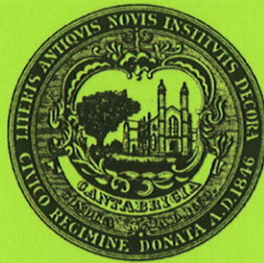


BID SET

SPECIFICATIONS FOR THE CITY OF CAMBRIDGE, MASSACHUSETTS

WESTERN AVENUE INFRASTRUCTURE IMPROVEMENTS PROJECT



CAMBRIDGE
DEPARTMENT
OF PUBLIC
**THE
WORKS**

In the City of Cambridge, Massachusetts

May 2012

Prepared By:



HALVORSON DESIGN
PARTNERSHIP

RONALD W. BUJA, INC.
Electrical Engineers

5 Tilton Lane
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RBUJA@BUJAENGINEERING.COM

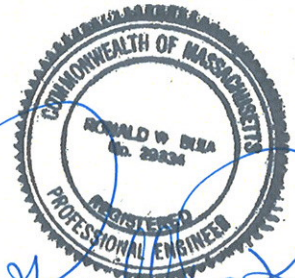
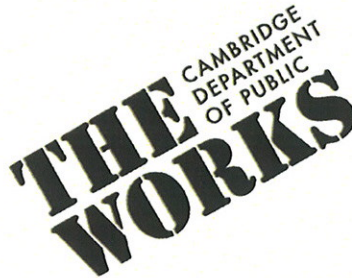
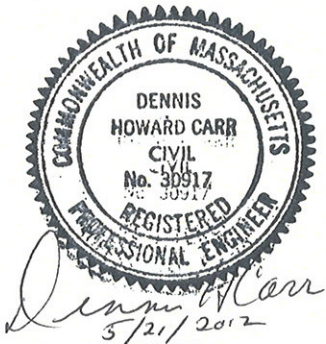
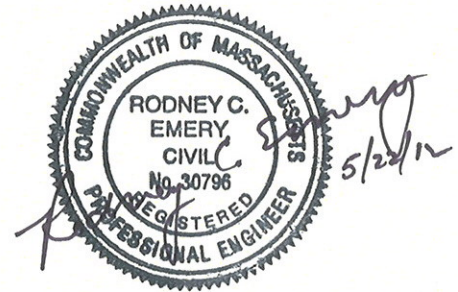


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BID SET

SPECIFICATIONS FOR THE CITY OF CAMBRIDGE, MASSACHUSETTS

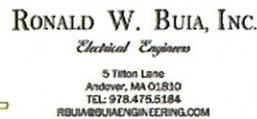
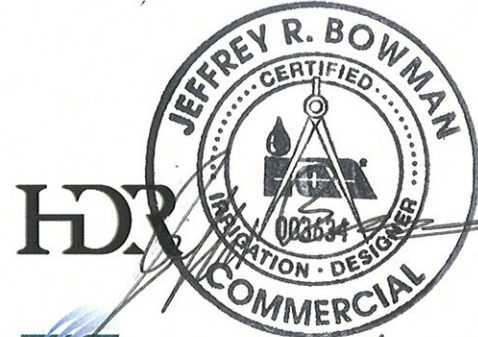
WESTERN AVENUE INFRASTRUCTURE IMPROVEMENTS PROJECT



In the City of Cambridge, Massachusetts

May 2012

Prepared By:



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SECTION 00020

INVITATION TO BID

The City of Cambridge, Massachusetts, the Awarding Authority, invites sealed bids for the project: City of Cambridge, Massachusetts – Western Avenue Infrastructure Improvements Project.

Nature and scope of work

The major components of work to be performed includes, but is not limited to the construction of sewers and drains ranging in size from 10-inch to 48-inch in diameter; cured-in-place pipelining of an existing 42-inch x 48-inch brick sewer; the construction of manholes and catch basins; the installation of 36-inch diameter pipe through an existing corridor beneath a steam tunnel; the construction of a total phosphorous removal structure; the construction of an outfall to the Charles River with an isolation gate structure; the replacement of existing water mains; relocation of existing utilities; full depth roadway construction; asphalt excavation by cold planer; pavement overlay; granite curbing installation, construction of concrete and brick sidewalks, construction of a porous asphalt bicycle track; installation of street trees and landscaping including structural soil and passive irrigation system; roadway lighting and traffic signal construction, pavement markings and traffic signage; coordination with public art installation and streetscape furnishings; and the reconstruction of a public park, including stormwater planter system, granite seating and planter elements, automatic irrigation system, and miscellaneous furnishings and appurtenances.

Bidding procedures shall be accordance with M.G.L. c. 30, §39M, as most recently amended, and all other applicable laws.

The estimated project value is: \$17 million dollars.

Plans and specifications will be available from 8:30 a.m. to 8:00 p.m. on Mondays, 8:30 a.m. to 5:00 p.m. Tuesday through Thursday and 8:30 a.m. to Noon on Fridays, at the Purchasing Department, City Hall, 795 Massachusetts Avenue, Room 303, Cambridge, MA 02139 from Thursday, May 31, 2012 upon payment of a refundable fee of \$150.00 for each set in the form of a check made payable to the City of Cambridge. For the mailing of the plans and specifications, the bidder must prepay a mailing and handling fee of \$25.00 per set. NO PARTIAL SETS WILL BE DISTRIBUTED.

The contract documents may be examined at the Office of the Purchasing Agent, Room 303, City Hall, 795 Massachusetts Avenue, Cambridge, MA 02139 from 8:30 a.m. to 8:00 p.m. on Mondays, 8:30 a.m. to 5:00 p.m. Tuesday through Thursday and 8:30 a.m. to Noon on Fridays.

Sealed bids will be received at the Purchasing Department, City Hall, 795 Massachusetts Avenue, Room 303, Cambridge, MA 02139 until June 28, 2012 at 2:00 PM at which time all general bids will be publicly opened and read aloud.

An original and one copy of the bid forms must be submitted.

All questions must be faxed not later than 2:00pm Monday June 18, 2012 to the City of Cambridge Purchasing Department fax# 617-349-4008.

All general bids shall be accompanied by a bid deposit in the form of a certified, cashier's or treasurer's check (**NO CASH**) issued by a responsible bank or trust company made payable to the City of Cambridge or a bid bond, in an amount not less than five percent (5%) of the value of the bid.

The successful bidder will be required to furnish a Performance Bond and a Labor and Material (Payment) Bond each in the amount of one hundred percent (100%) of the contract sum. Bonds shall be obtained from a surety licensed to do business in the Commonwealth of Massachusetts and the form shall be satisfactory to the City of Cambridge.

The City of Cambridge reserves the right to reject any or all general bids if it is in the public interest to do so.

No less than the prevailing wage rates as set forth in the schedule contained in the Contract Documents must be paid on this project.

Attention is called to the following programs and ordinances of the City of Cambridge:

1. Minority Business Enterprise Program;
2. Cambridge Employment Plan: minority/women/resident hiring ordinance.
3. Cambridge Responsible Employer Plan
4. Living Wage Ordinance
5. Occupational Safety and Health Administration (OSHA)
6. CORI City Policy

Copies of the above are bound in the bid documents and are fully integral portions of the conditions of the contract with which each contractor and sub-contractor must comply.

A pre-bid conference for all bidders will be held as follows:

Date: Tuesday, June 12, 2012

Time: 2:00 PM

Place: Cambridge Department of Public Works
147 Hampshire Street, Cambridge, Massachusetts 02139

Cynthia H. Griffin
Purchasing Agent

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SECTION 00100
INFORMATION FOR BIDDERS

INFORMATION FOR AND INSTRUCTIONS TO BIDDERS

1. DEFINITIONS AND TERMINOLOGY

Article 1, Definitions, of the General Terms and Conditions of the Contract (“General Terms and Conditions”) included in the Project Manual are incorporated by reference as if fully rewritten herein. In the event of a conflict between the within definitions and those found in the General Terms and Conditions, the former govern for the purposes of these Instructions only. All other terms which are not herein defined have their ordinary dictionary meaning.

ADDENDUM (ADDENDA, PLURAL)–An Addendum is a document issued by the City prior to the opening of the General Bids which clarifies, amends, or modifies the Bidding Documents.

ALTERNATE BID–An Alternate Bid (or an Alternate) is an amount that is either added to or deducted from the Base Bid depending on the designation on the Bid form.

BASE BID–A Base Bid is the sum proposed by a Bidder to perform the Work and does not include any Alternate Bids.

BID–A Bid is a proposal to do the Work for a specified sum and includes accompanying forms which are required to be submitted.

BIDDER–A Bidder is a person who or an entity that submits a Bid pursuant to an entity that submits a Bid pursuant to M.G.L. c. 30, §39M or c. 30B, as the case may be. The pronouns “it” or “they” are used herein when referring to a Bidder or Bidders, respectively.

BIDDING DOCUMENTS–The Bidding Documents are comprised of the entire Project Manual, which includes, but is not limited to, the Invitation to Bid (advertisement), the Instructions to Bidders, all the forms (e.g., Bid Forms, sample Agreement form, bond forms), the wage rates, the General Terms and Condition of the Contract, any supplementary terms and conditions, thereto, the Plans, the Specifications, and all addenda.

BUSINESS DAYS–Business days are defined as all days of the week excluding Saturdays, Sundays, and those holidays for which the City offices are closed for observance.

PURCHASING DEPARTMENT–The Purchasing Department refers to the City of Cambridge Purchasing Department located at 795 Massachusetts Avenue, Third Floor, Cambridge, MA 02139.

2. COPIES OF BIDDING DOCUMENTS

A Bidder may obtain complete sets of Bidding Documents upon payment of a nonrefundable fee, the amount of which is set forth in the Invitation to Bid.

No partial sets of Bidding Documents will be issued.

It is the responsibility of the Bidder to insure that it has obtained a complete set of Bidding Documents. Complete sets of Bidding Documents shall be used in preparing Bids. Neither the City nor the Engineer assumes any responsibility for errors or misinterpretations resulting from the use of incomplete sets of Bidding Documents in preparing the Bids.

Distribution of the Bidding Documents is for the sole purpose of obtaining Bids and does not confer a license or grant permission for any other use of the Bidding Documents.

3. STATE WAGE RATE REQUIREMENTS

The prevailing wage rates are included within the Contract Documents and apply to this Project.

4. LAWS AND REGULATIONS

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

5. HEALTH AND SAFETY REGULATIONS

This project is subject to the Safety and Health Regulations of the U.S. Department of Labor set forth in Title 29 CFR, Part 1926 and to all subsequent amendments, and to the Massachusetts Department of Labor and Industries, Division of Industrial Safety "Rules and Regulations for the Prevention of Accidents in Construction Operations" (Chapter 454 CMR 10.00 et seq.). Contractors shall be familiar with the requirements of these regulations.

6. GUARANTEE

The Contractor guarantees that the Work and Services to be performed under the Contract and all workmanship, materials, and equipment performed, furnished, used or installed in the construction of the same, shall be free from defects and flaws and shall be performed and furnished in strict accordance with the Specifications, Details, Drawings, and other contract documents; that the strength of all parts of all manufactured equipment shall be adequate and as specified and that the performance test requirements of the Contract shall be fulfilled. This guarantee shall be for a period of one year from and after the date of completion and acceptance of the work as stated in the final estimate. If part of the work is accepted by the

Owner, in accordance with “Partial Acceptance” requirements of these Contract Documents, the guarantee for that part of the Work shall be for a period of one year from the date fixed for such acceptance.

If at any time within the said period of guarantee any part of the work requires repairing, correction or replacement, the Owner may notify the Contractor in writing to make the required repairs, correction, or replacements. If the Contractor neglects to commence making such repairs, corrections, or replacements to the satisfaction of the Owner within seven days from the date of receipt of such notice, or having commenced, fails to prosecute such work with diligence, the Owner may employ other persons to make the same, and all direct and indirect costs of making said repairs, correction or replacements, including compensation for additional professional services, shall be paid by the Contractor.

