massachusetts regulations (310 CMR 40.0032) that govern the removal and disposal of surplus excavated materials. Materials, including contaminated soils, having concentrations of oil or hazardous materials less than an otherwise Reportable Concentration and that are not a hazardous waste, may not be disposed of at locations where concentrations of oil and/or hazardous material at the receiving site are significantly lower than the levels of those oil and /or hazardous materials present in the soil being disposed or reused.

END OF SECTION

SECTION 31 05 13.13

LOAM BORROW (TOPSOIL)

PART 1 - GENERAL

1.01 WORK INCLUDED:

A. This Section covers all labor, materials, and equipment necessary to furnish and place Loam Borrow and all related work as indicated on the drawings and as herein specified.

B. Existing on-site topsoil that has been stockpiled may be re-used provided it meets these specifications. The Contractor shall be solely responsible to determine if adequate quantities of on-site topsoil exist that may potentially be reused.

1.02 RELATED WORK:

A. Section 31 00 00, EARTHWORK

B. Section 32 93 00, SHRUBS AND LANDSCAPING

1.03 QUALITY ASSURANCE:

A. For each particular source of loam, the Contractor shall send representative samples totaling approximately 10 pounds of Loam Borrow to an approved State-certified testing laboratory.

B. Loam shall be subject to tests for Soluble Salts (1:2 soil-water ratio), Nitrogen (including nitrate and ammonium Nitrogen), Phosphorous, Potassium, Sulfate, Calcium, Magnesium, Aluminum, and Ferric Iron concentrations.

C. Loam shall also be tested for heavy metals concentration, which shall include Boron, Cadmium, Zinc, Chromium, Copper, Lead, Manganese, and Nickel.

D. Mechanical gradation (textural analysis) as per USDA Soil Classification System and determine Organic matter content and the pH (1:1 soil-water ratio).

E. All tests shall be at the Contractor's expense. Laboratory test results shall state whether the Loam Borrow is acceptable as a planting medium, whether it needs to be amended, or if it fails to meet accepted requirements. Test results shall also include soil amendment and fertilizing recommendations and shall be forwarded to the Engineer at least 1month before any loaming is to be undertaken.

F. Samples and tests shall continue to be made at the Contractor’s expense until Loam Borrow to be provided is found to be acceptable to the Engineer.

1.04 SUBMITTALS:

In accordance with requirements of general specifications, the Contractor shall submit the following:

A. Six copies of information detailing the soil amendments including limestone, fertilizers, organic material amendments, and the name and address of the supplier and origin of Loam Borrow shall be submitted to the Engineer for approval.

B. Six copies of soils test results shall be submitted to the Engineer for review.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. LOAM BORROW:

1. Loam Borrow shall consist of, fertile, friable natural topsoil, typical of productive soils in the vicinity, obtained from naturally well-drained areas that have never been stripped. Loam Borrow shall be reasonably free of stumps, roots, heavy or stiff clay, stones larger than 1-inch in diameter, lumps, coarse sand, noxious weeds, sticks, brush or other litter.

2. Loam Borrow shall be classified as a sandy loam by the USDA textural classification system as determined by sieve and pipette or hydrometer analysis. Loam Borrow shall have the following mechanical analysis:

Textural Class	Percent of Total Weight	Avg. Percentage
Sand (0.05 – 2.0mm range)	45 – 75	60
Silt (0.002 – 0.05mm range)	15 – 35	25
Clay (less than 0.002mm)	5 – 20	15

3. Loam Borrow shall contain not less than 4 percent or more than 7 percent organic matter as determined by the loss of weight by ignition of oven-dried samples. Test samples shall be oven-dried to a constant weight at a temperature of 230 degrees F.

4. Loam Borrow shall not be excessively acid or alkaline, and shall not contain any phytotoxic materials or unacceptable concentration levels of any substance harmful to plant growth as determined by the soils testing laboratory. Loam Borrow shall have a pH value range between 5.0 and 6.5. Maximum soluble salt index shall be 100. The electrical conductivity (EC2) of a 1:2 soil-water suspension shall be less than or equal to 1.0 millimhos/cm. Aluminum concentration levels shall be less than 200ppm.

5. Loam Borrow shall not be worked, excavated, or delivered in a frozen or muddy condition. Soil structure shall not be destroyed through excessive and unnecessary handling or compaction.

6. Existing on-site topsoil may be re-used as Loam Borrow provided it meets these specifications.

7. All amendments to Loam Borrow shall be approved by the Engineer and shall be made in accordance with recommendations from the soils testing laboratory for use of Loam Borrow as a plant-growing medium and these specifications.

B. LIMESTONE:

Lime shall be an approved agricultural limestone containing at least 50 percent total oxides (calcium oxide and magnesium oxide). The material will be ground such that 50 percent of the material will pass through a No. 100 mesh sieve and 98 percent will pass a No. 2 mesh sieve. Lime shall be uniform in composition, dry and free-flowing and shall be delivered to the site in the original sealed containers, each bearing the manufacturer's guaranteed analysis.

C. FERTILIZER:

1. Fertilizer shall be a complete, standard commercial fertilizer, homogeneous and uniform in composition, dry and free-flowing, and shall be delivered to the site in the manufacturer's original sealed containers, each bearing the manufacturer's guaranteed analysis and marketed in compliance with State and Federal Laws. All fertilizer shall be used in accordance with the manufacturer's recommendations.

2. For Fertilizers containing Nitrogen, at least 50 percent of the nitrogenous elements shall be Urea-form or derived from organic sources and contain no less than 3 percent water-soluble Nitrogen.

3. Superphosphate shall be composed of finely ground phosphate rock as commonly used for agricultural purposes, containing not less than 18 percent available phosphoric acid.

D. ORGANIC MATERIAL AMENDMENTS:

1. Organic compost shall be a standard commercial product comprised of fully decomposed, 100 percent plant-derived, natural organic matter. Its composition shall furnish ample water holding capacity and cation exchange capacity for the retention of plant nutrients. Compost shall be free of sticks, stones, weed seeds, roots, mineral or other foreign matter and delivered air dry. It shall be free from excessive soluble salts, heavy metals, phytotoxic compounds, and/or substances

harmful to plant growth and viability. Organic compost shall have an acidity range of 4.5 to 7.0 pH.

2. Sphagnum Peat Moss shall be a standard commercial product. Its composition shall furnish ample water holding capacity and cation exchange capacity for the retention of plant nutrients. Peat moss shall be free of sticks, stones, weeds or weed seeds, roots, mineral or other foreign matter. It shall be free from toxic substances and/or compounds harmful to plant growth and viability. It shall be delivered air dry in standard bales and shall have an acidity range of 3.5 to 5.5 pH.

3. Humus shall be natural humus, reed peat, or sedge peat. Its composition shall furnish ample water holding capacity and cation exchange capacity for the retention of plant nutrients. Humus shall be free of sticks, stones, weeds, roots, mineral or other foreign matter and/or toxic substances harmful to plant growth and viability. It shall be low in wood content, free from hard lumps and excessive amounts of zinc and delivered air dry in a shredded or granular form. The acidity range for humus shall be 5.5 to 7.5 pH, and the organic matter content shall be not less than 85 percent, as determined by loss on ignition. The minimum water holding capacity shall be 200 percent by weight on an oven-dry basis.

4. Manure shall be well-rotted, leached, cow manure not less than 8 months or more than 2 years old. It shall be free of sawdust, shavings, or refuse of any kind and shall not contain more than 25 percent straw. It shall contain no substances harmful to plant growth. The Contractor shall furnish information regarding chemical disinfectants, if any, that may have been used in storage of the manure.

PART 3 - EXECUTION

3.01 After approval of rough grading, the sub-base shall be raked to a depth of 3 inches to remove stones, rock or other foreign materials 3-inches or larger in dimension. The Engineer shall inspect the work for approval, prior to placing of Loam Borrow.

3.02 Loam Borrow shall be placed and spread to the required depths over the locations approved by the Engineer.

3.03 Lime shall be uniformly applied in accordance with the soil testing laboratory recommendations, or as required by the Engineer, at a maximum rate of 100 pounds per 1000 square feet per application, in necessary quantities to achieve the pH range requirements for Loam Borrow.

3.04 Fertilizer shall be uniformly applied in accordance with the soil testing laboratory recommendations, or as required by the Engineer. At slopes exceeding 25 percent gradient, fertilizer shall be applied manually in a manner approved by the Engineer. Fertilizer shall not be applied between June 15 and August 31.

3.05 Loam Borrow shall be worked by tilling or power raking to a minimum depth of 3-inches, thoroughly incorporating the lime and fertilizer into the soil. The Loam Borrow shall then be raked until the surface is finely pulverized and smooth and compacted with rollers, weighing between 75 and 100 pounds per linear foot of tread, to an even surface conforming to the prescribed lines, grades and depths indicated on the plans.

END OF SECTION

SECTION 31 13 13

TREE PRUNING AND TREE AND STUMP REMOVALS

PART 1 - GENERAL

1.01 WORK INCLUDED:

A. The work of this Section includes the following:

1. Pruning - Class II, including the removal of all limbs necessary to execute the field, playground and fence work required under this contract.

2. Removal of trees and stumps.

B. Refer to the Contract Drawings for general location of trees along the site perimeter. In general, all trees are to remain and be pruned in conformance with this Specification. Tree removals shall be limited to the area denoted on the plans and shall include the removal of individual trees that would impede the construction of proposed facilities.

1.02 QUALIFICATIONS OF CONTRACTOR:

A. This work shall be limited to individuals, partnerships and corporations who are actively engaged in the field of Arboriculture, and who demonstrate competence, experience and financial capability to carry out the terms of this project. The Owner may require proof of these qualifications.

B. All work shall be conducted by qualified and trained personnel under the direct supervision of a Massachusetts Certified Arborist (MCA) in the Contractor's employ.

1.03 PERSONNEL:

A. The Contractor shall submit each employee's name and title prior to the commencement of work. The Contractor shall advise the Owner of any changes in personnel assigned to this Contract.

B. The crew foreman shall have a minimum of five (5) years climbing/pruning experience. At least one (1) crew person shall be an MCA and shall be certified in CPR.

C. Each trimmer shall be experienced and highly qualified with the necessary tree worker skills to successfully complete the work of this Section, including the ability and training to perform aerial rescue. Said skill shall also include worker safety

and ability in compliance with current OSHA and ANSI Z-133.1 Standards.

1.04 SPECIAL REQUIREMENTS:

A. Dutch Elm diseased wood shall be disposed of in accordance with provisions of General Laws, Chapter 87, Section 5, and Chapter 132, Sections 8 and 11 as amended; and in accordance with any additional local regulations. All wood shall be removed from the site and be properly disposed of in accordance with state and local regulations.

B. No burning shall be permitted on the project site.

C. Prior to commencing work, the Contractor shall submit a plan to the Owner for legal disposal of removed materials, in conformance with State and Federal regulations.

1.05 STANDARDS AND DEFINITIONS:

A. All pruning work shall be performed in accordance with the following:

1. The ANSI A300 'Standard Practices for Trees, Shrubs, and Other Wood Plant Materials' of the Secretariat: National Arborist Association, Post Office Box 1094, Amherst, New Hampshire 03031.

2. American National Standards Institute (ANSI) Standard Z-133.1.

3. The standards and practices of the International Society of Arborists.

4. The standards and practices of the Massachusetts Arborist Association.

5. The standards and practices of the American Association of Nurserymen.

B. The term 'Owner' shall mean the Owner's designated representative charged with carrying out the requirements of this Project, Architect, Engineer, Planner, or Tree Warden as referenced herein, rendering approvals for the Owner.

1.06 EXAMINATION OF SITE AND DOCUMENTS:

A. The Contractor shall be responsible for having a clear understanding of the existing site conditions and shall be responsible for fully carrying out the work of this Section, regardless of actual site conditions encountered.

1.07 ORDER OF WORK:

A. Based on the site conference, the Contractor shall submit a schedule of work for the Owner's review and approval prior to beginning work. Unless otherwise

authorized by the Owner, failure of the Contractor to comply with the approved removal schedule shall be sufficient cause to give notice that the Contractor is in default of the contract.

1.08 PROTECTION OF THE VEGETATION TO BE PRESERVED:

A. The Contractor shall protect all existing trees, shrubs, lawns and other site features designated to remain. The placement of protection devices, such as snow fence enclosures, shall, however, be at the Contractor's discretion.

B. Damage no plant to remain by burning, pumping water, cutting of live roots or branches, or any other means. Neither vehicles nor equipment shall be parked within the dripline of trees to remain, or where ever damage may result to trees to be saved. Construction material shall not be stored beneath trees to be saved.

C. The Contractor shall be liable for any damage to any trees, shrub, lawn or other site features to remain, and shall immediately report to the Owner. Damaged shrubs or lawns shall be restored or replaced to match existing to remain to the satisfaction of the Owner.

D. The Contractor shall compensate the Owner for damages by installing replacement tree(s) of the size and species approved by the Owner and of sufficient quantity such that the sum of the Diameter at Breast Height (DBH) inches for replacement trees equals the total DBH inches of the damaged tree(s). Damaged shrubs shall be replaced with shrubs(s) of the same size, species, and quantity, unless determined otherwise by the Owner.

1.09 USE AND CARE OF THE SITE:

A. The Contractor shall leave the work site at the end of each working period in a condition satisfactory to the Owner.

B. Pavements shall be swept and lawns or other surfaces raked and/or otherwise cleaned of all material related to the work operation. Degree of clean-up required will be described by the Owner and will be based upon the character of the work area.

C. All trimmings or any other form of debris (except diseased materials or trimmings from Elms) shall be collected and chipped. The Contractor shall remove all materials and shall dispose of such materials off site in a legal manner.

D. No vehicles are to be stored on site. The Contractor shall be fully and solely responsible for any damage to equipment or vehicles left at the site of the work. All necessary permits shall be obtained by the Contractor.

PART 2 - PRODUCTS

2.01 EQUIPMENT:

A. Equipment necessary for this Contract shall be properly maintained and in good operating condition to the City's satisfaction. The Contractor shall promptly remove and replace any equipment which the Owner deems to be in unsatisfactory condition or otherwise unsuitable.

B. Cutting tools shall be kept well sharpened to provide clean smooth cuts. Any tools utilized on any tree suspected to have cankers or other fungal, bacterial or viral diseases shall be sterilized or not used on any other specimen.

C. A disc chipper shall be used which will process material up to twelve (12) inches in diameter.

PART 3 - EXECUTION

3.01 PRUNING:

A. Under this Section, the Contractor shall furnish all labor, materials, equipment and transportation required to complete all aspects of the work in accordance with all local, state and federal regulations in force at the same time of this Contract and in accordance with tree pruning as specified herein.

B. The work of this Section consists of all pruning work and related items as specified herein and includes, but is not limited to:

1. Pruning - Class II throughout the designated areas and limb removal required to allow for the proper installation of all fields, play equipment and new fencing.

   Class II pruning is defined as medium pruning and shall consist of the removal of dead, dying, diseased, interfering, objectionable and weak branches on the main trunks as well as those within the leaf area. An occasional branch one (1) inch or less in diameter may remain within the main leaf area where it is not practical to remove it.

3.02 DESCRIPTION OF PRUNING WORK:

A. Pruning and trimming are generally described as the removal and disposal of limbs, branches and stubs which are either dead, potentially detrimental to the health of the tree or dangerous to pedestrians, visually deficient, interfering or otherwise objectionable as determined by the Owner.

B. The limits of all trees to be pruned have been identified on the plans or referenced elsewhere in this specification section.

C. Vehicle access shall be controlled and approved by the Owner.

D. If the Contractor discovers tree(s) which have not been marked for pruning, but whose condition is such that removal is warranted, whether due to death, disease, decay, or structural weakness, such tree(s) shall not be pruned and the Contractor shall immediately report these findings in writing to the Owner and await the Owner's direction before proceeding with work on the particular tree(s) in question.