7. MANUFACTURER EXPERIENCE

Whenever it may be written that an equipment manufacturer must have a specified period of experience with his product, equipment which does not meet with the specified experience period can be considered if the equipment supplier or manufacturer is willing to provide an “Efficiency Guarantee Bond” or cash deposit for the duration of the specified time period which will guarantee replacement of that equipment in the event of failure.

8. QUESTIONS AND INTERPRETATIONS

All questions about the meaning or intent of the Bidding Documents shall be received in writing by the Purchasing Agent, Room 303, 795 Massachusetts Avenue, Cambridge MA 02139, fax no (617) 349-4008, no later than 2:00 pm on Monday, June 18, 2012, seven calendar days before the date herein set for the opening of Bids. Any questions received after such time will be answered at the discretion of the City.

Written clarifications or interpretations will be issued by the Purchasing Department in the form of an Addendum. Only questions answered by an Addendum will be binding. Oral clarifications or interpretations will be without legal effect. Addenda will either be faxed or mailed to all persons having received Bidding Documents from the Purchasing Department.

Each Bidder shall be responsible for determining that it has received all Addenda issued.

9. THE BID

Bidder’s Representations.

In submitting a Bid, the Bidder represents that:

- It has read and examined the Bidding Documents thoroughly;
- It understands the Bidding Documents;
- The Bid is made in accordance with the Bidding Documents;

- It has visited the site, has become familiar with the conditions of the site and the surrounding area, and has familiarized itself with local conditions that may in any manner affect cost, progress, or performance of the Work;
- It has correlated its own observations with the Bidding Documents;
- It has found no errors, conflicts, ambiguities, or omissions in the Bidding Documents, except for those that it has brought to the Purchasing Department's attention either orally at a pre-bid conference or in writing at least seven (7) calendar days prior to submitting its Bid;
- It is familiar with all of the applicable Federal, State, and City laws, rules, regulations, and procedures affecting its Bid and its Bid is in conformity with those laws, rules, regulations, and procedures; and
- The Bidder has complied with every requirement of these Instructions and that the Bidding Documents are sufficient in scope and detail to indicate and convey an understanding of all terms and conditions for the performance of the Work.

Contents of a bid.

The checklists below are included for the bidders' convenience and in no way waive or abridge the City's right to reject any or all bids.

A Bid must include:

- A completed Bid form (City of Cambridge form);
- A Bid deposit;
- MBE Forms 1 and 2 or Forms 3 and 4 (City of Cambridge form);
- General Contractor's Certification Form;
- Sub-Bidders Certification
- Projected Workforce Certification (City of Cambridge form); and
- Notarized Statement of Bidder's Qualifications (City of Cambridge form).
- OSHA Certification Form
- CREP General Contractor Certification Form
- CREP Subcontractor Certification Form
- Massachusetts Diesel Retrofit Program Statement of Intent to Comply

Right to Waive Informalities and Permit Curative Measures

The City reserves the right to waive any Bid informalities. The City may permit bidders who fail to include all non-statutory, City of Cambridge forms to cure such omission(s) within five days of bid opening, subject to the City's discretion.

Bid Deposits. Unless otherwise stated, every Bid must be accompanied by a Bid deposit in

the form of a Bid bond, certified check, or a treasurer's or cashier's check issued by a responsible bank or trust company, payable to the City of Cambridge. The Bid bond shall be (a) in a form satisfactory to the City, (b) with a surety company qualified to do business in the Commonwealth and satisfactory to the City, and (c) conditioned upon the faithful performance by the principal of the agreements contained in the Bid. The Bid deposit shall be no less than five percent (5%) of the value of the Bid.

Bid Forms. Each Bid shall be submitted on the Bid form included in the Project Manual. Total bid prices shall be stated in both dollar figures and words. In the case of a conflict, written amounts shall control over numbers. All blank spaces shall be filled. Do not leave any blanks. Print "N/A" in any space not needed or used. The Bid form shall be completed in ink or by typewriter.

Acknowledgment of Addenda. Each Bidder is required to acknowledge the receipt of all Addenda (the numbers of which are to be filled in on the Bid form by the Bidder). The City, in its sole discretion, may deem a Bidder's failure to acknowledge any Addendum a minor informality.

Submission of a bid.

Prior to the deadline for receipt of Bids, each Bid must be submitted to the Purchasing Department in a sealed envelope which is plainly marked on the outside with the name and address of the Bidder, the title of the Project, and the date and time of the Bid opening. Any hand delivered Bid received after the deadline will not be accepted. Any other Bid received after the deadline will be returned to the addressee. Any Bid submitted to any other office or department of the City and received by the Purchasing Department after the deadline for receipt of Bids will not be accepted. It is the responsibility of the Bidder to ensure that its Bid is received by the Purchasing Department in a timely fashion. The deadline for receipt of Bids can be extended by Addendum only.

Bids may not be submitted orally, by facsimile, by telephone, or by any other method except for the methods described above.

Modification of a bid.

A Bid may be modified only by submitting any such modification in the form of a document executed in the same manner as a Bid, delivered in a sealed envelope in the same manner as a Bid, designated as a modification to the original Bid and submitted to the Purchasing Department prior to the time designated for the opening of Bids.

Withdrawal of a bid.

Prior to Bid Opening. A Bid may be withdrawn before the time designated for opening Bids. The Bidder requesting such withdrawal must make the request in writing and in a specific manner designated by the City if the City so requires. Withdrawal of a Bid prior to the Bid opening time will not prejudice the right of a Bidder to resubmit a Bid. A Bid cannot

be withdrawn after the Bid opening time except as provided by law.

After Bid Opening. In the case of death, disability, bona fide clerical error or mechanical error of a substantial nature or other unforeseen circumstances affecting a Bidder, a Bidder may withdraw its Bid after the time designated for Bid opening, if within five (5) days of the date designated for opening its Bid, such Bidder submits a statement under the penalties of perjury to the Purchasing Department detailing the basis for withdrawal. The City will then make a determination as to whether such Bidder has satisfied both the statutory and City requirements for such withdrawal. If the City is satisfied, the Bid Deposit will be returned to such Bidder.

Bid opening.

All Bids received prior to the date and time designated for the Bid opening will be opened publicly and read aloud at a location designated by the Purchasing Department.

Public bid review and inspection.

Upon opening, all Bids become public records except for portions thereof that are not subject to public disclosure as a matter of law.

Bids may be reviewed by the public in a manner set forth by the Purchasing Department.

Any Bidder who objects to a Bid may protest the Bid. In order to be considered, the protest must be received by the Purchasing Department within two (2) business days after the Bid opening date. The protest must be in writing, must state in detail the basis for the protest, and must be signed by the protester.

10. RESERVATION OF RIGHTS TO REJECT BIDS

The City reserves the right to reject any or all Bids, if it is in the public interest to do so.

The City reserves the right to reject any or all Bids, if it determines that the Bidder does not possess the qualifications to perform the Work specified in the Bidding Documents.

The City reserves the right to reject the Bid of any Bidder who the City has determined has not completed a prior project, whether with the City or elsewhere, because of the fault of the Bidder, its Subcontractors or employees; has been declared in default on a prior contract whether with the City or elsewhere; has failed to complete a prior project in a timely fashion whether with the City or elsewhere; based on its work record, is not capable of performing the within Contract whether due to lack of sufficient prior experience, as determined by the City, or any other reason; has a work record of its Subcontractors demanding direct payment from the City; has a work record of its Subcontractors, employees or material suppliers complaining to the City or other awarding authority regarding the Bidder's failure to pay them; has a record of complaints made to the City or other awarding authority by persons offended by the behavior of the Bidder, its Subcontractors or employees; or has a record of its failure to comply with the Commonwealth and/or City laws or requirements. "Work

record" or "record" constitutes a minimum of one event in the work history of the Bidder.

The City shall reject every Bid that is not accompanied by a Bid deposit.

11. AWARD OF CONTRACT

The City shall award the contract to the lowest responsible (demonstrably possessing the skill, ability, and integrity necessary to faithfully perform the work called for by the Contract, based upon a determination of competent workmanship and financial soundness) and eligible (able to meet all requirements for Bidders set forth in the Bidding Documents) Bidder within 120 Business Days after the date of the opening of the Bids. If the Bidder selected as the contractor fails to perform its agreement to execute a contract in accordance with the terms of its Bid and furnish a performance bond and a labor and materials or payment bond, if required by the Bidding Documents, an award shall be made to the next lowest responsible and eligible Bidder. The ninety-day time limit shall not be applicable to a second or subsequent award made after the expiration of the time limit with the consent of the next lowest responsible and eligible bidder, and made because the original award made within the time limit was invalid, or because the bidder failed to execute the Agreement or to provide a performance and labor and materials or payment bond.

Any Bidder who fails to perform its agreement to execute a contract and furnish a performance bond and a labor and materials or payment bond shall forfeit its Bid deposit which shall become the property of the City, but shall not exceed the difference between its Bid price and the Bid price of the next lowest responsible and eligible bidder.

The City will notify the selected Bidder and all other Bidders of the award.

The City will submit to the selected Bidder a Notice of Award and at least four (4) unsigned copies of the Agreement between the City and the Contractor. The selected Bidder will be required to return to the Purchasing Department within ten (10) business days of the date notice of award all of the copies of the Agreement between the City and the Contractor signed, its performance bond, its labor and materials or payment bond and all required certificates of insurance. Failure of the selected Bidder to submit all of the required documents in a timely fashion may result in the withdrawal of the award. The City will return one fully signed copy of the Agreement to the Contractor. Time is of the essence in the performance of the Agreement.

12. COMPLETION TIME

Bidder must agree to commence work on or before ten (10) days following receipt of a written "Notice to Proceed" of the Owner and shall fully complete the Western Avenue Infrastructure Improvements Project within 720 days from the date in the Notice to Proceed thereafter. Bidder must agree also to pay as liquidated damages the sum of \$3,600.00 for each consecutive calendar day thereafter that the work remains unfinished.

END OF INFORMATION FOR AND INSTRUCTIONS TO BIDDERS

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SECTION 00210

CAMBRIDGE EMPLOYMENT PLAN MUNICIPAL ORDINANCE SECTIONS 2.66.060, ET SEQ. MINORITY/ WOMEN/ RESIDENT HIRING

HIRING REQUIREMENTS

On any construction project which is funded in whole or in part by City, State or Federal funds, or funds which the City expends or administers in accordance with a federal grant, or on any construction project for which the City is a signatory to the construction contract, the worker hours shall be performed as follows:

1. No less than TWENTY-FIVE PERCENT (25%) of the total employee worker hours shall be performed by BONA FIDE CAMBRIDGE RESIDENTS. A Cambridge resident is any person for whom the principal place where that person normally eats and sleeps and maintains his or her normal personal and household effects is within the City of Cambridge.
2. No less than TWENTY-FIVE PERCENT (25%) of the total employee worker hours shall be performed by MINORITY PERSONS. Minority persons mean and include those persons who are Black, Hispanic, Asian, Native American, or Cape Verdean.
3. No less than TEN PERCENT (10%) of the total employee worker hours shall be performed by WOMEN.

COMPLIANCE, ENFORCEMENT, SANCTIONS

1. All contractors entering into construction contracts shall:
 - a. Certify that they have read the provisions Cambridge Municipal Ordinance 2.66.060, et seq. (a copy of which follows) and that they shall comply with them;
 - b. List all job openings with Employment Resources, Inc. ("ERI") and keep accurate records as to action taken on referrals from that agency;
 - c. Maintain personnel records listing names, addresses, sex and race of their employees; and require their subcontractors to do likewise. All records required to be maintained by this section shall be made available on request to representatives of the Cambridge Community Development Department. All such records shall be maintained for the duration of the construction project and for one year thereafter.
2. Failure to comply with these requirements will result in the imposition of sanctions permitted by the Cambridge Municipal Code and any other applicable laws or provisions.

3. The following standards will be used to determine whether the Contractor has acted in good faith in attempting to meet the requirements of Cambridge Municipal Ordinance 2.66.060, et seq. for hiring residents, minorities and women:

The Contractor must demonstrate that it has done all of the following except where such requirement would conflict with a collective bargaining agreement:

- a. Prior to construction and during construction, when necessary, it posted jobs with ERI and all appropriate trade unions and requested that referrals be made in the proportions necessary to meet the CEP's employment standards;
- b. It interviewed all qualified applicants and returned completed interview forms to ERI within one week of each respective interview;
- c. It provided the City with the name and telephone number of the person designated as Compliance Officer to work directly with the City; and
- d. It has submitted to the City a projection of workforce needs over the course of construction of the project. Such submission shall reflect the needs, by trade, for each month of the construction process.

In addition, at the discretion of the City, contractors may be required to comply with the following:

- a. Place its own ads in local and local minority newspapers or tabloids;
- b. Place a State Department Employment and Training ad.

END OF SECTION 00210

SECTION 00211

CAMBRIDGE RESPONSIBLE EMPLOYER PLAN

ORDINANCE NUMBER 1260

Final Publication Number 2965. First Publication in the Chronicle on July 31, 2002.

City of Cambridge

In the Year Two Thousand and Two

AN ORDINANCE

In amendment to the Ordinance entitled “Municipal Code of the City of Cambridge”

Be it ordained by the City Council of the City of Cambridge as follows:

That Title 2 of the Municipal Code entitled “Administration and Personnel” be amended in Chapter 2.66 entitled “Cambridge Employment Plan” by striking out Section 2.66.080 entitled “Contractor qualifications and sanctions” and substituting in place thereof the following new section.

Section 2.66.080 Contractor qualifications and sanctions.

- A. All bidders and all subcontractors under the bidder for projects subject to G.L. c. 149, §44A(2) and G.L. c 30 §39M shall, as a condition for bidding, agree in writing that they shall comply with the following obligations:
1. The bidder and all subcontractors under the bidder shall comply with the Cambridge Employment Plan as it currently exists and as it may, from time to time, be amended, and specifically shall comply with the worker hours requirements of Section 2.66.060(A).
 2. The bidder and all subcontractors under the bidder must comply with the obligations established under G.L. c. 149 and G.L. c 30 §39M to pay the appropriate lawful prevailing wage rates to their employees.
 3. The bidder and all subcontractors under the bidder must maintain or participate in a bona fide apprentice training program as defined by c. 23, §§11H and 11I for each apprenticeable trade or occupation represented in their workforce that is approved by the Division of Apprentice Training of the Department of Labor and Industries and must abide by the apprentice to journeymen ratio for each trade prescribed therein in the performance of the contract.
 4. The bidder and all subcontractors under the bidder must furnish, at their expense, hospitalization and medical benefits for all their employees employed on the project and/or coverage at least comparable in value to the hospitalization and medical benefits provided by the health and

CAMBRIDGE RESPONSIBLE
EMPLOYER PLAN
00211-1

welfare plans in the applicable craft recognized by G.L. c. 149, §26 and G.L. c 30 §39M in establishing minimum wage rates.

5. The bidder and all subcontractors under the bidder must maintain appropriate industrial accident insurance coverage for all the employees employed on the project in accordance with G.L. c. 152.
 6. The bidder and all subcontractors under the bidder must properly classify employees as employees rather than independent contractors and treat them accordingly for purposes of workers' compensation insurance coverage, unemployment taxes, social security taxes and income tax withholding in accordance with G.L. c. 149, §148B and G.L. c 30 §39M.
- B. All bidders and subcontractors under the bidder who are awarded or who otherwise obtain contracts on projects subject to G.L. c. 149, §44A(2) and G.L. c 30 §39M shall comply with the obligations numbered 1 through 6 as set forth in subsection A of this section for the entire duration of their work on the project, and an officer of each such bidder or subcontractor under the bidder shall certify under oath and in writing on a weekly basis that they are in compliance with such obligations.
- C. Any bidder or subcontractor under the bidder who fails to comply with any one of obligations 1 through 6 as set forth in subsection A of this section for any period of time shall be, at the sole discretion of the City Manager, subject to one or more of the following sanctions: (1) cessation of work on the project until compliance is obtained; (2) withholding of payment due under any contract or subcontract until compliance is obtained; (3) permanent removal from any further work on the project; (4) liquidated damages payable to the City in the amount of five percent of the dollar value of the contract.
- D. In addition to the sanctions outlined in subsection C of this section, a general bidder or contractor shall be equally liable for the violations of its subcontractor with the exception of violations arising from work performed pursuant to subcontracts that are subject to G.L. c. 149, §44F and G.L. c 30 §39M. Any contractor or subcontractor who has been determined to have violated any of the obligations set forth in subsections A and B of this section shall be barred from performing any work on any future projects for six months for a first violation, for three years for a second violation, and permanently for a third violation.
- E. The provisions of this section shall not apply to construction projects for which the low general bid was less than one hundred thousand dollars or to work performed pursuant to subcontracts that are subject to G.L. c. 149, §44F and G.L. c 30 §39M and that were bid for less than twenty-five thousand dollars, or to re-bids for construction projects for which the City receives fewer than three qualified general contract bidders in the original bid. (Ord. 1162, 1995)

In City Council September 9, 2002.
Passed to be ordained.
Yeas 8; Nays 0; Absent 1.
Attest:- D. Margaret Drury, City Clerk.

A true copy;

ATTEST:-

D. Margaret Drury
City Clerk

END OF SECTION 00211

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Chapter 2.121

LIVING WAGE ORDINANCE

Sections:

- 2.121.010 Title and Purpose**
- 2.121.020 Definitions**
- 2.121.030 Living Wage**
- 2.121.040 Waivers and Exceptions**
- 2.121.050 Notification Requirements**
- 2.121.060 Duties of covered Employers**
- 2.121.070 Community Advisory Board**
- 2.121.080 Enforcement**
- 2.121.090 Severability**
- 2.121.100 Effective Date**

2.121.010 Title and Purpose.

This Chapter shall be known as the "Cambridge Living Wage Ordinance". The purpose of this ordinance is to assure that employees of the City of Cambridge and employees of City contractors, subcontractors and beneficiaries of tax abatements, loans, grants, subsidies and other assistance provided by the City earn an hourly wage that is needed to support a family of four.

2.121.020 Definitions.

For the purposes of this ordinance, the term:

(a) "Applicable Department" means the Personnel Department for employees of the City of Cambridge, the Purchasing Department, with the advice and assistance of the appropriate department which receives the services, for Covered Employers who contract or subcontract

with the City of Cambridge, the School Department for employees, contractors and subcontractors of the School Department, and the City Manager's Office for any other Person who is a Beneficiary of assistance other than a contract or subcontract.

(b) "Assistance" means:

(1) any grant, loan, tax incentive, bond financing, subsidy, or other form of assistance valued at least \$10,000 that an employer receives by or through the authority or approval of the City of Cambridge, including, but not limited to, c. 121A tax abatements, industrial development bonds, Community Development Block Grant (CDBG) loans and grants, Enterprise Zone designations awarded after the effective date of this Chapter, and the lease of city owned land or buildings below market value; and

(2) any service contract, as defined herein, of at least \$10,000 with the City of Cambridge that is made with an employer to provide services pursuant to G.L.c. 30B or other public procurement laws, awarded, renegotiated or renewed after the effective date of this Chapter.

(3) any service subcontract, as defined herein, of at least \$10,000.

(c) "Beneficiary" means:

(1) any person who is a recipient of Assistance;

(2) any company or person that is a tenant or sub-tenant, leaseholder or sub-leaseholder of a recipient of Assistance, provided that said company or person employs at least 25 persons and occupies property or uses equipment or property that is improved or developed as a result of Assistance, after the effective date of this Chapter; and

(d) **"Covered Employer"** means the City of Cambridge or a Beneficiary of Assistance.

(e) **"Covered Employee"** means:

(1) a person employed by the City of Cambridge except for persons in those positions listed in Section 2.121.040(j) of this ordinance; and

(2) a person employed by a Covered Employer, or a person employed by an independent contractor doing business with a Covered Employer, who would directly expend any of his or her time on the activities funded by the contract or the activities for which the Beneficiary received the Assistance, except for persons in those positions listed in Section 2.121.040(j) of this ordinance..

(f) **"Living Wage"** has the meaning stated in Section 2.121.030.

(g) **"Person"** means one or more of the following or their agents, employees, servants, representatives, and legal representatives: individuals, corporations, partnerships, joint ventures, associations, labor organizations, educational institutions, mutual companies, joint-stock companies, trusts, unincorporated organizations, trustees, trustees in bankruptcy, receivers, fiduciaries, and all other entities recognized at law by the Commonwealth of Massachusetts.

(h) **"Service Contract"** means a contract let to a contractor by the City of Cambridge for the furnishing of services, to or for the City, except contracts where services are incidental to the delivery of products, equipment or commodities. A contract for the purchase or lease of

goods, products, equipment, supplies or other property is not a "service contract" for the purposes of this definition.

(i) **"Service Subcontract"** means a subcontract primarily for the furnishing of services, to or for a recipient of Assistance, except where services are incidental to the delivery of products, equipment or commodities. A contract for the purchase or lease of goods, products, equipment, supplies or other property is not a "service subcontract" for the purposes of this definition.

2.121.030 Living Wage.

(a) **Applicability.** Covered Employers shall pay no less than the Living Wage to their employees.

(b) **Amount of wage.** The Living Wage shall be calculated on an hourly basis and shall be no less than \$10.00, subject to adjustment as provided herein. The Living Wage shall be upwardly adjusted each year no later than March first in proportion to the increase at the immediately preceding December 31 over the year earlier level of the Annual Average Consumer Price Index for All Urban Consumers (CPI -U) Boston-Lawrence-Salem, MA - NH, as published by the Bureau of Labor Statistics, United States Department of Labor applied to \$10.00.

(c) **No reduction in collective bargaining wage rates.** Nothing in this Chapter shall be read to require or authorize any beneficiary to reduce wages set by a collective bargaining agreement.

(d) Cuts in non-wage benefits prohibited. No Beneficiary will fund wage increases required by this Chapter, or otherwise respond to the provisions of this Chapter, by reducing the health, insurance, pension, vacation, or other non-wage benefits of any of its employees.

2.121.040 Waivers and Exceptions.

(a) Waivers. A Covered Employer may request that the City Manager grant a partial or whole waiver to the requirements of this Chapter.

(b) General Waivers. Waivers may be granted where application of this Chapter to a particular form of Assistance is found by the City Solicitor to violate a specific state or federal statutory, regulatory or constitutional provision or provisions, and the City Manager approves the waiver on that basis.

(c) Hardship Waivers for certain not-for-profit employers. An employer, who has a contract with the City of Cambridge which is not subject to the provisions of G.L. c. 30B, may apply to the City Manager for a specific waiver where payment of the Living Wage by a not-for-profit Covered Employer would cause a substantial hardship to the Covered Employer.

(d) Chapter 30B contract waivers. Prior to issuing an invitation for bids for a procurement contract subject to the provisions of G.L. c. 30B, any Applicable Department may apply to the City Manager for a waiver of the application of the Living Wage to the contract where payment of the Living

Wage by a Covered Employer would make it inordinately expensive for the City to contract for the services or would result in a significant loss of services, because the contracted work cannot be segregated from the other work of the Covered Employer.