E. All pruning shall be performed in a manner that maintains the natural aesthetic characteristics of the species and variety of trees. No topping or dehorning of trees or stubbing back of branches shall be permitted. All cuts shall be made to a lateral branch that is a minimum of one third (1/3) the size of the branch being removed, unless otherwise instructed by the Owner.

F. The use of climbing spurs or spiked shoes shall not be permitted and their use will result in the immediate cancellation of the contract.

G. All cuts shall be made sufficiently close to the parent stem so that wound closure can be readily started under normal conditions. Cuts shall, however, never be made through the branch collar. Slab cuts and rip cuts will result in cancellation of the contract.

H. All limbs over two (2) inches in diameter to be removed shall be precut to prevent splitting. Any branches that by falling would injure existing trees to remain or other objects shall be lowered to the ground by proper ropes.

I. On trees known to be diseased and where there is known to be danger of transmitting the disease on tools, tools shall be disinfected with alcohol or bleach after each cut between trees.

J. Lateral branches as well as occasional branch suckers ("water sprouts") may be retained. Complete removal of secondary laterals and branch suckers resulting in the stripping of major limbs, ("lion tailing") will not be permitted.

K. Tree paint to seal pruning cuts shall not be used.

L. All branches and limbs shall be manually lowered to the ground via rope and pulley. This practice must be consistent with the National Arborist Association Standards for Pruning. All grade-level artifacts and landscaping must be protected from damage.

3.03 REMOVALS:

A. The Contractor shall furnish all labor, materials, equipment and transportation required to complete all aspects of the removals work in accordance with all local,

state, and federal regulations in force at the time of this contract and in accordance with tree and stump removals as specified herein.

3.04 DESCRIPTION OF REMOVAL WORK:

A. Removal is generally described as the removal of groups and individual trees and shrubs which interfere with the growth of more desirable types of trees; the clearing away of lesser growth that may obscure outstanding trees; and thinning out to provide space for healthy growth by the elimination of thinner, weaker trees.

B. The Contractor shall adhere to the specifications and provide suitable facilities for inspecting the work. Failure of the Owner to immediately reject unsatisfactory work or to notify the Contractor of deviations from the specification shall not relieve the Contractor of responsibility to correct or remedy unsatisfactory work.

C. The Contractor shall only work on trees designated by the Owner. No compensation will be made for work performed on any other tree or trees.

D. Trees designated to be removed shall be taken down and all leaves, branches and trunks of trees properly disposed of by chipping and removal from the premises.

E. Fell trees in a manner that allows all site features and those trees to be saved undamaged.

F. Removal of all the parts of each tree shall be completed on the same day that the tree is cut.

G. Stumps shall be ground to eighteen (18) inches below grade by grinding or other means acceptable to the Owner. The void from the stump removal operations shall be filled with ordinary borrow soil to within six (6) inches of finished grade. The top six (6) inches shall be filled with screened loam, moderately tamped to prevent future settling. In grass areas the disturbed area shall be sown with grass seed of a mix appropriate to the location, as required by the Owner.

H. Excavation or grading within the branch spread of trees to be saved shall be performed as required by the Owner. Removal of pavement such as bituminous concrete in these zones shall be by hand tools and/or air spade to ensure root health for trees to remain.

I. All equipment to be used and all work to be performed must be in full compliance with all standards as promulgated by OSHA at the time of bidding, including but not limited to those regulations concerning noise levels, protective devices and operator safety.

J. The Contractor shall be solely responsible for pedestrian and vehicular safety and control within the work site and shall protect the public and its property from injury

or damage that could be caused by the progress of the work. To this end the Contractor shall provide, erect, and maintain protective devices acceptable to the Owner, including but not limited to barricades, lights and warning signs.

K. Any practice employed by the Contractor that is obviously hazardous as determined by the Owner shall be immediately discontinued by the Contractor upon receipt of either written or oral notice from the Owner to discontinue such practice.

END OF SECTION

SECTION 31 23 00

EXCAVATION, BORROW AND BACKFILL

PART 1 - GENERAL

1.01 WORK INCLUDED:

A. Under this Section, the Contractor shall furnish all labor, materials, equipment and transportation required to complete Excavation, Borrow and Backfill work indicated on the drawings, as designated by the Engineer, or as specified herein, to complete all proposed work.

B. Without limiting the generality thereof, Excavation, Borrow and Backfill shall include excavating, furnishing borrow materials as necessary and back-filling for the construction of all proposed work from existing grades to finished grades. Work shall include the removal of unclassified material, such as bituminous pavements, curbs, ledge and boulders under one (1) cubic yard in size, concrete, reinforced and plain, structures, fencing of various types, and metal or wood posts; and unsuitable materials of every nature throughout the site within twelve (12) inches below finished subgrade elevations for proposed work; transportation of the excavated materials; back-filling to proposed base course subgrades with approved excavated and/or furnished materials; and the disposal of unsuitable, and/or surplus excavated materials.

C. Work under this Section shall also include the discing and harrowing of existing grass or topsoil areas to break down all sod clumps and vegetation and the complete excavation, stockpiling, rehandling, spreading, and re-use (placing) of on-site topsoil in conformity with the lines, grades and dimensions shown on the plans. This material may be utilized where general embankment (not beneath pavements or structural improvements) is proposed. The Contractor shall take extreme care in the process of discing and harrowing of the existing topsoil to ensure that subsoil to remain in place is not mixed with the topsoil. Disc compacted areas subject to construction traffic to the full depth of topsoil without mixing in subsoil.

D. Work under this Section shall also include the excavation of existing base courses under existing pavement areas for re-use in proposed fill areas up to base course subgrades or loam borrow subgrades if the existing material is deemed suitable and is excavated without contamination by or mixing with unsuitable materials and subsoils. This material may be utilized for backfill over pipe cover in trenches only if all material over four (4) inches in size is removed prior to back filling. All existing materials shall be removed to the full depth of proposed work.

E. Work under this Section shall also include the excavation of subsoil to the limit lines of proposed work. If deemed suitable by the Engineer, as meeting the criteria or intent of paragraph 2.02 of this Specification, this material may be used as fill material for grading and general filling of any unpaved areas to bottom of proposed work. **No subsoil** shall be used for fill at proposed pavement areas or below proposed pipes or structures without meeting the requirements for paragraph 2.02A below.

F. Work under this Section shall include the furnishing of all borrow materials required
to complete the proposed work as designed. Where "processed gravel", "gravel borrow", or "gravel" is indicated in the specifications or on the drawings, only gravel conforming to this section of the specifications may be utilized.

G. All topsoil/loam for sod, seed or plant material beds, whether re-used or furnished from off-site, shall conform to the loam borrow section of these Specifications.

1.02 RELATED WORK:

A. Section 00 31 43, PERMITS

B. Section 01 33 23, SUBMITTALS

C. Section 31 05 13.13, LOAM BORROW

1.03 REFERENCE STANDARDS AND SPECIFICATIONS:

A. References to specific standards, specifications and tests of the following technical societies, organizations, and governmental bodies may be made in the contract documents.

1. AASHTO - American Association of State Highway and Transportation Officials (tests or specifications).

2. ASTM - American Society for Testing and Materials.

3. MassDOT Standard Specs. - Latest edition of the Standard Specifications for Highways and Bridges, Massachusetts Department of Transportation, hereinafter referred to as the "Massachusetts Standard Specifications."

4. AWWA - American Waterworks Association.

1.04 SAMPLING AND TESTING:

A. Coordinate with Specification Section 01 45 23.

B. Four samples each of materials requested to be tested by the Engineer shall be taken at the locations ordered by, and in the presence of, the Engineer at the site or at the source of supply and under his direction for testing in accordance with requirements stated herein. The Contractor shall pay for these tests regardless of their results.

C. Test results shall be submitted directly to the Engineer by a Certified Testing Laboratory to be approved by the Engineer. No material shall be re-used or furnished until the Engineer's approval is given.

D. All tests of any kind ordered by the Engineer shall be paid for by the Contractor regardless of test results.

1.05 SPECIAL REQUIREMENTS:

A. If test results indicate that existing base course materials are suitable backfill material per paragraph 2.02, they shall be utilized as fill up to subgrade and for trench backfill over pipe cover. If results indicate that they meet the specifications for gravel, they may be utilized where gravel is proposed.

B. The sequence of all excavation operations shall be such as to insure the most efficient re-use of suitable excavated materials and the use of a minimum amount of specified borrow.

C. The Contractor shall inform and satisfy himself as to the character, quantity, and distribution of all material to be excavated. No payment will be made for the placement of any excavated material that is used for purposes other than those designated and as specified herein. Further, these shall be removed at no cost to the Owner if so, required by the Engineer.

D. The Engineer shall have final determination over the excavation, moving, placing and disposition of all materials, and shall determine the suitability of materials to be placed in excavated areas.

E. All backfill to subgrade, shall be compacted to not less than ninety-five percent (95%) of the maximum dry density of the material as determined by the Standard AASHTO Test Designation T-180-86, Modified Proctor Test.

F. Unsuitable and/or excess excavated materials shall be removed and properly disposed of in legal disposal areas off of the site at no additional cost to the Owner.

G. Exploratory excavation to locate existing utilities or obstructions shall be at the

Contractor's discretion to assist him in the work of this project and no extra payment shall be made for such verification. Although extra payment is not considered, lack of such payment does not constitute a waiver of the Contractor's responsibility to verify all utilities. The contractor must ensure verification of existing services and ensure the safety of the Contractor's work forces.

H. No on-site excavated backfill materials may be used as base courses for any pavements or structural elements unless test results show these materials to meet this specification for the type of material to be utilized and are so approved by the Engineer.

1.06 SUBMITTALS/COORDINATION:

A. The Contractor, per Section 01 33 23 SUBMITTALS and Paragraph 1.04 of this Section shall furnish all necessary submittals and certifications as to Certified Testing Laboratory, disposal sites, etc.

B. The Contractor shall notify Dig Safe at 1-888-344-7233 at least seventy-two (72) hours prior to initiating excavation.

C. Trench permit must be submitted prior to the beginning of any related excavation.

PART 2 - PRODUCTS

2.01 BORROW MATERIALS:

A. Excavated topsoil and furnished topsoil to be utilized for sodding, seeding and landscaping must conform to Section 31 05 13.13 Loam Borrow in order to be used as Loam Borrow. Existing topsoil not passing tests for Loam Borrow may be considered suitable as general fill below subgrade, in landscaped areas only and may be utilized throughout the proposed sod and seeded areas, up to subgrades of proposed work.

B. Gravel Borrow shall be as specified under paragraph 2.04 and shall be utilized whenever gravel is noted, including beneath pavements and structural elements unless otherwise noted. Gravel Borrow shall satisfy the requirements listed in MHD Specification Section M1.03.0, Type b. 3-inches largest dimension.

C. Although suitable excavated backfill materials and topsoil may be reused to fill to subgrade as specified herein, if there are insufficient quantities of materials available the Contractor shall furnish Suitable Backfill as specified in paragraph 2.02a below.

D. If approved by the Engineer, Suitable Backfill materials excavated from beneath pavements may be utilized as backfill from twelve (12) inches above the top of

pipes so long as all material over four (4) inches in size is removed from the material prior to backfilling and all trench compaction requirements may be met.

E. Where Sand Borrow is required, materials shall conform to Section M1.04.1 of the Massachusetts Standard Specifications. Utilize Sand Borrow as necessary for pipe bedding and cover.

F. Where Crushed Stone is required, materials shall conform to Section M2.01 of the Massachusetts Standard Specifications. Utilize Crushed Stone as necessary for granite block setting beds, backfill for sub-drains, and other details as noted in contract documents.

2.02 SUITABLE BACKFILL

A. All other materials to be placed where Specifications or Drawings call for "fill," "back-filling," or "filling" to subgrade, shall be natural soil, well-graded and free from all organic weak, compressible, and frozen materials, and shall contain no stone larger than four (4) inches in maximum dimension. It shall be of such nature and character that it can be dried and compacted and shall be free of all expansive materials (such as high plastic clays) and of materials subject to decay, decomposition, or dissolution, and shall conform to the following gradations:

U.S. Sieve No.	Total Percent Passing by Weight
4 inch	100
#4	20-75
#40	0-25
#200	0-5

B. If, sufficient suitable fill material is not available from excavations under this Contract, to complete filling to subgrades as specified above, additional fill, as specified under paragraph 2.02A above, shall be furnished by the Contractor from other sources at no additional cost. Excavated material from the site, and furnished material for use as Suitable Backfill, shall be deemed suitable only if they meet the requirements of paragraph 2.02A above, can be properly compacted, and are satisfactory to the Engineer.

C. Use Suitable Backfill compacted as specified for general grading as backfill except as specified herein; fill to sub-grades of proposed work where shown.

2.03 CRUSHED STONE FOR TRENCHES (IN WATER ONLY):

A. If trench excavations contain water, the Contractor shall substitute crushed stone, one and one-half (1-1 /2) inch minus, for bedding and backfill, in accordance with MHD Standard Specifications M2.01.2, at no additional cost to the Owner, to

three (3) inches above the standing water level; unless otherwise required by the Engineer.

2.04 GRAVEL BORROW:

All references to "Processed Gravel, "Gravel Borrow", or "Gravel" shall conform to the following:

A. All proposed gravel areas, utilizing salvaged or furnished materials shall conform to Section M1.03.0 Type "b", with maximum stone size two (2) inches in dimension, and Section 150 Embankment, of the Massachusetts Standard Specifications and shall consist of inert material that is hard, durable stone and coarse sand, free from loam and clay, surface coatings, and deleterious materials.

B. Gradation requirements for gravel borrow shall be determined by AASHO-T11 and T27 and shall conform to the following:

Sieve	Percent Passing
2"	100
1/2"	50-85
No. 4	40-75
No. 50	8-28
No. 200	0-10

C. Excavated materials from on-site may be utilized in all areas calling for gravel if they pass the test requirements for paragraph 2.04A above except that only stones above four (4) inches must be removed to reutilize the materials.

2.05 SAND BORROW:

A. The Sand Borrow shall consist of inert material that is hard durable coarse sand, free from loam, clay, roots, trash, frozen materials and other deleterious or organic materials. The sieve gradation requirements shall conform to the following:

	Percent By Weight Passing	
Size of Sieve	Minimum	Maximum
# 4	100	
# 16	55	80
# 50	10	25
#100	2	8
#200	0	2

PART 3 - EXECUTION

3.01 EXCAVATION AND FILLING:

A. Excavation and filling shall be executed to such depth that sufficient material will be left above the designated grade to allow for specified compaction to the required sub-grade. Should the Contractor, through negligence or other fault, excavate below the designated lines, he shall replace such excavation with approved materials, in an approved manner and condition, at his own expense.

B. When the plans require excavation in areas in proximity to existing sidewalks, structures and utilities, it shall be the responsibility of the Contractor, at his own expense, to provide adequate and suitable drainage away from proposed work and existing features or use other satisfactory means and methods to protect and maintain the stability of such construction within or adjacent to the limits of work.

C. Protect all existing trees, shrubs or other plan referenced features to remain. Hand excavate around all items to remain including tree roots or where utilities must be verified. Exposed tree roots shall be immediately covered with Loam Borrow in accordance with these specifications.

D. No roots greater than two (2) inches in diameter shall be cut from trees to remain without approval of the Engineer. Roots greater than one-half (1/2) inch in diameter that are cut or broken shall be promptly pruned to a smooth clean cut and painted with an approved compound.

E. Any removal of existing facilities required in order to achieve the excavation to proceed, such as fences, walls, walkways, etc., shall be accomplished by the Contractor at no additional cost to the Owner. Restoration of these facilities shall be to a condition equal to that before removal, and safe and operational to the satisfaction of the Engineer.