(e) General Waiver Request Contents. All General Waiver requests shall include the following:

(1) The nature of the Assistance to which this Chapter applies;

(2) The specific or official name of the Assistance and Assistance program, the statutory or regulatory authority for the granting of the Assistance, and a copy of that authority;

(3) The conflicting statutory, regulatory, or constitutional provision or provisions that makes compliance with this Chapter unlawful, and a copy of each such provision; and

(4) A factual explication and legal analysis of how compliance with this Chapter would violate the cited provision or provisions, and the legal consequences that would attach if the violation were to occur.

(f) Hardship Waiver Request Contents. All Hardship Waiver requests shall include the following:

(1) The nature of the Assistance to which this Chapter applies;

(2) A detailed explanation of why payment of the Living Wage would cause a substantial hardship to the Covered Employer; and

(3) A statement of proposed wages below the Living Wage.

(g) Chapter 30B Contract Waiver Request Contents. A Chapter 30B contract waiver request shall include the following:

(1) The nature of the Assistance to which this Chapter applies;

(2) A detailed explanation of why the contracted work cannot be segregated from the other work of the bidding Covered Employers thereby making the cost of the contract with the payment of the Living Wage inordinately expensive or would result in a significant loss of services;

(h) Community Advisory Board review and recommendation regarding waiver requests. The Community Advisory Board, as described in Section 2.121.070 of this ordinance, shall consider waiver requests along with their supporting documentation and analysis, and may hold a public hearing to consider the views of the public before making a recommendation to the City Manager regarding the waiver request. For a hardship waiver, the Community Advisory Board shall offer an opportunity to be heard to employees of the Covered Employer. After reviewing the recommendation of the Community Advisory Board, the City Manager may approve and grant or deny all or part of a request. The City Manager may in his or her discretion grant a temporary hardship waiver pending the hearing before the Community Advisory Board. For Chapter 30B contract waivers, the Community Advisory Board shall make its recommendation to the City Manager no more than thirty days after it is notified of the request for a Chapter 30B contract waiver.

(i) Terms of exceptions. If an employer is subject to this Chapter as a result of its receipt of more than one kind of Assistance covered by this Chapter, and if the City Manager grants

a waiver with respect to one form of Assistance, the City Manager need not find that this Chapter is inapplicable to the employer with respect to another form of Assistance received by the employer.

(j) Exceptions. The following positions will be excepted from the requirement of the payment of the Living Wage upon certification in an affidavit in a form approved by the Applicable Department and signed by a principal officer of the Covered Employer that the positions are as follows:

(1) youth hired pursuant to a city, state, or federally funded program which employs youth as defined by city, state, or federal guidelines, during the summer, or as part of a school to work program, or in other related seasonal or part-time program;

(2) work-study or cooperative educational programs;

(3) trainees who are given a stipend or wage as part of a job training program that provides the trainees with additional services, which may include, but are not limited to, room and board, case management, or job readiness services.

(4) persons working in a recognized supported employment program that provides workers with additional services, which may include, but are not limited to, room and board, case management, counseling, or job coaching;

(5) positions where housing is provided by the employer;

(6) employees who are exempt from federal or state minimum wage requirements; and

(7) individuals employed by the City of Cambridge where the employment of such individuals is

intended primarily to provide a benefit or subsidy to such individuals, although the City is compensating them for work performed.

2.121.050 Notification Requirements.

All Applicable Departments shall provide in writing an explanation of the requirements of this ordinance in all requests for bids for service contracts and to all persons applying for Assistance as defined by this ordinance. All persons who have signed a service contract with the City of Cambridge or a contract for Assistance shall forward a copy of such requirements to any person submitting a bid for a subcontract on the Assistance contract.

2.121.060 Duties of Covered Employers.

(a) Notification Requirements. Covered employers shall provide each Covered employee with a fact sheet about this ordinance and shall post a notice about the ordinance in a conspicuous location visible to all employees. The fact sheet and poster shall be provided to the Covered Employer by the Applicable Department and shall include:

- (1) notice of the Living Wage amount;
- (2) a summary of the provisions of this ordinance;
- (3) a description of the enforcement provisions of the ordinance;
- (4) the name, address, and phone number of a person designated by the Applicable Department to whom complaints of noncompliance with this ordinance should be directed.

(b) Contract for Assistance. At the time of signing a contract for assistance with the City of Cambridge or with a Beneficiary, the contract must include the following:

- (1) the name of the program or project under which the contract or subcontract is being awarded;
- (2) a local contact name, address, and phone number for the Beneficiary;
- (3) a written commitment by the Beneficiary to pay all Covered Employees not less than the Living Wage as subject to adjustment under this ordinance and to comply with the provisions of this ordinance;
- (4) a list of Covered Employees under the contract with the employees' job titles;
- (5) a list of all subcontracts either awarded or that will be awarded to Beneficiaries with funds from the Assistance. Upon signing any subcontracts, the Covered Employer shall forward a copy of the subcontract to the Applicable Department.

(c) Maintenance of payroll records. Each Covered Employer shall maintain payrolls for all Covered Employees and basic records relating thereto and shall preserve them for a period of three years. The records shall contain the name and address of each employee, the job title and classification, the number of hours worked each day, the gross wages, deductions made, actual wages paid, and copies of social security wage and withholding reports, and evidence of payment thereof and such other data as may be required by the Applicable Department from time to time.

(d) Applicable Department duties. The Applicable Department shall cause investigations to be made as may be

necessary to determine whether there has been compliance with this Ordinance. The Applicable Department shall report the findings of all such investigations to the Community Advisory Board.

(e) Covered Employer to cooperate. The Covered Employer shall submit payroll records on request to the Applicable Department. The Covered Employer shall permit City representatives to observe work being performed upon the work site, to interview employees and to examine the books and records relating to the payrolls being investigated to determine payment of wages.

(f) City Assistance Reports. Each Applicable Department shall file a City Assistance Report with the City Manager and the Community Advisory Board by July 31 of each year. The report shall include, for each Assistance package or contract approved during the preceding fiscal year:

(1) the name of the Applicable Department (awarding agency), the name of the specific program under which the Assistance was awarded, and the origin of funds for Assistance;

(2) a description of the purpose or project for which the Assistance was awarded;

(3) the name, address, and phone number of a local contact person for the Covered Employer;

(4) the total cost to the City of Assistance provided to each Beneficiary, including both face-value of Assistance, as well as revenue not collected as a result of the Assistance.

2.121.070 Community Advisory Board.

(a) Purpose. The purpose of the Community Advisory Board shall be to review the effectiveness of this Ordinance at creating and retaining Living Wage jobs, to make recommendations to the City Manager regarding the granting of Waivers to Covered Employers, to review the implementation and enforcement of this ordinance, and to make recommendations from time to time in connection therewith.

(b) Composition. The Community Advisory Board shall be composed of nine members and shall include representatives of labor unions, community organizations and the business community. All members will be appointed by the City Manager. Members of the Board shall serve a three-year term. Whenever a vacancy shall occur the City Manager shall appoint a replacement within thirty days of said vacancy.

(c) Meetings. The Community Advisory Board shall meet quarterly and in special session as required. All meetings of the Board shall be open to the public and will allow for public testimony on the uses of the City Assistance generally, and on specific instances of Assistance or proposed Assistance as received or sought by individual enterprises.

(d) Conflict of Interest. No member of the Community Advisory Board shall participate in any proceeding concerning a Beneficiary, a Covered Employer or a Covered Employee, or applicant for waiver or exemption, if the member or any member of his or her immediate family has a direct or indirect financial

interest in the outcome of said proceeding.

2.121.080 Enforcement.

(a) Enforcement powers. In order to enforce this Chapter, the Applicable Department may, with the approval and assistance of the City Solicitor, issue subpoenas, compel the attendance and testimony of witnesses and production of books, papers, records, and documents relating to payroll records necessary for hearing, investigations, and proceedings. In case of failure to comply with a subpoena, the City may apply to a court of appropriate jurisdiction for an order requiring the attendance and testimony of witnesses and the productions of books, papers, records, and documents. Said court, in the case of a refusal to comply with any such subpoena, after notice to the person subpoenaed, and upon finding that the attendance or testimony of such witnesses or the production of such books, papers, records, and documents, as the case may be, is relevant or necessary for such hearings, investigation, or proceedings, may issue an order requiring the attendance or testimony of such witnesses or the production of such documents and any violation of the court's order may be punishable by the court as contempt thereof.

(b) Complaint procedures. An employee who believes that he or she is a Covered Employee or an applicant for a position to be filled by a Covered Employee who believes that his or her employer is not complying with requirements of this Chapter applicable to the employer may file a complaint with the Applicable Department or with the Community Advisory Board.

Complaints of alleged violations may also be filed by concerned citizens or by the City Council. Complaints of alleged violations may be made at any time, but in no event more than three years after the last date of alleged violation, and shall be investigated promptly by the Applicable Department. Statements written or oral, made by an employee, shall be treated as confidential and shall not be disclosed to the Covered Employer without the consent of the employee.

(c) Investigations and hearings. The Applicable Department shall investigate the complaint, and may, in conjunction with the City Solicitor, and in accordance with the powers herein granted, require the production by the employer of such evidence as required to determine compliance. Prior to ordering any penalty the applicable Department shall give notice to the employer and conduct a hearing. If at any time during these proceedings, the employer voluntarily makes restitution of the wages not paid to the employee making the complaint and to any similarly situated employees, by paying all back wages owed plus interest at the average prior year Massachusetts passbook savings bank rate, or otherwise remedies the violation alleged if the violation involves matters other than wages, then the Applicable Department shall thereafter dismiss the complaint against the employer.

(d) Remedies. In the event that the Applicable Department, after notice and hearing, determines that any Covered Employer has failed to pay the Living Wage rate or has otherwise violated the provisions of this Chapter, the Applicable Department may order any or all of the following penalties and relief:

(1) Fines up to the amount of \$300 for each Covered Employee for each day that the Covered Employer is in violation of this Ordinance, except if the violation was not knowing and willful, then the total fine shall not exceed the amount of back wages plus interest owed;

(2) Suspension of ongoing contract and subcontract payments;

(3) Ineligibility for future City Assistance for up to three years beginning when all penalties and restitution have been paid in full. In addition, all Covered Employers having any principal officers who were principal officers of a barred beneficiary shall be ineligible under this section; and

(4) Any other action deemed appropriate and within the discretion and authority of the city.

Remedies in this section shall also apply to the party or parties aiding and abetting in any violation of this chapter.

(e) Private right of action. Any Covered Employee, or any person who was formerly employed by a Beneficiary, may bring an action to enforce the provisions of this Chapter to recover back pay and benefits, attorneys fees and costs, by filing suit against a Beneficiary in any court of competent jurisdiction.

(f) Remedies herein non-exclusive. No remedy set forth in this Chapter is intended to be exclusive or a prerequisite for asserting a claim for relief to enforce the right granted under this Chapter in a court of law. This Chapter shall not be construed to limit an employee's right to bring a common law cause of action for wrongful termination.

(g) Retaliation and discrimination barred. A Covered Employer shall not discharge, reduce the compensation or otherwise retaliate against any employee for making a complaint to the City, otherwise asserting his or her rights under this Chapter, participating in any of its proceedings or using any civil remedies to enforce his or her rights under the Chapter. The City shall investigate allegations of retaliation or discrimination and shall, if found to be true, after notice and a hearing, order appropriate relief as set out in paragraphs (c) and (d) herein

2.121.090 Severability.

In the event any provision of this ordinance shall be held invalid or unenforceable by any court of competent jurisdiction, such holding shall not invalidate or render unenforceable any other provisions hereof.

2.121.100 Effective Date.

This law shall be effective sixty (60) after final passage.

The Living Wage Ordinance (2.121) provides, at 1.121.030(b) that the wage shall be upwardly adjusted each year no later than March 1st in proportion to the increase in the Annual Average Consumer Price Index for the prior calendar year for All Urban Consumers (CPI-U) in the Boston area, as published by the federal Bureau of Labor Statistics.

For calendar year 1999, the CPI-U increased by 2.5%. Therefore the new living wage, as of March 1, 2000 is \$10.25.

For calendar year 2000, the CPI-U increased by 4.3%. Therefore the new living wage, as of March 1, 2001 is \$ 10.68.

For calendar year 2001, the CPI-U increased by 4.3%. Therefore the new living wage, as of March 1, 2002 is \$11.11.

For calendar year 2002, the CPI-U increased by 2.6% . Therefore the new living wage, as of March 1, 2003 is \$11.37.

The City Council has voted to amend the section of the Living Wage Ordinance (1.121.030 (b) that provides the method for calculating cost of living increases each year. As a result of this change, the living wage as of March 30, 2003 is \$11.44.

For calendar year 2003, the CPI-U increased by 3.76%. Therefore the new living wage, as of March 1, 2004 is \$11.87.

For calendar year 2004, the CPI-U increased by 2.7%. Therefore the new living wage, as of March 1, 2005 is \$12.19.

For calendar year 2005, the CPI-U increased by 3.3%. Therefore the new living wage, as of March 1, 2006 is \$12.59.

For calendar year 2006 the CPI-U increased by 3.1 %. Therefore the new living wage, as of March 1, 2007 is \$12.98.

For calendar year 2007 the CPI-U increased by 1.9 %. Therefore the new living wage, as of March 1, 2008 is \$13.23.

For calendar year 2008 the CPI-U increased by 3.5 %. Therefore the new living wage, as of March 1, 2009 is \$13.69.

For calendar year 2009 the CPI-U decreased by .67 %. Therefore the new living wage, as of March 1, 2010 will remain at \$13.69.

For calendar year 2010 the CPI-U increased by 1.57%. Therefore the new living wage, as of March 1, 2011 is \$13.90.

For calendar year 2011 the CPI-U increased by 2.71%. Therefore the new living wage, as of March 1, 2012 is \$14.28.

END OF SECTION 00215

SECTION 00221
CORI CITY POLICY

City of Cambridge CORI Policy

1. Where Criminal Offender Record Information (CORI) checks are part of a general background check for employment or volunteer work, the following practices and procedures will generally be followed.
2. CORI checks will only be conducted as authorized by Criminal History Systems Board (CHSB). All applicants will be notified that a CORI check will be conducted. If requested, the applicant will be provided with a copy of the CORI policy.
3. An informed review of a criminal record requires adequate training. Accordingly, all personnel authorized to review CORI in the decision-making process will be thoroughly familiar with the educational materials made available by the CHSB.
4. Prior to initiating a CORI check, the City will review the qualifications of the applicant to determine if the applicant is otherwise qualified for the relevant position. The City will not conduct a CORI check on an applicant that is not otherwise qualified for the relevant position.
5. Unless otherwise provided by law, a criminal record will not automatically disqualify an applicant. Rather, determination of suitability based on CORI checks will be made consistent with this policy and any applicable law or regulations.
6. If a criminal record is received from CHSB, the authorized individual will closely compare the record provided by CHSB with the information on the CORI request form and any other identifying information provided by the applicant, to ensure the record relates to the applicant.
7. If, in receiving a CORI report, the City receives information it is not authorized to receive (e.g. cases with dispositions such as not guilty or dismissal, in circumstances where the City is only authorized to receive convictions or case-pending information), the City will inform the applicant and provide the applicant with a copy of the report and a copy of CHSB's *Information Concerning the Process in Correcting a Criminal Record* so that the applicant may pursue correction with the CHSB.
8. If the City of Cambridge is planning to make an adverse decision based on the results of the CORI check, the applicant will be notified immediately. The applicant shall be provided with a copy of the criminal record and the City's CORI policy, advised of the part(s) of the record that make the individual unsuitable for the position and given an opportunity to dispute the accuracy and relevance of the CORI record.

9. Applicants challenging the accuracy of the criminal record shall be provided a copy of CHSB's *Information Concerning the Process in Correcting a Criminal Record*. If the CORI record provided does not exactly match the identification information provided by the applicant, the City of Cambridge will make a determination based on a comparison of the CORI record and documents provided by the applicant. The City of Cambridge may contact CHSB and request a detailed search consistent with CHSB policy.
10. If the City of Cambridge reasonably believes the record belongs to the applicant and is accurate, then the determination of suitability for the position will be made. Unless otherwise provided by law, factors considered in determining suitability may include, but not be limited to the following:
 - (a) Relevance of the crime to the position sought;
 - (b) The nature of the work to be performed;
 - (c) Time since the conviction;
 - (d) Age of the candidate at the time of offense;
 - (e) Seriousness and specific circumstances of the offense;
 - (f) The number of offenses;
 - (g) Whether the applicant has pending charges;
 - (h) Any relevant evidence of rehabilitation or lack thereof;
 - (i) Any other relevant information, including information submitted by the candidate or requested by the City.
11. The Personnel Department will assist affected departments, in assessing the suitability of candidates in accordance with paragraph 10, a through i above, to ensure consistency, fairness, and protection of employment opportunities and the public interest.
12. The City of Cambridge will notify the applicant of the decision and the basis of the decision in a timely manner.
13. CORI information shall not be disseminated or shared with any unauthorized employees or other, but shall be maintained in confidence consistent with the obligations of law.

Revised May 5, 2007

SECTION 00222
CITY CORI ORDINANCE

ORDINANCE NUMBER 1312

**Final Publication Number 3155. First Publication in the Chronicle on December 13,
2007.**

City of Cambridge

In the Year Two Thousand and Eight

AN ORDINANCE

**In amendment to the Ordinance entitled
“Municipal Code of the City of Cambridge”**

**Be it ordained that Cambridge Municipal Code Chapter 2.112 is hereby amended by
adding a new Section 2.112.060 entitled “CORI Screening by Vendors of the City of
Cambridge” as follows:**

Adding after Section 2.112.050 the following new sections:

SECTION 2.112.060

CORI SCREENING BY VENDORS OF THE CITY OF CAMBRIDGE

Sections:

2.112.061 Purpose

2.112.062 Definitions

2.112.063 CORI-Related Standards of the City of Cambridge

2.112.064 Waiver

2.112.065 Applicability

2.112.061 Purpose

These sections are intended to ensure that the persons and businesses supplying goods and/or services to the City of Cambridge deploy fair policies relating to the screening and identification of persons with criminal backgrounds through the CORI system.

2.112.062 Definitions

Unless specifically indicated otherwise, these definitions shall apply and control.

Awarding Authority means the City of Cambridge Purchasing Agent or designee.

Vendor means any vendor, contractor, or supplier of goods and/or services to the City of Cambridge.

2.112.063 CORI-Related Standards of the City of Cambridge

The City of Cambridge employs CORI-related policies, practices and standards that are fair to all persons involved and seeks to do business with vendors that have substantially similar policies, practices and standards. The City of Cambridge will do business only with vendors who, when required by law to perform CORI checks, employ CORI-related policies, practices, and standards that are consistent with policies, practices and standards employed by the City of Cambridge. The awarding authority shall consider any vendor's deviation from policies, practices and standards employed by the City of Cambridge as grounds for rejection, rescission, revocation, or any other termination of the contract.

2.112.064 Waiver

The City Manager may grant a waiver to anyone who or which has submitted a request for waiver if it is objectively reasonable; and the City Manager, or a delegate, shall report promptly in writing to the City Council all action taken with respect to every request for a waiver and the reasons for the decision.

2.112.065 Applicability

If any provision of these sections imposes greater restrictions or obligations than those imposed by any other general law, special law, regulation, rule, ordinance, order, or policy then the provisions of these sections shall control.

In City Council January 28, 2008.
Passed to be ordained by a yea and nay vote:
- Yeas 9; Nays 0; Absent 0.
Attest:- D. Margaret Drury, City Clerk.

A true copy;

ATTEST:-

D. Margaret Drury
City Clerk

END OF SECTION 00222

SECTION 00300
FORM FOR GENERAL BID

To the Awarding Authority: CITY OF CAMBRIDGE, MASSACHUSETTS

A. The undersigned proposes to furnish all labor and materials required for

Western Avenue Infrastructure Improvements Project

CAMBRIDGE, MA

in accordance with the accompanying plans and specifications including all Labor and Materials, for the contract price specified below, subject to additions and deductions according to the terms of the specifications.

The bidder may utilize subcontractors' qualifications for responding to the quality requirements. However, the bidder is specifically advised that any person, firm or other party to whom it proposes to award a subcontract under the terms of this contract must be acceptable to the owner and to the Commonwealth of Massachusetts.

B. **QUALITY REQUIREMENTS**

The City of Cambridge will reject any bid that does not meet the quality requirements. A "no" response or a failure to adequately respond to any of the following quality requirements will result in a rejection of your bid.

- | | | |
|---|-----|----|
| 1. Bidder has been in the business of performing reconstruction of sewers, drains, water mains, sidewalks, and roadways for municipalities or public utilities for at least ten (10) years. | YES | NO |
| 2. Bidder has equipment and personnel available to respond within four (4) hours to emergency calls relating to work of this contract 24 hours a day, 7 days a week, throughout the contract period. | YES | NO |
| 3. Bidder has evaluated its current project workload and determined that it has the capacity, through its current professional and labor workforce, to begin the contract within ten days following the date set forth in the Notice to Proceed. | YES | NO |
| 4. The Bidder has reviewed the labor, equipment, and capacity requirements for its projected workload in Year(s) 2012-2014 and has determined that the Bidder has the resources to perform the work proposed in the Western Avenue Infrastructure Improvements project. | YES | NO |

Bidder's Name _____

- C. This bid includes addenda numbered _____
- D. The bidder hereby agrees to commence work under this Contract on or before a date to be specified, in a written "Notice To Proceed", by the Owner, and to fully complete all work of this Project, within 720 calendar days from the date in the "Notice to Proceed" thereafter.
- E. Liquidated damages specified in this contract are **\$3,600.00** per day for each calendar day beyond the contract completion date for all work that remains uncompleted, except for final paving; and are **\$3,600.00** per day for each calendar day beyond the 720 calendar days from date set forth in the "Notice to Proceed"
- F. Proposed Contract Price is _____

DOLLARS

(\$ _____)

- G. The subdivision of the Proposed Contract Price is as follows: **(All quantities are approximate)**
- H. **Items 2080.1 through 2095.8 contain the minimum unit prices. The Contractor shall add to this value an adjustment to provide the final unit price bid for the respective item. The final unit price bid shall be the sum of the minimum unit price and the Bidders additional price. Insertion of 0 is allowable. In that case, the final unit cost will be the minimum unit cost.**

(SEE FOLLOWING PAGES)

Bidder's Name _____

BASE BID ITEMS

Item #	Estimated Quantity	Units	ITEM DESCRIPTION		Amount
			Description of the Work and Unit Price Bid Written in Words and Numbers		
1200.1	1	Lump Sum	Temporary Utility Support and Coordination _____ Dollars (\$ _____) Lump Sum		\$ _____
1505.1	1	Lump Sum	Mobilization (Maximum 5% Bid) _____ Dollars (\$ _____) Lump Sum		\$ _____
1568.1	1	Lump Sum	Sedimentation and Erosion Control _____ Dollars (\$ _____) Lump Sum		\$ _____
1570.1	1	Lump Sum	Traffic and Pedestrian Management _____ Dollars (\$ _____) Lump Sum		\$ _____
1570.2	300	Unit Week	Variable Message Boards _____ Dollars (\$ _____) Per Unit Week		\$ _____
2010.1	1	Lump Sum	Geotechnical Borings _____ Dollars (\$ _____) Lump Sum		\$ _____