F. Excavation shall be performed to the lines, grades, and elevations shown on the plans or as required by the Engineer, and shall be made in such a manner that the requirements for formation of the subgrade can be followed.

G. No excavation shall be started until the Engineer has reviewed and acknowledged the area of proposed construction. All material encountered, of whatever nature within the limits indicated, shall be removed and disposed of as directed. During the process of excavation, the grade shall be maintained in such condition that it will be well drained at all times.

H. The planes at the bottom of the excavation (in cut), or the top of the fill, when completed, shall be known as the subgrade, and shall be true to the lines, grades

and cross section shown on the plans, to allow proposed work (base courses and finished courses) to be completed.

I. Hardpan, loose rock, boulders or other material unsatisfactory for subgrades shall be excavated to a depth as the Engineer may require below the contemplated subgrade. Muck, peat, matted roots or other yielding material unsatisfactory for subgrade foundation shall be removed to such depth as required to provide a satisfactory foundation. Unsatisfactory materials shall be disposed of by the Contractor. The portion so excavated shall be refilled with suitable backfill as specified, furnished or obtained from the grading operations, or gravel borrow, as required, and thoroughly compacted. Such excavation and filling beyond the limits called for on the plans shall be considered extra work and shall be processed accordingly. Solid ledge (not able to be removed by machine) or boulders (over 1 c.y.) encountered within the proposed work lines shall be removed as required by the Engineer and shall be considered extra work and processed accordingly. Clean off overburden for measurement by the Engineer and do not proceed without the written approval of the Engineer. Cross sections shall be taken and reviewed by the Engineer for quantity approval.

J. The removal of existing structures and utilities required to permit the orderly prosecution of the work shall be accomplished by the Contractor as directed and under this Section, unless otherwise shown on the plans. All existing foundations and structures shall be excavated to at least three (3) feet below the bottom of the proposed subgrade and the material properly disposed of offsite. All such excavations shall be back-filled with Suitable Backfill and compacted. Floors of structures to be abandoned shall be broken, to ensure drainage, at no additional cost.

K. All unsuitable excavated material shall be legally disposed of outside of, and away from, the project limits. All suitable excavated material deemed surplus by the Engineer shall become the property of the Contractor and shall be properly removed from the site.

L. The subgrade under areas to be paved shall be brought to proper line and grade by excavating and/or placement of compacted fill with suitable excavated material or gravel borrow as specified herein. Where filling is not required, the undisturbed subgrade shall be compacted according to the requirements stated herein.

M. Fills to subgrade level shall be formed of successive layers not exceeding lifts six (6) inches in depth and each layer shall be compacted to not less than 95 percent of maximum dry density of the material as determined by the standard AASHTO Test Designation T-180-86, Modified Proctor Test. Testing shall be done a minimum of 50 feet on center throughout the site where pavements are proposed.

N. No additional payment will be made for materials removed, manipulated or

replaced by the Contractor in order to obtain the specified density. Any removal, manipulation, aerating, replacement and re-compaction of materials necessary to obtain the required density shall be considered as incidental to the excavation and compaction operations and shall be performed by the Contractor at no additional cost.

O. Topsoil excavation and rehandling shall consist of discing and harrowing grassed and existing topsoil areas at ninety (90) degrees to each prior operation to minimum 12-inch depth or as specified by Engineer, and removing topsoil from all areas of proposed work and placing and grading the topsoil in embankment areas. Topsoil encountered below subgrade shall remain in place unless new paving is to be placed thereon and only as required by the Engineer. Then, such topsoil shall be excavated and rehandled, replaced with Suitable Backfill materials or gravel borrow and compacted as herein specified or as required by the Engineer.

P. All areas exhibiting grass or weed growth shall be tilled by disc/harrow or rototilled in two directions to completely break up sod clumps prior to stripping the topsoil, and shall be stored in stockpiles if necessary, to ensure organic matter decomposition. Such on-site stockpiled materials must be tested prior to reuse, and treated to prevent weed growth.

Q. After the areas to receive loam borrow or skinned infield (if required) mix have been brought to subgrade, and immediately prior to placing and spreading such material, the subgrade shall be loosened by discing or rototilling to a depth of at least three inches to permit bonding of the finished material to the subgrade material. Then place and spread the loam borrow or skinned infield material to the depths required by the Drawings to establish finish grades. Refer to Screened Loam Specifications and Skinned Infield Mix Specifications (as applicable).

R. Protect all existing areas against damage due to the work under this Contract, and perform all repair and replacement work to any such areas which are damaged hereunder.

S. Perform all excavation and back-filling required for the installation of subdrains, utility structures, and utility lines, and appurtenances required to the lines and grades shown on the Contract Drawings and as required by the Engineer.

T. No extra work shall be initiated without notification of the Engineer in writing, and the written approval of the Engineer in response.

U. The Contractor shall be responsible for any and all pumping or bailing necessary to complete his operations, and to keep all areas sufficiently dry to guarantee compaction in accordance with paragraph 3.01m. above.

V. Sawcut, with approved diamond-blade cutting device, at lines of all pavements to remain. Mark out prior to cutting for Engineer's approval.

W. Where insufficient suitable materials of any kind exist on site for incorporation into the proposed work within proposed work lines, the Contractor shall furnish materials from off site, as necessary and in accordance with these specifications, at no additional cost to the Owner.

3.02 DRAINAGE AND DEWATERING:

A. Upon entering the premises, the Contractor shall assume responsibility for site and surface drainage of all areas affected by its work and shall maintain such drainage during the life of this Contract in a manner acceptable to the Owner, at all times protecting and maintaining the existing conditions in adjacent areas.

B. Legally remove by pumping, draining or bailing all water that may accumulate or be found on the site within the contract limits where excavation and grading are to be done. Excavate and form all pump wells, sumps, dams, flumes or other necessary work to keep excavations entirely clear of water. Newly made and existing concrete and masonry shall be protected from injury resulting from dewatering work by the use of canvas, tar paper or by such other sufficient method. Maintain at all times upon the work sufficient and satisfactory pumping machinery, including standby equipment. Provide pump wells or well points and underdrains as may be required, where needed to properly handle the water. Maintain excavations free from water until date of acceptance of the project by the Owner.

C. Water from excavations shall be disposed of in such a manner as will not cause injury to public health nor to public or private property, nor to existing work, nor to the work completed or in progress, nor cause any interference with the use of the same by the public. Under no circumstances place concrete, place fill, or install appurtenances in excavations containing free water.

3.03 SHEETING AND BRACING:

A. The Contractor shall furnish, put in place, and maintain such sheeting and bracing, etc., as may be required to support the sides of the excavation and to prevent any movement of earth which could in any way diminish the width of the excavation below that necessary for proper construction, or otherwise injure or delay the work or endanger adjacent structures or personnel. If the Engineer is of the opinion that sufficient or proper supports have not been provided at any points, he may order additional supports put in at the expense of the Contractor.

B. Whenever possible, sheeting shall be driven ahead of the excavation to avoid loss of material from behind the sheeting. If necessary, to excavate below the sheeting, care shall be taken to avoid trimming behind the face along which the

sheeting will be driven. Care shall be taken to prevent voids outside of the sheeting, but if voids are formed, they shall be immediately filled with sand borrow and compacted.

C. The Contractor shall leave in place, to be embedded in the backfill, all sheeting, bracing, etc., which the Engineer may require it to leave in place at any time during the progress of the work, for the purpose of preventing injury to structures, personnel, utilities or property at no additional cost. Timber or steel sheeting and bracing to be left in place shall be cut-off at least two (2) feet below finish grade. This shall not constitute a waiver of the Contractor's responsibility to use his own judgement as to where sheeting shall be left in place, regardless of the Engineer's requirement.

D. All sheeting and bracing not to be left in place shall be carefully removed in such a manner as not to endanger the construction or other structures. All voids left or caused by withdrawal of sheeting shall be immediately back-filled with approved material and compacted by ramming with tools especially adapted to that purpose, by watering, or otherwise as may be directed.

3.04 TRENCH HAND EXCAVATION:

A. When approaching the vicinity of the dripline of trees to remain, any roots from vegetation on abutting properties, underground pipes, conduits, or other structures, or any suspected functioning underground features, digging by machinery shall be discontinued and the excavation shall be done by hand. Hand excavation shall also be undertaken when so required by the Engineer. Such hand excavation shall be considered incidental to the trench excavation and no additional compensation will be allowed.

B. Protection of Existing Structures - All existing pipes, conduits, poles, wires, fences, curbing, property line markers, and other structures which, in the opinion of the Engineer, are not required to be changed in location, shall be carefully supported and protected from injury by the Contractor, and in case of damage, they shall be restored by the Contractor without additional compensation, to as good a condition as that in which they were found.

3.05 BACKFILLING IN OPEN TRENCH:

A. As soon as practical after the pipe has been installed and tested, back-filling shall begin, and shall thereafter be prosecuted expeditiously.

B. Drainage pipe shall be back-filled with Suitable Backfill or Gravel Borrow from a plane one (l) foot above the top of the pipe to the proposed subgrade.

C. The area around the pipe shall be bedded with Sand Borrow and back-filled only

with suitable backfill material conforming to paragraphs 2.01D or 2.02B of this Specification, or Gravel Borrow from the mid-diameter of the pipe to twelve (12) inches above the top of the pipe. Substitute crushed stone as specified if water is encountered.

D. Water pipe shall be back-filled with Suitable Backfill material or Gravel Borrow from six (6) inches above the top of the pipe to the proposed subgrade. The area around the pipe shall be bedded and back-filled only with Sand Borrow per these specifications, to six (6) inches above the top of the pipe.

3.06 BASE COURSE:

A. The gravel shall be spread and compacted in layers not exceeding six (6) inches in depth compacted measurement and all layers shall be compacted to not less than ninety-five percent (95%) of the maximum dry density of the material as determined by the Standard AASHTO Test Designation T99 compaction test Method C at optimum moisture content as determined by the Engineer. If the material retained on the #4 sieves is fifty percent (50%) or more of the total sample this test shall not apply and the material shall be compacted to the satisfaction of the Engineer. The specific density of the Gravel Sub-base shall be maintained by determining the number of passes of a roller required to produce a constant and uniform density, after conducting a series of tests either using the sand/volume method or the nuclear device.

B. Compaction shall continue until the surface is even and true to the proposed lines and grades within a tolerance of three-eighths (3/8) inch above or below the required cross sectional elevations and to a maximum irregularity not exceeding three-eighths (3/8) inch under a ten (10) foot line extended longitudinally. Any specific area of gravel sub-base which, after being rolled, does not form a satisfactory, solid, stable foundation shall be removed and replaced and/or recompacted by the Contractor without extra compensation.

C. All tests for compaction shall be as ordered by the Engineer and paid for by the Contractor, regardless of their result.

3.07 SAND BORROW:

A. The Contractor shall deliver, spread and compact Sand Borrow to conform to the lines and grades shown on the plans, and shall spread and compact the Sand Borrow in no greater than six (6) inch layers.

B. Compaction shall continue until the surface is even and true to the proposed lines and grades indicated on the plans or as required by the Engineer.

C. Sand shall not be placed if it is excessively moist and unable to be satisfactorily

spread and compacted.

D. Compaction for Sand Borrow shall be not less than ninety-five percent (95%) of the maximum dry density as determined by the standard AASHTO-T99, Standard Proctor Test.

E. Compaction of the sand and any adjoining embankment material shall be done simultaneously so that the respective materials will be confined substantially to the indicated lines.

F. Sand borrow shall be graded to a true even surface to the proposed lines and grades within a tolerance of three-eighths (3/8) inches above or below the required elevation.

G. Any tests of materials, and/or compaction, shall be as ordered by the Engineer and paid for by the Contractor regardless of their result. Percolation tests to be verified in the field by Engineer.

END OF SECTION

SECTION 31 23 19

DEWATERING

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION I – GENERAL REQUIREMENTS, which are hereby made a part of this Section of the Specifications.

1.02 DESCRIPTION OF WORK

This section specifies designing, furnishing, installing, maintaining, operating and removing temporary dewatering systems as required to lower and control water levels and hydrostatic pressures during construction; disposing of pumped water; constructing, maintaining, observing and, except where indicated or required to remain in place, removing of equipment and instrumentation for control of the system.

1.03 RELATED WORK:

A. Section 31 00 00, EARTHWORK

B. Section 31 50 00, SUPPORT OF EXCAVATION

1.04 SYSTEM DESCRIPTION:

A. Dewatering includes lowering the water table and intercepting seepage which would otherwise emerge from the slopes or bottom of the excavation; increasing the stability of excavated slopes; preventing loss of material from beneath the slopes or bottom of the excavation; reducing lateral loads on sheeting and bracing; improving the excavation and hauling characteristics of sandy soil; preventing rupture or heaving of the bottom of any excavation; and disposing of pumped water.

1.05 QUALITY ASSURANCE:

A. The Contractor is responsible for the adequacy of the dewatering systems.

B. The dewatering systems shall be capable of effectively reducing the hydrostatic pressure and lowering the groundwater levels to a minimum of 2 feet below excavation bottom, unless otherwise directed by the Department, so that all excavation bottoms are firm and dry.

C. The dewatering system shall be capable of maintaining a dry and stable subgrade until the structures, pipes and appurtenances to be built therein have been completed to the extent that they will not be floated or otherwise damaged.

D. The dewatering system and excavation support (see Section 31 50 00, SUPPORT OF EXCAVATION) shall be designed so that lowering of the groundwater level outside the excavation does not adversely affect adjacent structures, utilities or wells.

1.06 SUBMITTALS

A. Contractor shall submit six copies of a plan indicating how they intend to control the discharge from any dewatering operations on the project, whether it is discharge of groundwater from excavations or Stormwater runoff during the life of the project.

1.07 REGULATIONS, FEES AND PERMITS

All materials and the installation thereof shall conform to the requirements of all Federal, State and local laws, rules and regulations and codes pertaining thereto. Where Provisions of the Contract drawings conflict with any codes, rules and regulations, the laws, codes or regulations shall govern.

All legally imposed charges made by local authorities for the work of this Section involving the connection, inspection and approval services of all bureaus administering all applicable codes and regulations shall be provided hereunder at no additional expense to the Department.

The Contractor shall give the proper authorities all required notices or information relating to work in his charge, pay all fees necessary to obtain all official licenses, permits and certificates, and comply with the rules of the Massachusetts Department of Public Safety.

PART 2 - PRODUCTS: NOT APPLICABLE

PART 3 - EXECUTION

3.01 DEWATERING OPERATIONS:

A. All water pumped or drained from the work shall be disposed of in a manner that will not result in undue interference with other work or damage to adjacent properties, pavements and other surfaces, buildings, structures and utilities. Suitable temporary pipes, flumes or channels shall be provided for water that may flow along or across the site of the work.

B. Dewatering facilities shall be located where they will not interfere with utilities and construction work to be done by others.

C. Dewatering procedures to be used shall be as described below:

1. Crushed stone shall encapsulate the suction end of the pump to aid in minimizing the amount of silt discharged.

2. For dewatering operations with relatively minor flows, pump discharges shall be directed into silt fence sedimentation traps lined with filter fabric. Water is to be filtered through the silt fence and filter fabric prior to being allowed to seep out into its natural watercourse.

3. For dewatering operations with larger flows, pump discharges shall be into a steel dewatering basin. Steel baffle plates shall in used to slow water velocities to increase the contact time and allow adequate settlement of sediment prior to discharge into waterways.

4. Where indicated on the contract drawings or in conditions of excess silt suspended in the discharge water, silt control bags shall be utilized in catch basins.

D. The Contractor shall be responsible for repair of any damage caused by his dewatering operations, at no cost to the Department.