Bidder's Name _____
 Western Avenue
 Bid Documents

Item #	Estimated Quantity	Units	ITEM DESCRIPTION	
			Description of the Work and Unit Price Bid Written in Words and Numbers	Amount
2015.1	180	Day	Geotechnical and Instrumentation and Monitoring _____ Dollars (\$ _____) Per Day	\$ _____
2051.1	7,250	Ton	Disposal of Construction Debris as Solid Waste _____ Dollars (\$ _____) Per Ton	\$ _____
2051.2	11,900	Ton	Disposal of Bituminous Concrete _____ Dollars (\$ _____) Per Ton	\$ _____
2051.3	46	Each	Demolition or Removal of Lamp Hole, Manhole, Catch Basin or Other Structure _____ Dollars (\$ _____) Per Each	\$ _____
2051.4	13	Each	Abandon In Place Manhole, Catch Basin or Other Structure _____ Dollars (\$ _____) Per Each	\$ _____
2051.5	1,250	Linear Foot	Demolition or Removal of Pipe Greater than 15-Inch Through 36-Inch Pipe Diameter _____ Dollars (\$ _____) Per Linear Foot	\$ _____

Bidder's Name _____
 Western Avenue
 Bid Documents

Item #	Estimated Quantity	Units	ITEM DESCRIPTION	
			Description of the Work and Unit Price Bid Written in Words and Numbers	Amount
2051.6	825	Linear Foot	Demolition or Removal of Pipe Greater than 36-Inch Through 48-Inch Pipe Diameter _____ Dollars (\$ _____) Per Linear Foot	\$ _____
2051.7	1,325	Linear Foot	Demolition or Removal of Pipe – 22-Inch x 28-Inch Old Sewer _____ Dollars (\$ _____) Per Linear Foot	\$ _____
2051.8	8	Each	Bulkhead for Pipe Plug or Abandonment Equal to or Greater than 30-Inch Diameter _____ Dollars (\$ _____) Per Each	\$ _____
2080.1	1	Lump Sum	OHM – Soil and Waste Management Thirty Thousand and 00/100 + _____ Dollars (\$30,000.00 + _____ = _____ Lump Sum	\$ _____
2080.2	60	Cubic Yard	OHM – Handling Asbestos Contaminated Soil/Fill Fifty and 00/100 + _____ = _____ Dollars (\$50.00 + _____ = _____) Per Cubic Yard	\$ _____
2080.3	60	Cubic Yard	OHM – Handle and Characterize Unknown Materials Fifty and 00/100 + _____ = _____ Dollars (\$50.00 + _____ = _____) Per Cubic Yard	\$ _____

Bidder's Name _____
 Western Avenue
 Bid Documents

Item #	Estimated Quantity	Units	ITEM DESCRIPTION	
			Description of the Work and Unit Price Bid Written in Words and Numbers	Amount
2095.1	9,000	Ton	OHM – Disposal of Soil – Daily Cover Unlined Landfill (Class B-1) Fifteen and 00/100 + _____ = _____ Dollars (\$15.00 + _____ = _____) Per Ton	\$ _____
2095.2	60	Ton	OHM – Disposal of Soil – Daily Cover Lined Landfill (Class B-2) Twenty and 00/100 + _____ = _____ Dollars (\$20.00 + _____ = _____) Per Ton	\$ _____
2095.3	2,260	Ton	OHM – Disposal of Soil - Non-Hazardous Solid Waste Asphalt Batching In-State (Class B-3) Twenty and 00/100 + _____ = _____ Dollars (\$20.00 + _____ = _____) Per Ton	\$ _____
2095.4	60	Ton	OHM – Disposal of Soil - Non Hazardous Solid Waste Thermal Treatment (Class B-4) Thirty and 00/100 + _____ = _____ Dollars (\$30.00 + _____ = _____) Per Ton	\$ _____
2095.5	60	Ton	OHM – Disposal of Soil – Non-Hazardous Solid Waste Recycling (Class B-5) Thirty and 00/100 + _____ = _____ Dollars (\$30.00 + _____ = _____) Per Ton	\$ _____
2095.6	60	Ton	OHM – Disposal of Soil – Treatment of RCRA Characteristically Hazardous Soil to De-Characterize and Disposal of Soil as Non-Hazardous Waste (Class C-1) Eighty and 00/100 + _____ = _____ Dollars (\$80.00 + _____ = _____) Per Ton	\$ _____

Bidder's Name _____
 Western Avenue
 Bid Documents

Item #	Estimated Quantity	Units	ITEM DESCRIPTION	
			Description of the Work and Unit Price Bid Written in Words and Numbers	Amount
2095.7	30	Ton	OHM – Disposal of Soil - RCRA Hazardous Waste (Class C-2) <u>Eighty and 00/100 + _____ = _____</u> Dollars (\$ <u>80.00</u> + _____ =) Per Ton	\$ _____
2095.8	30	Ton	OHM – Disposal of Asbestos Waste <u>One Hundred and 00/100 + _____ = _____</u> Dollars (\$ <u>100.00</u> + _____ =) _____ Per Ton	\$ _____
2140.1	180	Day	Treatment of Construction Dewatering _____ Dollars (\$ _____) Per Day	\$ _____
2210.1	1,700	Cubic Yard	Test Pits _____ Dollars (\$ _____) Per Cubic Yard	\$ _____
2210.2	600	Cubic Yard	Control Density Fill _____ Dollars (\$ _____) Per Cubic Yard	\$ _____
2210.3	1,160	Cubic Yard	Overexcavation of Organic Silt and Peat _____ Dollars (\$ _____) Per Cubic Yard	\$ _____

Bidder's Name _____
 Western Avenue
 Bid Documents

Item #	Estimated Quantity	Units	ITEM DESCRIPTION		Amount
			Description of the Work and Unit Price Bid Written in Words and Numbers		
2210.4	7,675	Cubic Yard	Unclassified Excavation _____ Dollars (\$ _____) Per Cubic Yard		\$ _____
2210.5	4,890	Cubic Yard	Imported Gravel Sub-Base _____ Dollars (\$ _____) Per Cubic Yard		\$ _____
2210.6	150	Cubic Yard	Crushed Stone Cycle Track Base _____ Dollars (\$ _____) Per Cubic Yard		\$ _____
2210.7	14,200	Square Yard	Fine Grading and Compacting (Subgrade Areas) _____ Dollars (\$ _____) Per Square Yard		\$ _____
2252.1	525	Vertical Foot	Manhole – Precast 4-Foot Diameter _____ Dollars (\$ _____) Per Vertical Foot		\$ _____
2252.2	260	Vertical Foot	Manhole – Precast 5-Foot Diameter _____ Dollars (\$ _____) Per Vertical Foot		\$ _____

Bidder's Name _____
 Western Avenue
 Bid Documents

Item #	Estimated Quantity	Units	ITEM DESCRIPTION	
			Description of the Work and Unit Price Bid Written in Words and Numbers	Amount
2252.3	75	Vertical Foot	Manhole – Precast 5-Foot Diameter Exterior Drop _____ Dollars (\$ _____) Per Vertical Foot	\$ _____
2252.4	50	Vertical Foot	Manhole – Precast 6-Foot Diameter _____ Dollars (\$ _____) Per Vertical Foot	\$ _____
2252.5	20	Vertical Foot	Manhole – Precast 6-Foot Diameter Exterior Drop _____ Dollars (\$ _____) Per Vertical Foot	\$ _____
2252.6	150	Vertical Foot	Manhole – Precast 8-Foot Diameter _____ Dollars (\$ _____) Per Vertical Foot	\$ _____
2252.7	20	Vertical Foot	Manhole – Precast 8-Foot Diameter Exterior Drop _____ Dollars (\$ _____) Per Vertical Foot	\$ _____
2252.8	4	Each	Manhole – 3'x4' Precast _____ Dollars (\$ _____) Per Each	\$ _____

Bidder's Name _____
 Western Avenue
 Bid Documents

Item #	Estimated Quantity	Units	ITEM DESCRIPTION	
			Description of the Work and Unit Price Bid Written in Words and Numbers	Amount
2252.9	15	Each	Existing Drainage or Sewer Structure Adjusted _____ Dollars (\$ _____) Per Each	\$ _____
2252.10	35	Each	Drainage or Sewer Structure Remodeled _____ Dollars (\$ _____) Per Each	\$ _____
2604.1	565	Vertical Foot	Catch Basin – Type 1 Single Grate (4-Foot Diameter) _____ Dollars (\$ _____) Per Vertical Foot	\$ _____
2604.2	13	Each	Direct Inlet _____ Dollars (\$ _____) Per Each	\$ _____
2609.1	320	Linear Foot	Pipe – RCP (Gravity) 18-inch _____ Dollars (\$ _____) Per Linear Foot	\$ _____
2609.2	500	Linear Foot	Pipe – RCP (Gravity) 24-inch _____ Dollars (\$ _____) Per Linear Foot	\$ _____

Bidder's Name _____
 Western Avenue
 Bid Documents

Item #	Estimated Quantity	Units	ITEM DESCRIPTION		Amount
			Description of the Work and Unit Price Bid Written in Words and Numbers		
2609.3	2,150	Linear Foot	Pipe – RCP (Gravity) 36-inch _____ Dollars (\$ _____) Per Linear Foot	\$ _____	
2609.4	20	Linear Foot	Pipe – RCP (Gravity) 48-inch _____ Dollars (\$ _____) Per Linear Foot	\$ _____	
2615.1	915	Linear Foot	Pipe – DI (Gravity) 12-inch _____ Dollars (\$ _____) Per Linear Foot	\$ _____	
2615.2	75	Linear Foot	Pipe – DI (Gravity) 36-inch _____ Dollars (\$ _____) Per Linear Foot	\$ _____	
2622.1	1,850	Linear Foot	Pipe – PVC (Gravity) 6-inch Perforated Underdrain _____ Dollars (\$ _____) Per Linear Foot	\$ _____	
2622.2	1,700	Linear Foot	Pipe – PVC (Gravity) 12-inch _____ Dollars (\$ _____) Per Linear Foot	\$ _____	

Bidder's Name _____
 Western Avenue
 Bid Documents

Item #	Estimated Quantity	Units	ITEM DESCRIPTION		Amount
			Description of the Work and Unit Price Bid Written in Words and Numbers		
2622.3	150	Linear Foot	Pipe – PVC (Gravity) 15-inch _____ Dollars (\$ _____) Per Linear Foot	\$ _____	
2622.4	450	Linear Foot	Pipe – PVC (Gravity) 18-inch _____ Dollars (\$ _____) Per Linear Foot	\$ _____	
2622.5	50	Linear Foot	Pipe – PVC (Gravity) 21-inch _____ Dollars (\$ _____) Per Linear Foot	\$ _____	
2622.6	55	Linear Foot	Pipe – PVC (Gravity) 24-inch _____ Dollars (\$ _____) Per Linear Foot	\$ _____	
2622.7	2,500	Linear Foot	Reconnect, Repair or Relocate Existing Sanitary Sewer and Storm Drain Laterals _____ Dollars (\$ _____) Per Linear Foot	\$ _____	
2623.1	1,225	Linear Foot	Pipe – FRP (Gravity) 36-inch _____ Dollars (\$ _____) Per Linear Foot	\$ _____	

Bidder's Name _____
 Western Avenue
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Item #	Estimated Quantity	Units	ITEM DESCRIPTION	
			Description of the Work and Unit Price Bid Written in Words and Numbers	Amount
2623.2	40	Linear Foot	Pipe – FRP (Gravity) 48-inch _____ Dollars (\$ _____) Per Linear Foot	\$ _____
2623.3	1	Lump Sum	Pipe – FRP (Gravity) 36-inch and Related Pipeline work at Harvard Steam Tunnel Crossing _____ Dollars (\$ _____) Lump Sum	\$ _____
2630.1	180	Linear Foot	Pipe – DI (Water) 4-inch _____ Dollars (\$ _____) Per Linear Foot	\$ _____
2630.2	120	Linear Foot	Pipe – DI (Water) 6-inch _____ Dollars (\$ _____) Per Linear Foot	\$ _____
2630.3	775	Linear Foot	Pipe – DI (Water) 8-inch _____ Dollars (\$ _____) Per Linear Foot	\$ _____
2630.4	60	Linear Foot	Pipe – DI (Water) 10-inch _____ Dollars (\$ _____) Per Linear Foot	\$ _____