END OF SECTION

SECTION 31 50 00

SUPPORT OF EXCAVATION

PART 1 - GENERAL

1.01 WORK INCLUDED:

A. This section covers wood and steel sheeting or soldier piles and lagging with internal bracing for support of excavations. The requirements of this section shall also apply, as appropriate, to any methods of excavation support and underpinning which the Contractor elects to use to complete the work.

B. The Contractor shall furnish and place timber or steel sheeting or soldier piles and lagging of the kinds and dimensions required, complying with these specifications, where required by regulation, indicated on the drawings or required by the Engineer.

C. Vibration monitoring shall be provided during installation and extraction of sheeting whenever the braced excavation is adjacent to existing structures, in critical areas as noted in the contract documents, or as requested by the Engineer.

D. Routine monitoring of the in-place excavation support system shall be provided.

1.02 RELATED WORK:

A. Section 31 00 00, EARTHWORK

B. Section 31 23 19, DEWATERING

1.03 QUALITY ASSURANCE:

A. This project is subject to the Safety and Health regulations of the U.S. Department of Labor set forth in 29 CFR, Part 1926, and to the Massachusetts Department of Labor. Contractors shall be familiar with the requirements of these regulations.

B. The Contractor is responsible for the adequacy of the excavation support system and shall retain the services of a Professional Engineer registered in the Commonwealth of Massachusetts to design the required excavation support systems. The Contractor's Professional Engineer shall practice in a discipline applicable to excavation work, shall have experience in the design of excavation support systems and shall design in conformance with OSHA requirements. The Contractor's Professional Engineer shall provide sufficient on-site inspection and supervision to assure that the excavation support system is installed and functions in accordance with his design. Criteria listed herein defining the responsibilities of the Contractor's Professional Engineer are minimum requirements.

1.04 REFERENCES:

The following standards form a part of this specification as referenced herein.

American Society for Testing and Materials (ASTM)

ASTM	A6	General Requirements for Rolled Steel Plates, Shapes, Sheet Piling, and Bars for Structural Use
ASTM	A328	Steel Sheet Piling

1.05 SUBMITTALS:

A. At least three weeks before starting installation of the excavation support system, the Contractor shall submit the attached Certificate of Design completed and signed by the Contractor and the Professional Engineer, identifying the Contractor's Professional Engineer who will be responsible for design of the excavation support system, and including, for record purposes only:

1. An overall time schedule for construction of the braced excavation system.

2. A description of the anticipated sequence of construction.

3. Three (3) copies each of:

a. Complete details of braced excavation methods, equipment and sizes and lengths of materials proposed to be used.

b. Details of vibration monitoring devices and reports.

c. Details of the means and methods that will be used in monitoring the integrity of the support system during its entire period of use to insure the safety of the excavation.

d. Complete computations for the design of the braced excavation system bearing the seal of the responsible, licensed Professional Engineer in the Commonwealth of Massachusetts, experienced in the practice within a discipline applicable to excavation work.

e. Any other pertinent data required for record purposes by the Engineer.

B. Receipt of the information by the Engineer will not relieve the Contractor of the sole responsibility for the adequacy of the braced excavation system, and for assuring that there will be no resulting damage to adjacent pavement, utilities or structures, and for providing safe conditions within the sheeted areas.

C. Further for the record, upon completion of the work of this section, the Contractor shall submit 3 copies of all records of survey, vibration monitoring and inspection of existing structures to the Owner's Engineer.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. Timber sheeting shall be sound spruce, pine, or hemlock, and either tongue and grooved or splined. Timber sheeting shall not be less than nominal 2-inches thick.

B. Where steel sheet piling is indicated on the drawings or installation is ordered by the Engineer or required by OSHA standards, the material shall be of such size and strength as required by the excavation support design prepared and submitted by the Contractor's Professional Engineer. Steel sheet piling may be new or used material but shall not contain splices, cutouts, patches, or other alterations which would impair its integrity or strength. Steel sheeting shall be an approved standard section, weighing not less than 22 pounds per square foot of wall and conforming to ASTM A6 and A328.

C. Where soldier piles and lagging are used, the steel piles shall conform to ASTM A6, and the lagging shall meet the requirements for timber sheeting, as defined above.

D. Timber and steel used for bracing shall be of such size and strength as required in the excavation support design prepared and submitted by the Contractor's Professional Engineer. Timber or steel used for bracing shall be new or undamaged used material, which does not contain splices, cutouts, patches, or other alterations, which would impair its integrity or strength.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Work shall not be started until all materials and equipment necessary for construction are either on the site of the work or satisfactorily available for immediate use as required.

B. The sheeting/lagging shall be sufficiently tight to minimize any resulting lowering of the groundwater level outside the excavation, as required in Section 31 23 19, DEWATERING.

C. The sheeting/piling shall be driven by approved means to the design elevation. No ends or edges of sheeting/piling shall be left exposed in a manner, which could create a possible hazard to safety of the public or a hindrance to traffic of any kind.

D. If boulders or very dense soils are encountered, making it impractical to drive a sheeting/piling section to the desired depth, the section shall be treated as directed by

the Contractor's Engineer.

E. Within seven days of completing the initial installation of the earth support system, the Contractor shall submit a certification from his Professional Engineer, stating that the excavation support system as installed is in general compliance with the design or approved modifications thereto.

F. The sheeting/piling shall be left in place where indicated on the drawings or required by the Engineer in writing. At all other locations, the sheeting/piling may be left in place or salvaged at the option of the Contractor. Wood or steel sheeting/piling permanently left in place shall be cut off at a depth of not less than two feet below finish grade unless otherwise required.

G. All cut-off material is the property of the Contractor and shall be promptly removed by it from the site.

H. The satisfactory construction and maintenance of the excavation support system, complete in place, shall be the responsibility of the Contractor.

I. The Contractor shall be responsible for promptly repairing all damage to adjacent structures caused by the installation, performance, or removal of the excavation support system.

END OF SECTION

(Certificate of Design follows this page)

CERTIFICATE OF DESIGN

RE: Contract between
OWNER: _____
(Name)
and
CONTRACTOR: _____
(Name)
on
CONTRACT: _____
(Title)

_____
(Number) (Date)

The undersigned hereby certify that the engineer listed below:

1. Is licensed or registered to perform professional engineering work in the state of _____;
(Location of Project)

2. Is qualified by education and training to design the _____

specified in Section_____of subject contract;

3. Has previously designed comparable excavation support systems;

4. Has prepared the design in full compliance with the requirements of subject contract, including all applicable laws, regulations, rules, and codes; and

5. Will inspect and supervise installation of the excavation support system and will monitor the in-place system to confirm that the system is installed and functions in accordance with the design.

CONTRACTOR	ENGINEER
By:_____	By:_____
(Signature)	(Signature)
_____	_____
(Name)	(Name)
_____	_____
(Title)	(Engineering Discipline)
_____	_____
(Date)	(Date)

SECTION 32 12 00

PAVING

PART 1 - GENERAL

1.01 WORK INCLUDED:

The Contractor shall furnish all labor, materials and equipment and shall replace the pavements as indicated on the drawings and as herein specified.

1.02 RELATED WORK:

A. Section 00 31 43, PERMITS

B. Section 31 00 00, EARTHWORK

1.03 SYSTEM DESCRIPTION:

A. GENERAL

The types of pavement systems to be utilized on this project are as follows:

TYPE 1. PERMANENT TRENCH PAVEMENT

PAVEMENT SCHEDULE

B. TYPE 1. PERMANENT TRENCH PAVEMENT

Areas shall be paved with temporary trench binder course pavement, 2.5 inches thick, as soon as practicable after installation of individual pipeline segments. Temporary pavement shall be maintained a minimum of 90 days prior to installation of permanent trench binder course pavement, 2.5 inches thick and permanent trench top course pavement, 1-1/2 inches thick. This may require that the temporary pavement be maintained until the following year, at which time the permanent pavement shall be installed. Permanent trench binder course and trench top course pavement shall be installed only with the approval of the Engineer.

1.04 REFERENCES

The following standards form a part of these specifications and indicate the minimum standards required:

American Society for Testing and Materials (ASTM)

ASTM D1557 Test for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 Pound Rammer and 18-Inch Drop

Massachusetts Department of Transportation (MassDOT)
Standard Specifications for Highways and Bridges

MassDOT 403 Reclaimed Base Course

MassDOT 405 Gravel Base Course

MassDOT 420 Hot Mix Asphalt Base Course

MassDOT 460 Hot Mix Asphalt Pavement

MassDOT 476 Cement Concrete Pavement

MassDOT 482 Sawcutting

MassDOT 860 Reflectorized Pavement Markings

Federal Specifications

SS-S-1401 Sealants, Joint, Non-Jet-Fuel-Resistant, Hot Applied, for Portland Cement and Asphalt Concrete Pavement

AASHTO Standard Specifications for Materials and Methods of Sampling and Testing

1.05 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF GENERAL SPECIFICATIONS, SUBMIT THE FOLLOWING:

Six sets of complete job mix formula shall be submitted to the Engineer at least two weeks before any of the work of this section is to begin.

PART 2 - PRODUCTS

2.01 GRAVEL SUBBASE:

A. Gravel subbase shall consist of inert material that is hard durable stone and coarse sand, free from loam and clay, surface coatings and deleterious materials.

B. Gradation requirements for gravel subbase shall be as specified in Section 31 00 00, EARTHWORK for Gravel Borrow.

2.02 RECLAIMED SUBBASE:

A. Reclaimed subbase shall consist of crushed asphalt pavement, crushed cement concrete, and gravel borrow (as specified in paragraph 2.01) uniformly pre-mixed.

B. Reclaimed subbase mixtures shall be within the composition limits in accordance with MassDOT M1.11.0, with constituents that conform to Table A, below.

C. The approved source of reclaimed pavement borrow material shall be processed by mechanical means. The equipment for producing crushed material shall be of adequate size and with sufficient adjustments to produce the desired materials. The processed material shall be stockpiled in such a manner as to minimize segregation of particle sizes. All reclaimed pavement borrow material shall come from approved stockpiles.

2.03 HOT MIX ASPHALT PAVEMENT:

A. Pavements shall consist of hot mix asphalt.

B. Pavement mixtures shall be within the composition limits of base courses, binder courses, top courses and surface treatment, in accordance with MassDOT M3.11.03, with constituents that conform to Table A, below.

TABLE A

PERCENT BY MASS PASSING SIEVE DESIGNATION

							Low Permeability	
Standard Sieves (in.)	Reclaimed Subbase	Base Course	Binder Course	Top Course	Mod. Top Course	Surface Treat.	**Dense Binder Course**	**Dense Top Course**
3 in	100							
2 in		100						
1-1/2 in	70-100							
1 in		57-87	100		100		**100**	
¾ in	50-85		80-100		95-100		**80-100**	
5/8 in				100				
½ in		40-65	55-75	95-100	79-100		**65-80**	**100**
3/8 in				80-100	68-88	100		**80-100**
No.4	30-60	20-45	28-50	50-76	48-68	80-100	**48-65**	**55-80**
No.8		15-33	20-38	37-49	33-46	64-85	**37-49**	**48-59**
No.16				26-40	20-40	46-68		**36-49**
No.30		8-17	8-22	17-29	14-30	26-50	**17-30**	**24-38**

Standard Sieves (in.)	Reclaimed Subbase	Base Course	Binder Course	Top Course	Mod. Top Course	Surface Treat.	**Low Permeability Dense Binder Course**	**Low Permeability Dense Top Course**
No.50	8-24	4-12	5-15	10-21	9-21	13-31	**10-22**	**14-27**
No.100				5-16	6-16	7-17		**6-18**
No.200	0-10	0-4	0-5	2-7	2-6	3-8	**0-6**	**4-8**
Binder		4-5	4.5-5.5	5.6-7.0	5.1-6	7-8	**5.1-6**	**7-8**

Percentages shown for aggregate sizes are stated as proportional percentages of total aggregate for the mix.

Unless authorized by the Engineer, no Job-Mix Formula will be approved which specifies:

More than 45% passing No. 8 for Top and Dense Binder Courses
More than 38% passing No. 8 for Modified Top Course
More than 55% passing No. 8 for Dense Mix
Less than 4% passing No. 200 for Top Course.
Less than 6% bitumen for Top Course.

C. The joint sealant shall be a hot poured rubberized emulsified asphalt sealant meeting the requirements of FS SS-S-1401.

D. The tack coat shall be an asphalt emulsion, RS-1 if required, conforming to MassDOT Section M3.03.0.

2.04 SEAL COAT:

A. Seal coats shall be within the composition limits for protective seal coat emulsion in accordance with MassDOT M3.03.3.

B. Silica sand when blended with seal coat emulsion shall be No. 30 silica sand.

2.06 PAVEMENT MARKINGS:

A. Pavement markings shall conform to the requirements of MassDOT 860.

B. The mixture of the marking material shall be within the composition limits for reflectorized pavement markings as described in the MassDOT Specifications as follows:

1. Fast drying traffic paint - M7.01.10/11.

C. Application of the glass beads to be used as reflector material on the striping shall conform to Sections 860.62 and M7.03.07 of the MassDOT Specifications.

PART 3 - EXECUTION

3.01 GENERAL:

Paving courses required for the project shall be as shown on the drawings and as specified herein. Pavement thicknesses specified are measured in compacted inches. If a pavement course thickness exceeds 2-1/2 compacted inches, the course shall be installed in multiple lifts with each lift not exceeding 2-1/2 compacted inches in thickness.

3.02 GRAVEL SUBBASE:

A. The gravel subbase to be placed under pavement shall consist of 12-inches of gravel evenly spread and thoroughly compacted.

B. The gravel shall be spread in layers not more than 4-inches thick, compacted measure. All layers shall be compacted to not less than 95 percent of the maximum dry density of the material as determined by ASTM D1557 Method C at optimum moisture content.

3.03 RECLAIMED SUBBASE:

A. The reclaimed borrow material to be placed under the pavement shall consist of 12-inches of reclaimed borrow material evenly spread and thoroughly compacted.

B. The reclaimed borrow material shall be spread and compacted in layers not exceeding 4-inches thick, compacted measure, except the last layer of reclaimed pavement borrow material shall be 2-inches thick, compacted measure. All layers shall be compacted to not less than 95 percent of the maximum dry density of the material as determined by ASTM D1557 Method C at optimum moisture content.

3.04 TEMPORARY BITUMINOUS PAVEMENT:

A. Where specified and required by the Engineer and after placement of the gravel subbase, the Contractor shall place temporary bituminous pavement above the trench, between the edges of the existing pavement. It shall consist of hot mix asphalt, 1.5-inches thick, in accordance with MassDOT 460.

B. The temporary pavement shall be repaired as necessary to maintain the surface of the pavement until replaced by permanent pavement. When so required by the Engineer, the Contractor shall remove the temporary pavement and install or regrade the subbase for installation of permanent pavement.

3.05 PERMANENT BITUMINOUS PAVEMENT:

A. The bituminous paving mixture, equipment, methods of mixing and placing, and the precautions to be observed as to weather, condition of base, etc., shall be in accordance with MassDOT 460.

B. BASE COURSE AND BINDER COURSE PAVEMENT:

1. Immediately prior to installing the base and/or (**dense**) binder course, the trimmed edges shall be made stable and unyielding, free of loose or broken pieces and all edges shall be thoroughly broomed clean. Contact surfaces of trench sides, curbing, manholes, catch basins, or other appurtenant structures in the pavement shall be painted thoroughly with a uniform coating of asphalt emulsion (tack coat), just before any mixture is placed against them.

2. The (**dense**) binder course shall be repaired as necessary to maintain the surface of the pavement until placement of the permanent overlay. If required, the Contractor shall place a leveling course before placing the permanent overlay.

C. TOP COURSE OR SURFACE TREATMENT PAVEMENT (PERMANENT OVERLAY):

1. Top course or surface treatment shall be placed over the trench or full width as shown on the drawings or as specified.

2. Prior to placement of the top course or surface treatment, the entire surface over which the top course or surface treatment is to be placed shall be broom cleaned and tack coated.

3. Top course or surface treatment pavement placed over trenches may be feathered to meet existing paved surfaces, if approved by the Engineer.

4. Prior to placing full width top course or surface treatment pavements, keyways shall be cut in all intersecting streets.

3.06 PAVEMENT PLACEMENT:

A. Unless otherwise permitted by the Engineer for particular conditions, only machine methods of placing the pavement shall be used. The equipment for spreading and finishing shall be mechanical, self-powered pavers, capable of spreading and finishing the mixture true to line, grade, width and crown. The mixtures shall be placed and compacted only at such times as to permit proper inspection and checking by the Engineer.

B. After the paving mixtures have been properly spread, initial and intermediate compaction shall be obtained by the use of steel wheel rollers having a weight of not less than 240 pounds per inch width of tread.

C. Final rolling of the top course or surface treatment pavement shall be performed by a steel wheel roller weighing not less than 285 pounds per inch width of tread at a mix temperature and time sufficient to allow for final smoothing of the surface and thorough compaction.

D. Immediately after placement of top course or surface treatment pavement, all joints between the existing and new top course or surface treatment pavements shall be sealed with hot poured rubberized asphalt joint sealant.

E. Where there is no backing for the edges of the curb-to-curb pavement, the Contractor shall provide a gravel transition. The gravel transition shall be installed immediately after the pavement is placed, shall be feathered and extend a minimum of 18-inches, and shall be compacted using the same equipment as for pavement compaction. The gravel shall be uniformly graded material with a maximum size of 3/8- to ½-inch.

F. When required by the Engineer, the Contractor shall furnish and install additional paving to provide satisfactory transition for driveways and walkways impacted by a new curb-to-curb pavement installation. The transition installation will be considered incidental to the curb-to-curb pavement installation.

3.07 ADDITIONAL PAVING:

A. If the Engineer determines that the existing bituminous concrete pavement on local streets is thicker than the permanent pavement specified herein, the Contractor may be required to install hot mix asphalt to obtain the depth of the existing pavement.

B. If for the installation of full width paving, the Engineer determines that the existing road surface requires additional leveling pavement, then the Contractor shall install additional hot mix asphalt to bring the section to proper line and cross section. Additional paving required to restore the proper line and cross section of binder course installed by the Contractor which has become rough and uneven shall be furnished and installed at the expense of the Contractor.

3.08 PARKING LOTS AND DRIVEWAYS:

A. Pavement shall consist of a 2.5-inch binder course and a 1-1/2-inch top course on a 12-inch gravel sub-base. All thicknesses are compacted thicknesses.

B. Adjacent concrete work, slate work, sidewalks, structures, etc., shall be protected from stain and damage during the entire operation. Damaged or stained areas shall be replaced or repaired to equal their original condition.

C. All joints between binder and top course shall be staggered a minimum of 6-inches.

D. After final rolling, no vehicular traffic of any kind shall be permitted on the pavement until it has cooled and hardened sufficiently to prevent distortion and loss of fines, and in no case in less than 6 hours.

E. Smoothness of all areas of the finished surface shall not vary more than 1/4-inch when tested with a 16 foot straight-edge, applied both parallel to and at right angles to the centerline of the paved area. At building entrances, curbs, and other locations where an essentially flush transition is required, pavement elevation tolerance shall not exceed plus or minus 1/8-inch. Irregularities exceeding these amounts, or which retain water on the surface, shall be corrected by removing the defective work and replacing or repairing it to the satisfaction of the Engineer.

F. The surface area to be seal coated, as shown on the drawings, shall be swept and air cleaned. The first coat shall be applied with eight (8) pounds of #30 silica sand blended with each gallon of emulsion applied at a rate of 0.15 gallons per square yard. The second coat shall be a straight sealer applied at the rate of 0.1 gallons per square yard.

G. The Contractor shall prepare the pavement surface for painting lines according to the recommendations of the paint manufacturer. Applied markings shall have clean-cut edges, true and smooth alignment and uniform film thickness of 15 mils, +/- 1.0. The Contractor shall be responsible for removing, to the satisfaction of the Engineer, tracing marks, and spilled paint applied in an unauthorized area.

3.09 RAISING AND ADJUSTING CASTINGS:

A. In areas of permanent top course paving, existing municipally-owned catch basin and manhole castings and valve boxes shall be raised to the proper grade where required by the Engineer.

B. Castings owned by private utilities shall be raised by their own forces. The Contractor shall be responsible for coordinating this work.

C. The method of adjusting these castings shall be as follows: Cut around catch basin or manhole castings a minimum of 8-inches from casting. Excavate and if required rebuild up to 12-inches of masonry below the bottom of the casting. Backfill with suitable material and compact to bottom of casting. Place high, early strength cement or bituminous concrete collar, as directed, to approximately 1½-inches below the raised casting grade. Masonry work shall conform to Section 33 39 13, PRECAST MANHOLES AND CATCH BASINS.

D. In some areas, raising of castings may not be required. Where required by the Engineer, castings not to be raised shall have at least 12-inches of bituminous concrete pavement

chipped and removed around the casting. New bituminous concrete pavement shall be placed and compacted around such castings to approximately 1-1/2-inches below the top of the casting. The overlay course shall then be sloped down to the level of the casting.

E. The method of raising valve boxes shall be as follows: Cut around valve box a minimum of 8-inches from valve box. Excavate as required and raise the valve box. Pour high early strength cement or bituminous concrete collar, as directed, to approximately 1-1/2-inches below the top of the valve box.

F. Castings which need to be raised or adjusted to complete permanent curb to curb paving shall be done immediately prior to paving.

3.10 PAVEMENT MARKINGS:

A. The Contractor shall replace all pavement markings removed or covered-over in carrying out the work, and as required by the Engineer, no sooner than 48 hours after completion of permanent pavement. The markings shall be 4-inches wide, white or yellow, single or double lines as required.

B. When required by the Engineer, the Contractor shall provide temporary markings at no additional cost to the Owner.

3.11 PAVEMENT REPAIR:

A. If required in the contract or if permanent pavement becomes rough or uneven, permanent pavement patches and trenches shall be repaired and brought to grade utilizing "infrared" paving methods following completion of the construction.

B. The Contractor performing the work shall use care to avoid overheating the pavement being repaired.

C. Pavement repair shall extend a minimum of 6-inches beyond all edges of the pavement patch to assure adequate bonding at the pavement joints.

END OF SECTION

SECTION 32 17 23

PARK SIGNAGE

PART 1 – GENERAL

1.01 WORK INCLUDED

A. The work of this Section consists of a park sign and related items as indicated on the Drawings and/or as specified herein and includes, but is not limited to, the following:

1. Signage

1.02 REFERENCES

A. The General Documents, as listed on the Table of Contents, and applicable parts of Division 1, GENERAL REQUIREMENTS, shall be included in and made a part of this Section.

B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this trade.

1.04 STANDARDS

A. The following standards including all current amendments form a part of these Specifications:

1. American Society for Testing and Materials (ASTM):

A36	Structural Steel
A53	Pipe, Steel, Black and Hot-Dipped, Zinc Coated, Welded and Seamless
A120	Pipe, Steel, Black and Hot-Dipped Zinc Coated (Galvanized), Welded and Seamless, for Ordinary Uses
A307	Carbon Steel Externally and Internally Threaded Standard Fasteners
A325	High Strength Bolts for Structural Steel Joints
A500	Cold Formed Welded and Seamless Carbon Steel Structural Tubing Rounds and Shapes

2. American Welding Society (AWS):

D1.1	Structural Welding Code

3. Steel Structures Painting Council (SSPC):

SSPC	Surface Preparation Specifications

1.05 SAMPLES AND SUBMITTALS

A. At least thirty days prior to intended use, the Contractor shall provide the following samples and submittals for approval in conformance with requirements this specification. Do not order materials until Landscape Architect's approval of samples, certifications or test results have been attained. Delivered materials shall closely match the approved samples.

1. Shop Drawings: Submit detailed shop drawings for each item required to be fabricated or installed under work of this Section. Include plans, sections, and details as required to show completely materials, layout, jointing, clearances and connections for all items required. Shop drawings for handrails at stairs and at other site conditions requiring accurate dimensional relationships to as-built construction shall be prepared following a review and confirmation of as-built measurements and conditions for areas scheduled to receive miscellaneous metal items. Submit shop drawings for the following:

    a. Signage

2. Material Samples: Submit samples for each material for the following:

    a. Sheet metal material and finishes – submit three (3) samples of finishes for brushed stainless steel per manufacturer’s recommendation and Owner’s direction.

PART 2 - PRODUCTS

2.01 12” x 18” LWCF SIGN

A. The contractor shall furnish and install one (1) sign: a 12-inch by 18-inch Land and Water Conservation Fund (LWCF) sign, which will temporarily replace the granite marker removed and stored for reinstallation in the future.

B. The Owner shall provide the artwork to be displayed on the sign.

C. The Owner or Owner’s Representative shall determine the location of this sign in the field prior to its installation.

D. The Shop drawings for the sign will then be produced for review, comment and approval prior to final manufacturing.

2.02 MISCELLANEOUS HARDWARE

A. Miscellaneous stainless steel hardware as required to affix the sign to the existing chain link fence shall be 18-8 stainless steel (AISI Type 304).

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B. Bolts (if needed): 3/8" Dia. SS Kwik Bolt II Expansion Anchor – Countersunk Version by HILTI Inc., PO Box 21148, Tulsa, OK, 74121

C. All steel for the sign shall conform to ASTM-A53-67A and all galvanizing shall conform to ASTM-A-123.

PART 3 - EXECUTION

3.01 MISCELLANEOUS HARDWARE

A. All anchoring systems employed shall be vandal-proof.

3.02 TOUCH-UP OF SURFACES

A. After erection, all scratches or abrasions in the color galvanized surface shall be repaired or replaced to the satisfaction of the Engineer

END OF SECTION

SECTION 32 31 29

WOOD SCREEN FENCE

PART 1 - GENERAL

1.01 WORK INCLUDED:

This section covers the horizontal wood screen fence, also called 'horizontal wood slat fence', complete as indicated on the drawings and specified herein.

1.02 SYSTEM DESCRIPTION:

The fence shall be dimensioned as shown on the drawings, with gates provided in the located as indicated.

1.03 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF GENERAL SPECIFICATIONS, SUBMIT THE FOLLOWING:

A. Six sets of manufacturers literature of the materials specified herein shall be submitted to the Owner's Representative for review.

B. Six sets of shop drawings of the fence and the proposed color shall be submitted to the Owner's Representative for review.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. All fencing shall be fabricated of Ipe. All lumber shall be sound, straight, well-seasoned and rough sawn.

B. All fencing shall be shop fabricated with all holes pre-drilled as required for on-site assembly.

D. The fence boards shall be 2-inch thick, 3-inch thick, or 4-inches thick, nominally in the arrangement and as dimensioned on the drawings.

E. The fence shall be factory pre-stained with a color approved by the Owner's Representative.

2.02 HARDWARE:

A. All gate hardware shall be double hot dip galvanized.

B. All bolts, washers, nuts, etc. shall be in accordance with the requirements of AASHTO-M183 and shall be galvanized after fabrication to meet the requirements of ASTM A153.

C. Gate latches shall be self-closing and include provisions for padlocks.

D. A padlock and two sets of keys shall be furnished for each gate by the Contractor.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Unless otherwise directed, the Owner's Representative shall be on-site during entire fence installation.

B. Gate latch location shall be approved by District prior to installation.

C. Fence boards shall be installed straight and true, parallel and plumb.

D. Install gates plumb, level, and secure for full opening without interference. Adjust hardware for smooth operation.

END OF SECTION

SECTION 32 92 19

SEEDING

PART 1 - GENERAL

1.01 WORK INCLUDED:

A. This Section includes furnishing all labor, materials, equipment, seed and incidental materials necessary to accomplish all grass seeding and related work, complete in place, maintained, and accepted, in accordance with the Contact Drawings and Specifications. All grassed areas disturbed by the Contractor's operations shall be repaired as herein specified.

B. The Contractor shall bear the responsibility and cost of furnishing and applying water or any other substances, as necessary to ensure the sustainability of grass seeded areas, as part of the work of this contract.

1.02 RELATED WORK:

A. Section 31 05 13.13, LOAM BORROW

B. Section 32 93 00, SHRUBS AND LANDSCAPING

1.03 SUBMITTALS:

A. In accordance with requirements of general specifications, the Contractor shall submit the following to the Engineer for review and approval:

B. Six copies of information for seed mixes including the following:

1. Name and address of the seed supplier.

2. Source of origin and dates of harvest for each of the various types of seed

3. Certification of seed mix composition and proportion, indicating named seed varieties by percent, percent germination, purity, and percent crop seed, percent inert matter, and percent weed seed content.

4. Estimated number of seeds per pound of each type of seed in the mix

C. Six copies of information detailing proposed limestone, fertilizers, insecticides, herbicides, fungicides, mulch materials, hydroseeding materials (as required), and slope protection material (as required) to be applied to seeded areas.

D. Six copies of watering, fertilizing and maintenance schedule.

E. Six copies of marked up prints indicating the square footage of all proposed seeded areas with quantities of various soil additives and amendments, and quantities of seed for each area prior to beginning work.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. LOAM BORROW:

1. Loam Borrow shall be as specified in Section 31 05 13.13, LOAM BORROW.

B. LIMESTONE:

1. Lime shall be an approved agricultural limestone containing at least 50 percent total oxides (calcium oxide and magnesium oxide). The material will be ground such that 50 percent of the material will pass through a No. 100 mesh sieve and 98 percent will pass a No. 2 mesh sieve. Lime shall be uniform in composition, dry and free-flowing and shall be delivered to the site in the original sealed containers, each bearing the manufacturer's guaranteed analysis.

C. FERTILIZER:

1. Fertilizer shall be a complete, standard commercial fertilizer, homogenous and uniform in composition, dry and free-flowing, and shall be delivered to the site in the manufacturer's original sealed containers, each bearing the manufacturer's guaranteed analysis and marketed in compliance with State and Federal Laws. All fertilizer shall be used in accordance with the manufacturer's recommendations.

2. The analysis for supplemental maintenance fertilizer shall have a ratio of Nitrogen (N) – Phosphorous (P) – Potassium (K) of approximately 4 – 1 – 2 and shall be applied to deliver 1 pound of Nitrogen per 1000 square feet, or as approved by the Engineer. At least 50 percent of nitrogenous elements shall be Urea-form or derived from organic sources and contain no less than 3 percent water soluble Nitrogen.

D. SEED:

1. Seed shall be of an approved perennial variety mixture, the previous year's crop, clean, and high in germinating value. Weed seed content shall be less than 0.5 percent and include no noxious weeds. Seed shall be obtained from a reliable seed company and shall be accompanied by certificates of compliance relative to mixture purity and germinating value. Seed shall be furnished and delivered in new, clean, sealed and properly labeled containers. All seed shall comply with applicable State

and Federal laws. Seed that has become wet, moldy or otherwise damaged shall not be accepted.

2. Grass seed for lawn areas shall conform to the following requirements:

Botanical and Common Names	Proportion by Weight	Germination Rate	Purity Minimum
Chewing's Fescue (Festuca rubra commutata)	30%	70%	97%
'Kentucky 31' Tall Fescue (Festuca arundinacea 'Kentucky 31')	30%	90%	98%
Kentucky Bluegrass (Poa pratensis)	20%	80%	85%
Perennial Ryegrass (Lolium perenne)	20%	90%	98%

E. MULCH:

1. Materials to be used in mulching seeded areas shall be free of weed seed and shall conform to the following requirements:

   a. Hay Mulch shall consist of mowed and properly cured grass, clover or other acceptable plants. No salt hay shall be used.

   b. Straw Mulch shall consist of stalks or stems of grain after threshing.