Bidder's Name _____
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Item #	Estimated Quantity	Units	ITEM DESCRIPTION		Amount
			Description of the Work and Unit Price Bid Written in Words and Numbers		
2630.5	3,675	Linear Foot	Pipe – DI (Water) 12-inch _____ Dollars (\$ _____) Per Linear Foot	\$ _____	
2630.6	185	Linear Foot	Pipe – DI (Water) 16-inch _____ Dollars (\$ _____) Per Linear Foot	\$ _____	
2630.7	20	Linear Foot	Pipe – DI (Water) 20-inch _____ Dollars (\$ _____) Per Linear Foot	\$ _____	
2640.1	8	Each	2-inch Gate Valve and Gate Box _____ Dollars (\$ _____) Per Each	\$ _____	
2640.2	2	Each	4-inch Gate Valve and Gate Box _____ Dollars (\$ _____) Per Each	\$ _____	
2640.3	10	Each	6-inch Gate Valve and Gate Box _____ Dollars (\$ _____) Per Each	\$ _____	

Bidder's Name _____
 Western Avenue
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Item #	Estimated Quantity	Units	ITEM DESCRIPTION		Amount
			Description of the Work and Unit Price Bid Written in Words and Numbers		
2640.4	25	Each	8-inch Gate Valve and Gate Box	_____ Dollars (\$ _____) Per Each	\$ _____
2640.5	6	Each	10-inch Gate Valve and Gate Box	_____ Dollars (\$ _____) Per Each	\$ _____
2640.6	42	Each	12-inch Gate Valve and Gate Box	_____ Dollars (\$ _____) Per Each	\$ _____
2640.7	4	Each	16-inch Butterfly Valve and Box	_____ Dollars (\$ _____) Per Each	\$ _____
2640.8	1	Each	20-inch Butterfly Valve and Box	_____ Dollars (\$ _____) Per Each	\$ _____
2640.9	40	Each	Water Gate Adjustment	_____ Dollars (\$ _____) Per Each	\$ _____

Bidder's Name _____
 Western Avenue
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Item #	Estimated Quantity	Units	ITEM DESCRIPTION	
			Description of the Work and Unit Price Bid Written in Words and Numbers	Amount
2645.1	8	Each	New Hydrant _____ Dollars (\$ _____) Per Each	\$ _____
2645.2	8	Each	Remove and Dispose Existing Hydrant _____ Dollars (\$ _____) Per Each	\$ _____
2660.1	2,150	Linear Foot	½-inch to 3-inch Water Service Replacement, Reconnection and Extension _____ Dollars (\$ _____) Per Linear Foot	\$ _____
2660.2	1,000	Linear Foot	2-inch PVC Sleeve for 1-inch Diameter Services on North Side of Western Ave _____ Dollars (\$ _____) Per Linear Foot	\$ _____
2660.3	150	Linear Foot	3-inch PVC Sleeve for 1 ½-inch to 2-inch Diameter Services on North Side of Western Ave _____ Dollars (\$ _____) Per Linear Foot	\$ _____
2760.1	1,010	Linear Foot	CCTV Pipe Inspection – MWRA 48-inch Sewer and MET Sewer _____ Dollars (\$ _____) Per Linear Foot	\$ _____

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 Western Avenue
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Item #	Estimated Quantity	Units	ITEM DESCRIPTION	
			Description of the Work and Unit Price Bid Written in Words and Numbers	Amount
2760.2	1,550	Linear Foot	CCTV Pipe Inspection – NCRS 10'-4" X 4'-1" Sewer _____ Dollars (\$ _____) Per Linear Foot	\$ _____
2761.1	1	Lump Sum	Flow Bypass _____ Dollars (\$ _____) Lump Sum	\$ _____
2767.1	925	Linear Foot	Full-Length Cured-in-Place Pipelining – 42"x48" _____ Dollars (\$ _____) Per Linear Foot	\$ _____
3300.1	1	Each	CIP Concrete Pipe Connection Greater than 24" through 36" Diameter (CIP Field Closure) _____ Dollars (\$ _____) Per Each	\$ _____
3300.2	8	Each	CIP Concrete Pipe Connection Greater than 36" through 48" Diameter (CIP Field Closure) _____ Dollars (\$ _____) Per Each	\$ _____
3300.3	1	Each	CIP Concrete Pipe Connection Greater than 48" Dia to NCRS Overflow Structure _____ Dollars (\$ _____) Per Each	\$ _____

Bidder's Name _____
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Item #	Estimated Quantity	Units	ITEM DESCRIPTION	
			Description of the Work and Unit Price Bid Written in Words and Numbers	Amount
3300.4	1	Lump Sum	CIP Concrete Water Quality Sampling Station Equipment Pad _____ Dollars (\$ _____) Lump Sum	\$ _____
3411.1	1	Lump Sum	Isolation Gate Structure _____ Dollars (\$ _____) Lump Sum	\$ _____
3411.2	1	Lump Sum	Total Phosphorous Deflection Structure _____ Dollars (\$ _____) Per Lump Sum	\$ _____
3411.3	1	Lump Sum	Outfall _____ Dollars (\$ _____) Per Lump Sum	\$ _____
15202.1	1	Each	Vortex Valve in Existing Structure _____ Dollars (\$ _____) Per Each	\$ _____
15203.1	1	Each	Flow Throttle in Proposed Structure _____ Dollars (\$ _____) Per Each	\$ _____
15251.1	1	Each	4'W X 2'H Cast Iron Slide Gate _____ Dollars (\$ _____) Per Each	\$ _____

Bidder's Name _____
 Western Avenue
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Item #	Estimated Quantity	Units	ITEM DESCRIPTION		Amount
			Description of the Work and Unit Price Bid Written in Words and Numbers		
15299.1	1	Each	Hydoslide _____ Dollars (\$ _____) Per Each		\$ _____
32102.5	1	Lump Sum	Tree Protection and Maintenance _____ Dollars (\$ _____) Lump Sum		\$ _____
32103	4	Each	Tree Removed – Diameter Under 24 Inches _____ Dollars (\$ _____) Per Each		\$ _____
32129	5550	Square Yard	Pavement Milling _____ Dollars (\$ _____) Per Square Yard		\$ _____
32204.1	2	Each	Rain Garden Overflow Structure _____ Dollars (\$ _____) Per Each		\$ _____
32204.98	2	Each	Rain Garden Inlet Structure – Type 1 _____ Dollars (\$ _____) Per Each		\$ _____
32204.99	2	Each	Rain Garden Inlet Structure – Type 2 _____ Dollars		\$ _____

Bidder's Name _____
 Western Avenue
 Bid Documents

Item #	Estimated Quantity	Units	ITEM DESCRIPTION	
			Description of the Work and Unit Price Bid Written in Words and Numbers	Amount
			(\$ _____) Per Each	
32381.02	1	Lump Sum	Irrigation System – Cronin Park _____ Dollars (\$ _____) Lump Sum	\$ _____
32389	1	Each	Drinking Fountain _____ Dollars (\$ _____) Per Each	\$ _____
32402	1,580	Cubic Yard	Dense Graded Crushed Stone for Sub-base _____ Dollars (\$ _____) Per Cubic Yard	\$ _____
32420	3,050	Ton	Hot Mix Asphalt Base Course _____ Dollars (\$ _____) Per Ton	\$ _____
32431	80	Square Yard	High Early Strength Cement Concrete Base Course _____ Dollars (\$ _____) Per Square Yard	\$ _____
32460	8,360	Ton	Hot Mix Asphalt and Temporary Trench Patch _____ Dollars (\$ _____) Per Ton	\$ _____

Bidder's Name _____
 Western Avenue
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Item #	Estimated Quantity	Units	ITEM DESCRIPTION	
			Description of the Work and Unit Price Bid Written in Words and Numbers	Amount
32460.2	300	Ton	Hot Mix Asphalt – Open Graded Friction Course _____ Dollars (\$ _____) Per Ton	\$ _____
32464.51	6,640	Linear Foot	Hot Poured Rubberized Asphalt Sealer _____ Dollars (\$ _____) Per Linear Foot	\$ _____
32472	520	Ton	Hot Mix Asphalt for Miscellaneous Work _____ Dollars (\$ _____) Per Ton	\$ _____
32482.3	640	Linear Foot	Sawing Asphalt Pavement _____ Dollars (\$ _____) Per Linear Foot	\$ _____
32504	1,650	Linear Foot	Granite Curb Type VA4 – Straight _____ Dollars (\$ _____) Per Linear Foot	\$ _____
32504.1	828	Linear Foot	Granite Curb Type VA4 – Curved _____ Dollars (\$ _____) Per Linear Foot	\$ _____

Bidder's Name _____
 Western Avenue
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Item #	Estimated Quantity	Units	ITEM DESCRIPTION	
			Description of the Work and Unit Price Bid Written in Words and Numbers	Amount
32509	210	Linear Foot	Granite Transition Curb for Pedestrian Ramps – Straight _____ Dollars (\$ _____) Per Linear Foot	\$ _____
32509.1	230	Linear Foot	Granite Transition Curb for Pedestrian Ramps – Curved _____ Dollars (\$ _____) Per Linear Foot	\$ _____
32516	32	Each	Granite Curb Corner Type A _____ Dollars (\$ _____) Per Each	\$ _____
32517	16	Each	Granite Curb Corner Type B _____ Dollars (\$ _____) Per Each	\$ _____
32580	5,020	Linear Foot	Curb Removed and Reset _____ Dollars (\$ _____) Per Linear Foot	\$ _____
32594	2,480	Linear Foot	Curb Removed and Discarded _____ Dollars (\$ _____) Per Linear Foot	\$ _____

Bidder's Name _____
 Western Avenue
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Item #	Estimated Quantity	Units	ITEM DESCRIPTION		Amount
			Description of the Work and Unit Price Bid Written in Words and Numbers		
32655.2	20	Linear Foot	Ornamental Handrail _____ Dollars (\$ _____) Per Linear Foot	\$ _____	
32655.31	80	Linear Foot	Ornamental Loop Fence _____ Dollars (\$ _____) Per Linear Foot	\$ _____	
32670	100	Linear Foot	Fence Removed and Reset _____ Dollars (\$ _____) Per Linear Foot	\$ _____	
32701	9,220	Square Yard	Cement Concrete Sidewalk _____ Dollars (\$ _____) Per Square Yard	\$ _____	
32701.11	920	Square Yard	Cement Concrete Sidewalk at Driveways and Intersections _____ Dollars (\$ _____) Per Square Yard	\$ _____	
32701.2	410	Square Yard	Cement Concrete Pedestrian Ramp _____ Dollars (\$ _____) Per Square Yard	\$ _____	

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Item #	Estimated Quantity	Units	ITEM DESCRIPTION		Amount
			Description of the Work and Unit Price Bid Written in Words and Numbers		
32701.28	110	Square Yard	Detectable Tile – Cast Iron _____ Dollars (\$ _____) Per Square Yard		\$ _____
32701.29	20	Square Yard	Detectable Tile – Precast Concrete _____ Dollars (\$ _____) Per Square Yard		\$ _____
32702.89	210	Square Foot	Rubber Paving Surface _____ Dollars (\$ _____) Per Square Foot		\$ _____
32706.6	110	Square Yard	Concrete Pavers on Hot Mix Asphalt Surface _____ Dollars (\$ _____) Per Square Yard		\$ _____
32706.9	640	Square Yard	Brick Walk on 4-inch HMA Base _____ Dollars (\$ _____) Per Square Yard		\$ _____
32706.91	160	Square Yard	Brick Walk on 6-inch HMA Base _____ Dollars (\$ _____) Per Square Yard		\$ _____