F. HYDROSEED MULCH, TACKIFIERS AND WATER RETENTION AGENTS:

1. Wood fiber mulch for Hydroseed application shall be a manufactured product of natural wood cellulose fibers with a non-toxic green marking dye incorporated to ensure uniform distribution. Mulch shall be packed in sealed original containers, clearly labeled with brand name and manufacturer. It shall have delivered moisture content less than 12 percent.

2. Hydroseed tackifier shall be a powdered starch-based product approved by the Engineer. Hydroseed tackifier shall be applied in conjunction with the hydroseed slurry in accordance with the manufacturer's recommendations.

3. Moisture retention agent shall be a powdered starch-based product, approved by the Engineer, and shall be capable of retaining up to 400 times their weight in water.

Moisture retaining agents shall be added to the hydroseed slurry in accordance with the manufacturer's recommendations. Moisture retention agent shall be 'Hydro-Gel', as manufactured by Finn Corporation, Fairfield, OH.

G. WATER:

1. Water shall be furnished by the Contractor, unless otherwise specified, and shall be suitable for irrigation and free from ingredients harmful to plant growth and viability. The delivery and distribution equipment required for the application of water shall be the furnished by the Contractor, at no additional cost to the Owner.

H. INSECTICIDES:

1. No insecticides shall be used on-site without the Contractor notifying and obtaining prior approval of the Engineer.

2. Insecticides shall be EPA registered and approved for use in public open spaces. All insecticides shall be handled by State licensed applicators only, delivered in the original sealed manufacturer's containers, and used in accordance with the manufacturer's instructions.

3. Insecticide use shall be limited and selective, only to control specific insect infestations, as identified by the Contractor or the Owner's Representative, that may result in the disfigurement, decline, or death of plant materials.

4. Grub control insecticide shall be Proturf Insecticide III, as manufactured by A.M. Scotts & Sons, Inc.; Dursban Granules, as manufactured by Old Fox Chemical Corp., or ACMC; or approved equal.

I. HERBICIDES:

1. No herbicides shall be used on-site without the Contractor notifying and obtaining prior approval of the Engineer.

2. All herbicides shall be EPA registered and approved for use in public open spaces. All herbicides shall be handled by State licensed applicators only, delivered in the original sealed manufacturer's containers, and used in accordance with the manufacturer's instructions.

3. Herbicide for post-emergent application shall be glyphosate contact, 'Roundup', as manufactured by Monsanto, Inc., or approved equal.

4. Herbicide use shall be limited and selective, only to control specific weed infestations that have been identified by the Contractor or the Owner's Representative.

J. FUNGICIDES:

1. No fungicides shall be used on-site without the Contractor notifying and obtaining prior approval of the Engineer.

2. Fungicides shall be EPA registered and approved for use in public open spaces. All fungicides shall be handled by State licensed applicators only, delivered in the original sealed manufacturer's containers, and used in accordance with the manufacturer's instructions.

3. Fungicide use shall be limited and selective, only to control specific fungal pathogenic disease infestations, as identified by the Contractor or the Owner's Representative that may result in the disfigurement, decline, or death of plant materials.

PART 3 - EXECUTION

3.01 GENERAL:

A. All work shall be performed by skilled workers with a minimum of 2 years of seeded lawn construction and establishment experience and under the full-time supervision of a qualified foreman.

B. Seeding operations shall not begin less than 4 days after the application of lime and fertilizer and the seedbed areas are reviewed and approved by the Engineer.

C. Seeding shall be done when soil and weather conditions permit in early spring, until June 15, or from September 10 to October l5, unless otherwise approved. If it becomes necessary for seed to be sown after June 15, provisions shall be made for supplementary water and using a mulch cover over lawn areas.

D. If there is a delay in seeding, during which weeds grow, or soil is washed out, the Contractor shall eliminate the weeds by chemical or physical means, or replace the soil before sowing the seed, without additional compensation. Immediately before seeding is begun, the soil shall be lightly raked.

E. Seed shall be sown at the approved rate, on a non-windy day by machine, or as approved by the Engineer.

F. The surface shall be kept moist by a fine spray until the seed shows uniform germination over the entire area. Wherever poor germination occurs in areas larger than 3 square feet, the Contractor shall reseed, roll, and water as necessary to obtain proper germination.

G. If there is insufficient time in the planting season to complete soil preparations, fertilizing, and seeding, permanent seeding may be left until the following planting season, at the option of the Contractor, or as required by the Engineer. In that event, a temporary cover

crop shall be sown. This cover crop shall be cut and watered as necessary until the beginning of the following planting season, at which time it shall be plowed or harrowed into the soil, the area shall be fertilized and the permanent seed crop shall be sown as specified.

H. Protection of all newly loamed and graded areas is required and shall be accomplished by whatever means necessary such as mulch applied with a tackifier, or by other means approved by the Engineer. The Contractor shall be responsible for the prevention of siltation in areas beyond the limit of work and for all means of protection throughout the maintenance period at no additional cost to the Owner.

3.02 SURFACE PREPARATION:

A. If approved by the Engineer, the entire site area to be seeded shall be treated with an approved herbicide, in accordance with the manufacturer's instructions, not less than 7 days before the start of seeding operations.

B. If approved by the Engineer, grub control insecticide shall be spread on the surface of the seedbed, in accordance with the manufacturer's instructions, after the seedbed has been properly graded, not less than 24 hours before the start of seeding operations.

3.03 BROADCAST SEEDING, PLACING MULCH AND SLOPE EROSION PROTECTION:

A. The seed mix shall be broadcast at 6 pounds per 1000 square feet, as recommended by the seed supplier, or as required by the Engineer. Seed shall be divided into 2 equal amounts and uniformly distributed in 2 applications at right angles to each other. Seed shall then be raked lightly into the soil to a depth of l/4-inch.

B. If mulch is not necessary the seed shall be directly firmed into the soil with a roller that will apply pressure between 75 and 100 pounds per linear foot of width.

C. Straw Mulch shall be used based on time of seeding as previously specified over all seeded areas, as designated on the plans, or as otherwise required. If mulch is to be used, it shall be loosely spread to a uniform depth at a rate of 4-1/2 tons per acre to provide ¼-inch of cover, or as otherwise required. The seed and mulch shall then be firmed into the soil with a roller that will apply a pressure between 75 and 100 pounds per foot of width.

D. Straw Mulch may be applied by mechanical apparatus, if in the judgment of the Engineer, the apparatus spreads the mulch uniformly and forms a suitable mat to control slope erosion. The apparatus shall be capable of spreading at least 80 percent of the hay or

straw in lengths of 6-inches or more, otherwise it shall be spread by hand without additional compensation.

E. Slope erosion control blankets shall be placed as indicated on the plans or as required by the Engineer.

3.04 HYDROSEEDING:

A. The application of lime, fertilizer, grass seed and mulch may be accomplished in a single operation with the use of approved hydroseeding equipment. The materials shall be mixed with water in the machine and kept in an agitated state in order that the materials may be uniformly suspended in the water. The slurry shall be of such consistency that it can be sprayed from a hydroseed gun or through at least 200 feet of 1½- inch diameter hose. The spraying equipment shall be so designed that when the solution is sprayed over an area, the resulting deposits of lime, fertilizer, grass seed, and mulch shall be equal to the specified quantities.

B. Prior to the start of hydroseeding, the Contractor shall furnish to the Engineer, in writing, the weights of limestone, fertilizer, grass seed, mulch, tackifier (as required) and moisture retention agent (as required) per 100 gallons of water to be used. This statement should also specify the number of square yards of seeding that can be covered with the solution specified above. If the results of hydroseeding operations are unsatisfactory, the Contractor will be required to abandon this method and to apply the lime, fertilizer, grass seed and mulch by other means.

C. Seed shall be incorporated with the mulching material to obtain a minimum hydroseeded sown coverage of 200 pounds of the specified seed mix per acre, as recommended by the seed suppliers, or as required by the Engineer.

D. Wood fiber mulch shall be uniformly spread over certain selected seeded areas at the minimum rate of 1,400 pounds per acre unless otherwise directed. Mulch shall be placed by spraying from an approved spraying machine with pressure sufficient to cover the entire area in a single operation.

E. The Contractor shall immediately cleanup hydroseed oversprays from plant materials, pavements, furnishings, etc., to the satisfaction of the Engineer.

3.05 MAINTENANCE:

A. The Contractor shall maintain and protect the entire seeded area, as necessary to ensure dense healthy growth, until completion of the guarantee period and final acceptance of the project, or for 60 days, whichever is longer. If lawns are planted in late summer or during the fall, maintenance shall continue through the following spring for at least 30 days. Maintenance shall include watering as specified, liming, fertilizing, removal of stones, control of weeds, insect pests and fungal pathogens, and regular mowing.

Defective work shall be corrected as soon as possible after it becomes apparent and weather and season permit.

B. The first cutting of lawn areas shall be done when the grass is between 2½ - to 3-inches in height. The lawn shall be cut no shorter than 2-inches in height and shall be regularly mowed as necessary to maintain the above-prescribed conditions. All cuttings shall be removed from the lawn during the maintenance period and disposed of off-site.

C. The Contractor shall be responsible to regularly water seeded areas with the equivalent of 1-inch minimum of rainfall per week, or as necessary to develop and sustain dense, green growth.

D. Six weeks after turf has established, and only during the months of April, May, or September, the Contractor shall apply fertilizer as specified above, at one half the rate recommended by the initial soils laboratory tests, or as required by the Engineer.

E. The Contractor shall be responsible for securing all seeded areas from physical damage as necessary, including warning signs, barriers, temporary fencing, or other means of protection, through the guarantee period until final acceptance. All damaged areas shall be repaired to reestablish healthy vigorous growth of turf to the satisfaction of the Engineer, at no additional cost to the Owner. All temporary barriers shall remain the property of the Contractor and shall be removed by the Contractor upon final acceptance by the Engineer.

F. Pavement shall be kept clean and clear of cuttings and debris at all times during the maintenance period to the satisfaction of the Engineer.

3.06 INSPECTION AND PRELIMINARY ACCEPTANCE:

A. At the beginning of the planting season following that in which the permanent grass crop is sown, seeded areas will be inspected. Any section not showing dense, vigorous growth shall be promptly reseeded by the Contractor at no additional cost to the Owner. The seeded areas shall be watered, weeded, cut and otherwise maintained by the Contractor, as many times as necessary, in accordance with these specifications, until they are accepted.

B. The Contractor shall provide written notice to the Engineer not less than 10 days before the anticipated date of inspection for preliminary acceptance. The Engineer shall recommend preliminary acceptance of the work of this Section only after completion and re-inspection of all necessary repairs, renewals, or replacements.

C. Inspection and acceptance of seeded areas may be requested and granted in part, provided the areas for which acceptance is requested are relatively substantial in size, and with

clearly definable boundaries. Acceptance and use of these areas by the Owner shall not waive any other provisions of this Contract.

3.07 GUARANTEE:

A. Seeded areas shall be guaranteed until final acceptance of the project, or, in the case of late summer or fall planting, the guarantee period shall extend through the following spring.

B. When the work is accepted in part, the guarantee period shall extend from each partial acceptance to the terminal date of the last guarantee period. All guarantee periods terminate at one time.

C. Guarantee shall not apply to the replacement of seeded lawns resulting from the removal, loss, or damage due to occupancy of the project in any part; vandalism or acts of neglect on the part of others; physical damage by animals, vehicles, etc.; and Acts of God, including but not limited to, catastrophic fire, hurricanes, riots, war, etc.

D. In the instance of curtailment of water by local water authorities (when supply was to be furnished by the Owner), the Contractor shall furnish all necessary water by water tanker, the cost of which will be approved and paid for by the Owner.

3.08 FINAL INSPECTION AND FINAL ACCEPTANCE:

A. At the end of the guarantee period, the Contractor shall provide written notice to the Engineer not less than 10 days before the anticipated date of final inspection for final acceptance.

B. The Engineer shall recommend final acceptance of the work of this Section only after completion and re-inspection of all necessary repairs, renewals or replacements.

END OF SECTION

SECTION 32 93 00

SHRUBS AND LANDSCAPING

PART 1 - GENERAL

1.01 WORK INCLUDED:

A. This Section includes furnishing all labor, materials, equipment, plants, and incidental materials necessary to perform all operations related to the planting of all shrubs and for all appurtenant work, complete in place, maintained, and accepted, in accordance with the Contract Drawings and Specifications.

B. The Contractor shall bear the responsibility and cost of furnishing and applying water or any other substances, as necessary to ensure the sustainability of plant materials, as part of the work of this contract.

1.02 RELATED WORK:

A. Section 31 05 13.13, LOAM BORROW

1.03 SUBMITTALS:

In accordance with requirements of the general specifications, the Contractor shall submit the following:

A. Prior to planting, State nursery inspection certificates for all plant materials shall be submitted to the Engineer for review.

B. Samples and six copies of the manufacturer's product data, as applicable, shall be submitted to the Engineer for review and approval for the following materials:

1. Limestone.

2. Fertilizer.

3. Sphagnum Peat Moss.

4. Humus.

5. Organic Compost.

6. Manure.

7. Mulch.

8. Guying and Staking Apparatus.

10. Anti-transpirant/Anti-desiccant.

11. Insecticides.

12. Herbicides.

13. Fungicides.

PART 2 - PRODUCTS

2.01 PLANT MATERIALS:

A. The Contractor shall furnish and plant all plant materials as shown on the plans and in the quantities and sizes listed thereon. No substitutions shall be permitted without the written approval of the Engineer.

B. Plants larger than those specified in the Plant List may be used if approved by the Engineer. However, use of such oversized plants shall not be considered grounds for any increase in the contract price. If the use of larger plants is approved, the required spread of roots or ball of earth shall be increased in proportion to the size of the plant and plant pits shall be increased as necessary.

C. All plants shall be certified to have passed all required Federal and State inspection laws requiring freedom from plant diseases and insect infestations. The Contractor shall obtain clearance from applicable governing agencies, as required by law, before planting any plants delivered from outside the state in which they are to be planted.

D. All plants shall be nursery-grown under climatic conditions and environmental stresses similar to those in the locality of the project. All plants shall originate from nurseries that are no more than one Hardiness Zone higher (as established by the Arnold Arboretum, Jamaica Plain, MA) than where the plant is to be installed. Plants also shall conform to the botanical names and standards of size, culture, and quality for the highest grades and standards as adopted by the American Association of Nurserymen, Inc. in the American Standard for Nursery Stock, ANSI-Z60.1, latest edition. All plants shall be legibly tagged with their proper botanical name.

E. No heeled-in plants or plants from cold storage shall be used. All plants shall be typical of their species or variety and shall have a normal habit of growth. Plants shall be sound, healthy, and vigorous, well branched and densely foliated when in leaf; shall be free of disease, insects, eggs or larvae; and shall have healthy, well-developed root systems. All parts of the plant shall be moist and shall show active green cambium when cut.

F. All nursery plants shall be balled and burlapped or container-grown and shall have been acclimatized for at least one growing season. Container-grown stock shall have been grown in a container long enough for the root system to have developed sufficiently to hold its soil together, firm and whole, after removal from the container. No plants shall be loose in the container. Container-grown plants shall have no girdling roots and shall not be in a root-bound condition. Plants shall remain in their container until planted.

G. Care shall be exercised in digging and preparing field-grown plants for shipment and planting. Balled and burlapped materials shall have solid unbroken balls of earth of sufficient size to encompass all fibrous feeding roots necessary to ensure successful recovery and development of the plants. Balls shall be firmly wrapped in untreated biodegradable burlap and tied securely with wire cages and/or jute twine. Roots or balls of plants shall be adequately protected at all times from sun and drying winds. No plant shall be accepted when the ball of earth surrounding its roots has been badly cracked or broken preparatory to or during planting, or after the burlap, staves, wire cage, rope, or platform in connection with its transplanting have been removed. Soil characteristics (i.e., composition, texture, pH, etc.) of all field-grown plants shall closely match those of the soil where plant materials are to be planted.

H. Shrubs shall meet the requirements for spread and/or height stated in the Plant List on the Drawings. The measures for height are to be taken from the crown or root flare to the average height of the top of the shrub mass (not the longest branch). The fullness of each shrub shall correspond to the trade classification "No. 1". Single stemmed or thin plants will not be accepted. The side branches must be generous, well-twigged and the plant as a whole must be well-bushed to the ground. The plants must be in a moist, vigorous condition, free from dead wood, bruises or other root or branch injuries.

I. Plants shall be delivered only after preparations for planting have been completed. Plants shall be handled and packed in a horticulturally approved manner and all necessary precautions shall be taken to ensure that plants arrive on-site in a healthy vigorous condition. Trucks used for transporting plants shall be equipped with covers to protect plants from windburn, desiccation, and overheating during transport. Plants that have not been thoroughly watered shall not be accepted at the planting site. Any plants delivered to the site in a dry or wilted condition shall be rejected and replaced at no expense to the Owner. All plant materials shall be protected, watered and otherwise maintained prior to, during, and upon delivery to the site.

J. Plants shall be subject to inspection and approval by the Engineer at the place of growth, or upon delivery, for conformity to specification requirements as to quality, size, variety, and condition. Inspection and selection of plants before digging shall be at the option of the Engineer. The Contractor, or his representative, shall be present, if requested by the Engineer, for inspection of plants at the Nursery. Such approval

shall not impair the right of inspection and rejection upon delivery at the site or during the progress of work, for size and condition of balls and roots, disease, insects and latent defects or injuries. Rejected plants shall be removed immediately from the site. Certificates of inspection of plant materials shall be furnished as may be required by Federal, State and other authorities to accompany shipments.

2.02 LOAM BORROW:

A. Loam Borrow shall be as specified in Section 31 05 13.13, LOAM BORROW.

2.03 SOIL ADDITIVES AND AMENDMENTS:

A. LIMESTONE:

Lime shall be an approved agricultural limestone containing at least 50 percent total oxides (calcium oxide and magnesium oxide). The material will be ground such that 50 percent of the material will pass through a No. 100 mesh sieve and 98 percent will pass a No. 2 mesh sieve. Lime shall be uniform in composition, dry and free-flowing and shall be delivered to the site in the original sealed containers, each bearing the manufacturer's guaranteed analysis.

B. FERTILIZER:

1. Fertilizer shall be a complete, standard commercial fertilizer, homogeneous and uniform in composition, dry and free-flowing, and shall be delivered to the site in the manufacturer's original sealed containers, each bearing the manufacturer's guaranteed analysis and marketed in compliance with State and Federal Laws. All fertilizer shall be used in accordance with the manufacturer's recommendations.

2. Fertilizer for shrub plantings shall contain all major plant nutrients and minor trace elements essential to sustain plant growth and shall have the following analysis:

Nitrogen (N)	Phosphorous (P)	Potassium (K)
10%	10%	10%

3. As approved by the Engineer, a slow release root contact fertilizer installed at the time of planting, may be used in place of the above, at the discretion of the Contractor.

C. Organic Compost shall be a standard commercial product comprised of fully decomposed, 100 percent plant-derived, natural organic matter. Its composition shall furnish ample water holding capacity and cation exchange capacity for the retention of plant nutrients. Compost shall be free of sticks, stones, weed seeds, roots, mineral

or other foreign matter and delivered air dry. It shall be free from excessive soluble salts, heavy metals, phytotoxic compounds, and/or substances harmful to plant growth and viability. Organic compost shall have an acidity range of 4.5 to 7.0 pH.

D. Sphagnum Peat Moss shall be a standard commercial product. Its composition shall furnish ample water holding capacity and cation exchange capacity for the retention of plant nutrients. Peat moss shall be free of sticks, stones, weeds or weed seeds, roots, mineral or other foreign matter. It shall be free from toxic substances and/or compounds harmful to plant growth and viability. It shall be delivered air dry in standard bales and shall have an acidity range of 3.5 to 5.5 pH.

E. Humus shall be natural humus, reed peat, or sedge peat. Its composition shall furnish ample water holding capacity and cation exchange capacity for the retention of plant nutrients. Humus shall be free of sticks, stones, weeds, roots, mineral or other foreign matter and/or toxic substances harmful to plant growth and viability. It shall be low in wood content, free from hard lumps and excessive amounts of zinc and delivered air dry in a shredded or granular form. The acidity range for humus shall be 5.5 to 7.5 pH, and the organic matter content shall be not less than 85 percent, as determined by loss on ignition. The minimum water holding capacity shall be 200 percent by weight on an oven-dry basis.

F. Manure shall be well-rotted, leached, cow manure not less than 8 months or more than 2 years old. It shall be free of sawdust, shavings, or refuse of any kind and shall not contain more than 25 percent straw. It shall contain no substances harmful to plant growth. The Contractor shall furnish information regarding chemical disinfectants, if any, that may have been used in storage of the manure.

2.04 PLANTING MIXTURE:

A. Planting mix shall consist of 7 parts loam borrow and 1 part organic compost, humus, sphagnum peat moss, or manure, thoroughly blended.

2.05 WATER:

A. Water shall be furnished by the Contractor, unless otherwise specified, and shall be suitable for irrigation and free from ingredients harmful to plant growth and viability. The delivery and distribution equipment required for the application of water shall be furnished by the Contractor, at no additional cost to the Owner.

2.06 MULCH:

A. Mulch shall be fibrous pliable shredded soft bark mulch, not exceeding ½-inch in width. It shall be 98 percent organic matter with a pH range between 3.5 and 4.5 and a moisture content not to exceed 35 percent. It shall be free of weeds, weed seeds, debris, and other materials harmful to plant growth and viability. Organic mulch

shall be aged no longer than 2 years.

2.07 TREE PAINT:

A. Tree paint shall not be used.

2.08 ANTI-TRANSPIRANT/ANTI-DESICCANT:

A. Anti-transpirant or anti-desiccant shall be 'Wilt-Pruf', as manufactured by Nursery Specialty Products, Inc., Groton Falls, NY, or approved equal. It shall be delivered in original sealed manufacturer's containers and used in accordance with the manufacturer's instructions.

2.09 INSECTICIDES:

A. No insecticides shall be used on-site without the Contractor notifying and obtaining the prior approval of the Engineer.

B. Insecticides shall be EPA registered and approved for use in public open spaces. All insecticides shall be handled by State licensed applicators only, delivered in the original sealed manufacturer's containers, and used in accordance with the manufacturer's instructions.

C. Insecticide use shall be limited and selective, only to control specific insect infestations, as identified by the Contractor or the Engineer that may result in the disfigurement, decline, or death of plant materials.

2.10 HERBICIDES:

A. No herbicides shall be used on-site without the Contractor notifying and obtaining prior approval of the Engineer.

B. Herbicides shall be EPA registered and approved for use in public open spaces. All herbicide shall be handled by State licensed applicators only, delivered in the original sealed manufacturer's containers, and used in accordance with the manufacturer's instructions.

C. Herbicide for post-emergent application shall be glyphosate contact, 'Roundup', as manufactured by Monsanto, Inc., or approved equal.

D. Herbicide use shall be limited and selective, only to control specific weed infestations that have been identified by the Contractor or the Engineer.

2.11 FUNGICIDES:

A. No fungicides shall be used on-site without the Contractor notifying and obtaining prior approval of the Engineer.

B. Fungicides shall be EPA registered and approved for use in public open spaces. All fungicides shall be handled by State licensed applicators only, delivered in the original sealed manufacturer's containers, and used in accordance with the manufacturer's instructions.

C. Fungicide use shall be limited and selective, only to control specific fungal pathogenic disease infestations, as identified by the Contractor or the Engineer, that may result in the disfigurement, decline, or death of plant materials.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. All plants shall be subject to inspection and approval by the Engineer upon delivery to the site. No materials shall be planted until approval is received.

B. All work shall be performed by skilled workers with a minimum of 2 years planting experience, in accordance with accepted horticultural/nursery practices, under the full-time supervision of a Certified Nurseryman or Arborist.

C. All balled and burlapped plants that cannot be planted immediately upon delivery shall be set on the ground and the root balls shall be well protected with soil, wet moss, or other acceptable material. All foliage shall be protected and covered with perforated shade materials.

D. The planting season for shrubs shall extend from the time the soil becomes workable in the spring until new growth appears, and from September 15 until November 30 in the fall. Shrubs shall be planted only when dormant, either prior to bud break and/or before leaves appear in the spring, or subsequent to their leaf drop in the fall. Ground covers shall be planted only after the last frost in the spring through mid-May. Planting season periods may be extended if weather and soil conditions permit only with the written approval of the Engineer. Extended or out-of-season planting requirements shall include application of antitranspirant and extra water as needed. Plant guarantee periods shall remain as stated below. Planting shall not be permitted in frozen ground.

E. All plant locations and outlines for planting beds shall be staked out for review and potential adjustment by the Engineer before any excavation is begun. In the event that rock, underground construction work or obstructions are encountered in any proposed planting pit or bed, the Engineer may select alternate locations. Where locations cannot be changed, the obstruction shall be removed, subject to the Engineer's approval, to a depth of not less than 3 feet below grade and not less than 6-

inches below the bottom of the root ball when plant is properly set at the required grade. Removal of boulders or obstructions greater than 1 cubic yard in size shall be subject to approval and will be paid for by the Owner. No ledge will be removed to create planting pits or beds.

F. All planting pits shall be excavated with sloped walls, wider at the top than at the bottom, and scarified to eliminate glazing. Shrub pits shall be at least 1 foot greater than the diameter of the root ball. Planting pits shall not be deeper than the height of the root ball.

G. When excavation occurs in areas of heavily compacted earth, stones, concrete chunks or other foreign matter, pits shall be dug at least 3 times the width of the rootball. Excavated material from plant pits shall be disposed of as required.

H. Container plants shall be removed from their growing container before planting. If roots are densely matted, the outer root mass shall be scored, sliced vertically, with a sharp knife to separate roots.

I. Shrubs shall be set in the center of planting pits, plumb and straight, and at such a level that after settlement the crown of the roots will be 1-inch above the surrounding finished grade. Root ball masses shall not be loosened, broken or damaged. When balled and burlapped plants are set, planting mixture shall be compacted around bases of balls to fill all voids. All tying materials, twine and rope shall be cut and removed. Biodegradable burlap shall be laid back or cut away from the top half of the ball. If a wire basket is present, the upper 2/3 of the basket shall be cut away and removed. Do not remove the entire basket. Roots or bare root plants shall be properly spread out and planting mixture carefully worked in among them. Broken or frayed roots shall be cleanly cut.

J. Backfill plant pits with planting mixture in layers of not more than 9-inches and firmly tamp each layer and water to sufficiently settle the backfilled soil before the next layer is put in place. When the planting pit is 2/3 backfilled, the hole shall be flooded and watered thoroughly so that the water level reaches the top of the planting pit. Allow water to soak in, then complete the backfilling operation. Immediately after planting pit is backfilled, a shallow basin 3-inches deep and slightly larger than the pit shall be formed with a ridge of soil for water retention. Form a common basin for plant materials throughout mass planting beds. After planting, lightly till the soil in planting beds between planting pits and rake smooth to eliminate compaction of soils.

K. All planting hole basins shall be flooded with water twice within the first 24 hours of planting, and watered not less than twice per week until final acceptance of the work.

L. Immediately after planting and staking operations are complete, all plant pit basins and plant beds shall be covered with approved mulch to the depths designated on the

plans. Mulch shall not contact shrub crowns. No mulch shall be applied prior to the first watering.

M. The pruning of shrubs shall only be permitted to remove dead or dying branch limbs and tips, sucker growth, water sprouts, crossing or rubbing branches, broken or damaged branches, diseased or insect infested limbs, and to preserve the natural character of the plant. Plant materials shall be pruned in accordance with American Nurserymen Association Standards and as required by the Engineer. Questionable weak limbs and branch removals that may disfigure the plant shall be left to the discretion of the Engineer. Pruning shall be done with clean, sharp tools. All large pruning cuts that are ½-inch in diameter or larger shall be made along the bark branch ridge. Pruning cuts shall not breach or otherwise interfere with the branch collar. All pruning cuts less than ¼-inch diameter shall be made with hand pruners as close to the main stem as possible without damaging the cambium or bud. Tree paint shall not be used to cover pruning cuts.

N. As the work proceeds, the Contractor shall remove all debris from the site, including but not limited to branches, rock, paper, and rubbish. All areas shall be kept clean, neat and in an orderly condition at all times. Prior to final acceptance, the Contractor shall cleanup the entire area to the satisfaction of the Engineer.

3.02 MAINTENANCE:

A. Maintenance shall begin immediately after each plant is planted and shall continue until completion of the guarantee period and final acceptance of the project. Plants shall be watered, pruned, sprayed, fertilized, cultivated and otherwise maintained and protected. Defective work shall be corrected as soon as possible after it becomes apparent and weather and season permit.

B. Settled plants shall be reset to proper grade and position, planting pits and common basins restored, and dead materials removed and replaced. Planting beds and individual basins shall be neat in appearance, maintained to their original layout lines and kept free of weeds. Mulch shall be replaced as required to maintain proper depths.

C. Contractor shall make arrangements to provide sufficient water to maintain all shrubs until final acceptance. Plants shall be sprayed with anti-transpirant or anti-desiccant if required by seasonal conditions or as required by the Engineer.

D. Planting areas shall be protected against trespass and damage of any kind during the maintenance period. This shall include the furnishing and installation of approved temporary fencing if necessary. If any plants become damaged during the maintenance period, they shall be treated or replaced as required by the Engineer at no additional cost to the Owner.

3.03 INSPECTION AND PRELIMINARY ACCEPTANCE:

A. Contractor shall provide written notice to the Engineer not less than 10 days before the anticipated date of inspection for preliminary acceptance. The Engineer shall recommend preliminary acceptance of the work of this Section only after completion and re-inspection of all necessary repairs, renewals or replacements.

B. Inspection and acceptance of plantings may be requested and granted in part, provided the areas for which acceptance is requested are relatively substantial in size, and with clearly definable boundaries. Acceptance and use of these areas by the Owner shall not waive any other provisions of this Contract.

3.04 GUARANTEE:

A. All plant materials shall be guaranteed for a period of one year after the date of completion of the specified maintenance period and preliminary acceptance of the project by the Owner.

B. When the work is accepted in part, the guarantee period shall extend from each partial acceptance to the terminal date of the last guarantee period. All guarantee periods terminate at one time.

C. Plants shall be healthy, free of pests and disease. Plants shall exhibit vigorous growth, shall bear foliage of normal density, size and color and shall have no less than seventy-five percent (75%) of their branches alive at the end of the guarantee period. If the leader of any single-leader species is dead, the entire plant shall be considered dead.

D. Any plant required under this Contract that is dead or unsatisfactory, as determined by the Engineer, shall be removed from the site. These shall be replaced as soon as weather permits during the specified planting season, at no additional cost to the Owner, until the plants live through one year.

E. All replacements shall be plants of the same kind and size as specified on the Plant List. They shall be furnished and planted as specified above.

F. The guarantee of all replacement plants shall extend for an additional one-year period from the date of their acceptance as replacement.

G. Guarantee shall not apply to the replacement of unacceptable plants resulting from the removal, loss, or damage due to occupancy of the project in any part; vandalism or acts of neglect on the part of others; physical damage by animals, vehicles, etc.; and Acts of God, including but not limited to, catastrophic fire, hurricanes, riots, war, etc.

H. In the instance of curtailment of water by local water authorities (when supply was to

be furnished by the Owner), the Contractor shall furnish all necessary water by water tanker, the cost of which will be approved and paid for by the Owner.

3.05 FINAL INSPECTION AND FINAL ACCEPTANCE:

A. At the end of the guarantee period, the Contractor shall provide written notice to the Engineer not less than 10 days before the anticipated date of final inspection for final acceptance.

B. The Engineer shall recommend final acceptance of the work of this Section only after completion and re-inspection of all necessary repairs, renewals or replacements.

END OF SECTION

APPENDIX A
MANUFACTURER CUTSHEETS

Metalux

DESCRIPTION

The Vaportite LED Series is an energy efficient industrial Vaportite fixture that features rugged and durable construction. The Vaportite LED incorporates a full metal fixture liner inside a reinforced fiberglass housing with a high impact diffuser. This Vaportite series is suitable for interior and exterior applications and can be surface or chain mounted.

The Vaportite LED Series has been designed for maximum operation in commercial institutional and industrial environments and can operate in a wide range of temperatures (-20°C to 25°C) and is ideal for cold storage environments.

Catalog #		Type
Project	ARLINGTON RES	A & AE
Comments		Date
Prepared by		

SPECIFICATION FEATURES

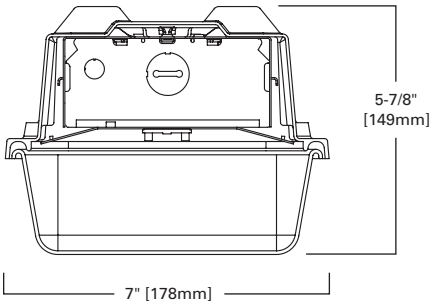
Construction
Fiberglass housing is reinforced polyester and self-extinguishing (ASTM-D635-74) plastic of a permanent pearl gray color. A watertite hub for 1/2" conduit entry is provided at each end of housing (standard) for continuous feed. Polyurethane gasketing is formed in the housing providing a continuous seamless seal for the diffuser. Four sturdy cam latches clamp diffuser tightly for a positive seal between housing, gasketing and diffuser. Electrical components and fixtures are UL/ cUL listed for Wet Locations.

Electrical
Long-Life LED system coupled with electrical driver to deliver optimal performance. LED's available in 3500, 4000 and 5000K with a CRI ≥ 85. Projected life is 60,000 hours at 91% lumen output. cULus listed. Electronic drivers are available for 120-277V applications. A 0-10V dimming control is available (standard). IP65 rated and NSF certified (4' only).

Lens
DR=Internal Prismatic Lens/15% DR High Impact Additive.
DR100=Internal Prismatic Lens/100% DR High Impact Additive.

Warranty
Vaportite LED features a five year limited warranty.

Compliance
UL/cUL listed for Wet location. RoHS compliant, and LED modules comply with IESNA LM-79 and LM-80 standards. DesignLights Consortium™ Qualified and classified for DLC Standard, refer to www.designlights.org for details.

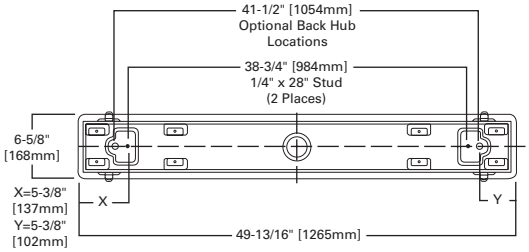


VAPORTITE
LED

4' INDUSTRIAL LED LAMP

Vaportite Industrial Refrigerated Case

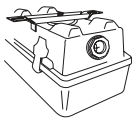
MOUNTING DATA



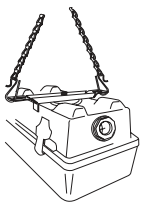
ENERGY DATA

Input Watts:
4VT2-LD4-4 (4,000 lumens)=38W
4VT2-LD4-6 (6,000 lumens)=57.3W
4VT2-LD4-8 (8,000 lumens)=81.1W

INSTALLATION DATA



MOUNTING BRACKETS
Furnished
Two per 2' and 4' Unit
Four per 8' Unit

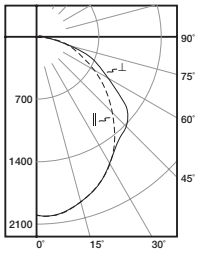


OPTIONAL CHAN HANGING SET
(VT2-CHAIN/SET-U)
Includes 6 ft. of chain, 4 large S-Hooks and 4 small S-Hooks
Order One (1) Kit for each 2' or 4' Fixture

LINEAR DISCONNECT
Safe and convenient means of disconnecting power

Powering Business Worldwide

PHOTOMETRICS



4VT2-LD4-6-DR-UNV-L835-CD1-U

Electronic Driver

Linear LED 3500K

Spacing criterion: (II) 1.2 x mounting height, (⊥) 1.2 x mounting height

Lumens: 5882

Input Watts: 56W

Efficacy: 104.7 lm/W

Test Report: 4VT2-LD4-6-DR-UNV-L835-CD1-U.IES

Candlepower

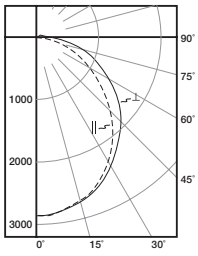
Angle	Along II	45°	Across ⊥
0	2000	2000	2000
5	2007	1979	1980
10	1981	1951	1956
15	1930	1900	1903
20	1857	1836	1844
25	1764	1748	1765
30	1645	1646	1660
35	1511	1522	1534
40	1375	1393	1468
45	1221	1271	1438
50	1062	1207	1343
55	903	1175	1148
60	749	1048	933
65	600	1151	771
70	461	591	600
75	332	398	426
80	206	249	255
85	94	137	127
90	34	75	63

Coefficients of Utilization

	Effective floor cavity reflectance 20%																	
rc	80%				70%				50%			30%			10%			0%
rw	70	50	30	10	70	50	30	10	50	30	10	50	30	10	50	30	10	0
RCR																		
0	119	119	119	119	116	116	116	116	110	110	110	105	105	105	101	101	101	99
1	108	103	98	94	105	101	96	93	96	93	90	92	89	87	88	86	84	82
2	98	89	82	76	95	87	81	75	84	78	73	80	75	71	77	73	70	67
3	89	78	70	63	86	76	69	62	73	67	61	70	65	60	68	63	59	56
4	81	69	60	53	79	68	59	53	65	58	52	62	56	51	60	55	50	48
5	75	62	52	46	73	60	52	45	58	51	45	56	49	44	54	48	44	41
6	69	55	46	40	67	54	46	40	52	45	39	51	44	39	49	43	38	36
7	64	50	41	35	62	49	41	35	48	40	35	46	39	34	45	38	34	32
8	59	46	37	31	58	45	37	31	44	36	31	42	35	31	41	35	30	28
9	56	42	34	28	54	41	33	28	40	33	28	39	32	28	38	32	27	25
10	52	39	31	25	51	38	31	25	37	30	25	36	30	25	35	29	25	23

Zonal Lumen Summary

Zone	Lumens	% Fixture
0-30	1536	26.1
0-40	2490	42.3
0-60	4463	75.9
0-90	5804	98.7
0-180	5882	100.0



4VT2-LD4-8-FR50-UNV-L835-CD1-WL-U

Electronic Driver

Linear LED 3500K

Spacing criterion: (II) 1.2 x mounting height, (⊥) 1.3 x mounting height

Lumens: 8553

Input Watts: 81W

Efficacy: 105.5 lm/W

Test Report: 4VT2-LD4-8-FR50-UNV-L835-CD1-WL-U.IES

Candlepower

Angle	Along II	45°	Across ⊥
0	2854	2854	2854
5	2857	2829	2842
10	2811	2790	2804
15	2733	2723	2742
20	2626	2629	2658
25	2484	2508	2545
30	2316	2365	2408
35	2120	2195	2253
40	1904	2011	2086
45	1678	1819	1914
50	1451	1622	1736
55	1222	1422	1558
60	1009	1229	1368
65	810	1034	1171
70	622	843	959
75	446	659	748
80	287	487	555
85	148	341	392
90	45	228	271

Coefficients of Utilization

	Effective floor cavity reflectance 20%																	
rc	80%				70%				50%			30%			10%			0%
rw	70	50	30	10	70	50	30	10	50	30	10	50	30	10	50	30	10	0
RCR																		
0	118	118	118	118	115	115	115	115	109	109	109	104	104	104	99	99	99	96
1	107	102	97	93	104	99	95	91	94	91	87	90	87	84	85	83	81	79
2	97	88	81	75	94	86	79	74	82	76	72	78	73	69	74	71	67	65
3	88	77	69	62	85	75	68	61	72	65	60	69	63	58	66	61	57	54
4	81	68	59	53	78	67	58	52	64	57	51	61	55	50	59	53	49	46
5	74	61	52	45	72	60	51	45	57	50	44	55	48	43	53	47	42	40
6	69	55	46	39	66	54	45	39	52	44	38	50	43	38	48	42	37	35
7	64	50	41	35	62	49	41	35	47	40	34	45	39	34	44	38	33	31
8	59	46	37	31	57	45	37	31	43	36	30	42	35	30	40	34	30	28
9	55	42	34	28	54	41	33	28	40	32	27	38	32	27	37	31	27	25
10	52	39	31	25	50	38	30	25	37	30	25	36	29	25	34	29	24	23

Zonal Lumen Summary

Zone	Lumens	% Fixture
0-30	2200	25.7
0-40	3573	41.8
0-60	6232	96.4
0-90	8248	100.0
0-180	8553	100.0

LUMEN MAINTENANCE

Ambient Temperature	TM-21 Lumen Maintenance (60,000 hours)	Theoretical L70 (Hours)
25°C	> 91%	> 247,000

ORDERING INFORMATION

SAMPLE NUMBER: 4VT2-LD4-4-DR-UNV-L840-CD1-WL-U

Series [2]
4VT2=4' Vaportite

Lamp Type
LD4=LED 4.0

LED Lumens Output
4=4000 Lumens
6=6000 Lumens
8=8000 Lumens

Lens
DR=Internal Prismatic Lens/15% DR High Impact Additive
DR100=Internal Prismatic Lens/100% DR High Impact Additive
FR50=Frosted Lens/15% DR High Impact Additive [1]

Distribution
[Blank]=Medium (Standard)
W=Wide Distribution

Voltage
UNV=Universal Voltage 120-277

EL10W=10-watt, 120-277V emergency battery pack installed [3]
VT-REM-EL=Remote Emergency Installed, 700 lumens [3]

FOR 'AE' ONLY

Lamps
L835=3500K, LED
L840=4000K, LED
L850=5000K, LED

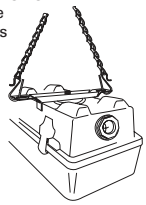
Driver Type
CD1=1 Dimming Driver
5LTD1=Fifth Light DALI

WL=Wet Location Label

Options
SSL=Stainless Steel Latches
TH=(2) Top Watertite Hubs
TEH=(2) Top and (2) End Watertite Hubs (all Watertite Hubs have 1/2" Conduit Entry)

Packaging
U=Unit Pack

Accessories (order separately)
VT2-Chain/Set-U=Chain Hanging Set
Includes 6 ft. of chain, 4 large S-Hooks and 4 small S-Hooks
Order One (1) Kit for each 2' or 4' Fixture
VT2-SS-MBK=Stainless Steel Mounting Bracket



NOTES: [1] Not availablie in wide distribution. [2] DesignLights Consortium™ Qualified and classified for DLC Standard (some models are not DLC qualified), refer to www.designlights.org for details. [3] EL must specify 120 or 277V only.

Specifications & dimensions subject to change without notice. Consult your Eaton Representative for availability and ordering information.

SHIPPING DATA

Catalog No.	Wt.
4VT2-LD4	18 lbs.

Eaton
1121 Highway 74 South
Peachtree City, GA 30269
P: 770-486-4800
www.eaton.com/lighting

Powering Business Worldwide

Specifications and dimensions subject to change without notice.

isolite

RL

Reliance Series
Thermoplastic LED Exit Sign

Features

- Damp location listed.
- Super bright, long-life LEDs.
- Quick-connect components.
- Snap-on canopy for easy installation.
- Universal face plates for both single and double face standard.
- Nickel Cadmium battery provides 3 hours of emergency operation.
- Sealed External Momentary test switch and dual diagnostic LED indicator displays AC presence and Hi-Charge status.
- Self-Test / Self-Diagnostic monitoring available.
- Low voltage cut-off prevents battery damage and ensures positive charge acceptance following an extended discharge.
- Line-latch prevents unnecessary discharge of battery during installation. Loads will not illuminate until after application of utility power.
- 120/277 VAC field-selectable inputs (with the exception of the 2C (dual circuit) option which requires voltage specification upon ordering)[3]

Construction

- UV stabilized, UL94V-O flame retardant ABS injection-molded thermoplastic.

Letters

- 6" high; 0.75" stroke.

Arrows

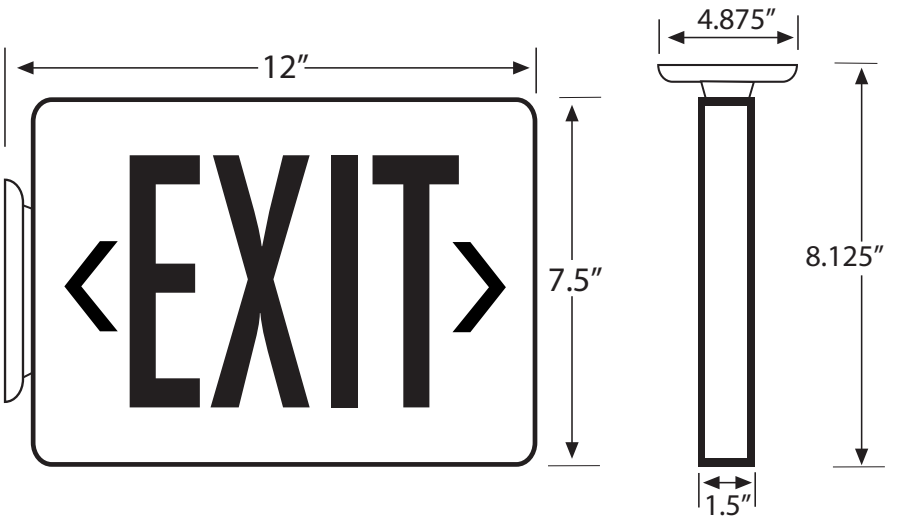
- NFPA-Type, field selectable chevrons.

CEC Title 20 Compliant

isolite

RL

Reliance Series
Thermoplastic LED Exit Sign



Temperature Rating
- From 32°F to 122°F

Approvals
- UL 924
- CEC Title 20 Compliant
- UL Listed for Damp Location
- NFPA Life Safety Code 101
- NFPA 70- NEC
- OSHA

Warranty
- Isolite offers a 3-year limited warranty. For further details, refer to General Warranty and Obligations in the Isolite manual or on our website.

Ordering Information

Series
RL

Operation
AC = AC Only
EM = NiCad Battery

Letters
R = Red
G = Green

Housing Color
WH = White
BK = Black

Mounting
UN = Universal Mounting Canopy
PA = 12" Swivel Pendant
PB = 24" Swivel Pendant
PC = 36" Swivel Pendant
PD = 48" Swivel Pendant

Options
SD = Self Diagnostics[1]
2C = Dual Circuit[2,3]

Notes
1 = EM Only
2 = AC Only
3 = Specify Voltage

www.isolite.com
Headquarters: 31 Waterloo Avenue • Berwyn, PA 19312 • 800-888-5483 • 610-647-8200
Western Office: 3563 Sueldo, Suite M • San Luis Obispo, CA 93401 • 800-799-5343 • 805-546-9669

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