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Item #	Estimated Quantity	Units	ITEM DESCRIPTION		Amount
			Description of the Work and Unit Price Bid Written in Words and Numbers		
32707.11	1	Each	Custom Wood Bench _____ Dollars (\$ _____) Per Each	\$ _____	
32707.21	14	Each	Trash Compactor _____ Dollars (\$ _____) Per Each	\$ _____	
32707.22	2	Each	Trash/Recycling Combination _____ Dollars (\$ _____) Per Each	\$ _____	
32707.9	20	Each	Bicycle Ring and Post _____ Dollars (\$ _____) Per Each	\$ _____	
32708	690	Linear Foot	6-inch Granite Planter Curb _____ Dollars (\$ _____) Per Linear Foot	\$ _____	
32709.1	100	Square Foot	Granite Stairs _____ Dollars (\$ _____) Per Square Foot	\$ _____	

Bidder's Name _____
 Western Avenue
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Item #	Estimated Quantity	Units	ITEM DESCRIPTION		Amount
			Description of the Work and Unit Price Bid Written in Words and Numbers		
32709.11	1	Lump Sum	Granite Retaining Wall No. 1 _____ Dollars (\$ _____) Lump Sum		\$ _____
32709.2	2	Each	Small Natural Stone Boulder _____ Dollars (\$ _____) Per Each		\$ _____
32709.3	6	Each	Medium Natural Stone Boulder _____ Dollars (\$ _____) Per Each		\$ _____
32709.4	4	Each	Large Natural Stone Boulder _____ Dollars (\$ _____) Per Each		\$ _____
32709.5	16	Each	Granite Seating Stone – Type A _____ Dollars (\$ _____) Per Each		\$ _____
32709.6	15	Each	Granite Seating Stone – Type B _____ Dollars (\$ _____) Per Each		\$ _____

Bidder's Name _____
 Western Avenue
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Item #	Estimated Quantity	Units	ITEM DESCRIPTION	
			Description of the Work and Unit Price Bid Written in Words and Numbers	Amount
32709.7	6	Each	Granite Seating Stone – Type C _____ Dollars (\$ _____) Per Each	\$ _____
32745	4	Each	Pedestrian Bus Shelter _____ Dollars (\$ _____) Per Each	\$ _____
32751	60	Cubic Yard	Lawn Soil _____ Dollars (\$ _____) Per Cubic Yard	\$ _____
32751.41	750	Cubic Yard	Sand Based Structural Soil _____ Dollars (\$ _____) Per Cubic Yard	\$ _____
32751.42	450	Cubic Yard	Planting Bed Soil _____ Dollars (\$ _____) Per Cubic Yard	\$ _____
32751.32	50	Cubic Yard	Rain Garden Planting Soil _____ Dollars (\$ _____) Per Cubic Yard	\$ _____

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 Western Avenue
 Bid Documents

Item #	Estimated Quantity	Units	ITEM DESCRIPTION		Amount
			Description of the Work and Unit Price Bid Written in Words and Numbers		
32767.6	30	Cubic Yard	Planting Mulch _____ Dollars (\$ _____) Per Cubic Yard		\$ _____
32770	210	Square Yard	Sodded Lawn _____ Dollars (\$ _____) Per Square Yard		\$ _____
32771.10	4	Each	Acer Rubrum 'October Glory' 3 to 3 ½-inch Cal. _____ Dollars (\$ _____) Per Each		\$ _____
32771.11	4	Each	Betula Nigra 'Heritage' 3 to 3 ½-inch Cal. _____ Dollars (\$ _____) Per Each		\$ _____
32771.12	5	Each	Gingko Biloba 3 to 3 ½-inch Cal. _____ Dollars (\$ _____) Per Each		\$ _____
32771.13	2	Each	Gleditsia Triacanthos 'Halka' 3 to 3 ½-inch Cal. _____ Dollars (\$ _____) Per Each		\$ _____

Bidder's Name _____
 Western Avenue
 Bid Documents

Item #	Estimated Quantity	Units	ITEM DESCRIPTION	
			Description of the Work and Unit Price Bid Written in Words and Numbers	Amount
32771.14	10	Each	Quercus Palustris 3 to 3 ½-inch Cal. _____ Dollars (\$ _____) Per Each	\$ _____
32771.15	16	Each	Zelkova Serrata 'Green Vase' 3 to 3 ½-inch Cal. _____ Dollars (\$ _____) Per Each	\$ _____
32771.20	8	Each	Clethra Alnifolia 18 to 24-inch HT. _____ Dollars (\$ _____) Per Each	\$ _____
32771.21	76	Each	Cornus Sericea 'Arctic Fire' 18 to 24-inch HT. _____ Dollars (\$ _____) Per Each	\$ _____
32771.22	20	Each	Ilex Glabra 'Dense' 18 to 24-inch HT. _____ Dollars (\$ _____) Per Each	\$ _____
32771.23	8	Each	Ilex Verticillata 'Red Sprite' 18 to 24-inch HT. _____ Dollars (\$ _____) Per Each	\$ _____

Bidder's Name _____
 Western Avenue
 Bid Documents

Item #	Estimated Quantity	Units	ITEM DESCRIPTION	
			Description of the Work and Unit Price Bid Written in Words and Numbers	Amount
32771.24	60	Each	Rosa 'Radkopink' 18 to 24-inch HT. _____ Dollars (\$ _____) Per Each	\$ _____
32771.25	14	Each	Taxus Baccata 'Repandens' 18 to 24-inch HT. _____ Dollars (\$ _____) Per Each	\$ _____
32771.26	39	Each	Xanthorhiza Simplicissima 12' to 15' HT. _____ Dollars (\$ _____) Per Each	\$ _____
32771.30	58	Each	Calamagrostis 3 Gal. _____ Dollars (\$ _____) Per Each	\$ _____
32771.31	126	Each	Chasmanthium Latifolium 1 Gal. _____ Dollars (\$ _____) Per Each	\$ _____
32771.32	152	Each	Deschampsia Caepitosa _____ Dollars (\$ _____) Per Each	\$ _____

Bidder's Name _____
 Western Avenue
 Bid Documents

Item #	Estimated Quantity	Units	ITEM DESCRIPTION	
			Description of the Work and Unit Price Bid Written in Words and Numbers	Amount
32771.33	39	Each	Liriope Spicata 1 Gal. _____ Dollars (\$ _____) Per Each	\$ _____
32771.34	86	Each	Onoclea Sensibilis 1 Gal. _____ Dollars (\$ _____) Per Each	\$ _____
32771.40	16	Each	Eupatorium Fistulosum 1 plug _____ Dollars (\$ _____) Per Each	\$ _____
32771.41	45	Each	Iris Versicolor 1 Quart _____ Dollars (\$ _____) Per Each	\$ _____
32771.42	106	Each	Nepeta Racemosa 'Little Tech' 1 Gal. _____ Dollars (\$ _____) Per Each	\$ _____
32771.43	705	Each	Liatrus Spicata 1 Gal. _____ Dollars (\$ _____) Per Each	\$ _____

Bidder's Name _____
 Western Avenue
 Bid Documents

Item #	Estimated Quantity	Units	ITEM DESCRIPTION	
			Description of the Work and Unit Price Bid Written in Words and Numbers	Amount
32771.44	150	Each	Rudbeckia Hirta 1 Gal. _____ Dollars (\$ _____) Per Each	\$ _____
32798	1	Lump Sum	Landscape Maintenance _____ Dollars (\$ _____) Per Lump Sum	\$ _____
32804.11	5,002	Linear Foot	Electrical Conduit (Single) Concrete Encased (Lighting) _____ Dollars (\$ _____) Per Linear Foot	\$ _____
32804.12	1,854	Linear Foot	Electrical Conduit (Double) Concrete Encased (Lighting) _____ Dollars (\$ _____) Per Linear Foot	\$ _____
32804.3	1,850	Linear Foot	3-inch Electrical Conduit Type NM – Plastic (UL) (Signal) _____ Dollars (\$ _____) Per Linear Foot	\$ _____
32811.22	17	Each	Electric Handhole – SD2.022 (Traffic) _____ Dollars (\$ _____) Per Each	\$ _____

Bidder's Name _____
 Western Avenue
 Bid Documents

Item #	Estimated Quantity	Units	ITEM DESCRIPTION	
			Description of the Work and Unit Price Bid Written in Words and Numbers	Amount
32811.27	60	Each	Electric Handhole (Lighting) _____ Dollars (\$ _____) Per Each	\$ _____
32812.09	103	Each	Light Standard Foundation (Standard Precast) _____ Dollars (\$ _____) Per Each	\$ _____
32812.99	15	Cubic Yard	Light Standard Foundation (Cast-in-Place) _____ Dollars (\$ _____) Per Cubic Yard	\$ _____
32813.30	12,060	Linear Foot	Wire Type 7 No. 10 General Purpose _____ Dollars (\$ _____) Per Linear Foot	\$ _____
32813.33	7,480	Linear Foot	Wire Type 7 No. 4 General Purpose _____ Dollars (\$ _____) Per Linear Foot	\$ _____
32813.36	29,380	Linear Foot	Wire Type 7 No. 1/0 General Purpose _____ Dollars (\$ _____) Per Linear Foot	\$ _____

Bidder's Name _____
 Western Avenue
 Bid Documents

Item #	Estimated Quantity	Units	ITEM DESCRIPTION		Amount
			Description of the Work and Unit Price Bid Written in Words and Numbers		
32813.71	163	Each	Ground Rod 8-ft Long _____ Dollars (\$ _____) Per Each	\$ _____	
32813.79	1	Lump Sum	Interconnect Cable System _____ Dollars (\$ _____) Lump Sum	\$ _____	
32815.98	10	Linear Foot	Mast Arm Footing Cost Adjustment _____ Dollars (\$ _____) Per Linear Foot	\$ _____	
32816.1	1	Lump Sum	Traffic Signal Reconstruction (Western Avenue at Putnam Avenue) _____ Dollars (\$ _____) Lump Sum	\$ _____	
32816.2	1	Lump Sum	Traffic Signal Reconstruction (Western Avenue at Howard Street) _____ Dollars (\$ _____) Lump Sum	\$ _____	
32823.01	67	Each	Lighting Pole and Luminaire – Type PT-1 (“Acorn” LED) _____ Dollars (\$ _____) Per Each	\$ _____	

Bidder's Name _____
 Western Avenue
 Bid Documents

Item #	Estimated Quantity	Units	ITEM DESCRIPTION	
			Description of the Work and Unit Price Bid Written in Words and Numbers	Amount
32823.02	29	Each	Lighting Pole and Luminaire – Type PT-2 (“1907” LED) _____ Dollars (\$ _____) Per Each	\$ _____
32823.03	7	Each	Lighting Pole and Luminaire – Type PT-2A (“1907” LED Double) _____ Dollars (\$ _____) Per Each	\$ _____
32823.6	1	Lump Sum	Highway Lighting Load Center _____ Dollars (\$ _____) Lump Sum	\$ _____
32823.73	19	Each	Highway Lighting Base, Pole and Luminaire Removed and Disposed _____ Dollars (\$ _____) Per Each	\$ _____
32832	550	Square Foot	Warning-Regulatory and Route Marker – Alum. Panel (Type A) _____ Dollars (\$ _____) Per Square Foot	\$ _____
32847.1	168	Each	Sign Sup (N/Guide) + Rte Marker W/1 Breakaway Post Assembly - Steel _____ Dollars (\$ _____) Per Each	\$ _____

Bidder's Name _____
 Western Avenue
 Bid Documents

Item #	Estimated Quantity	Units	ITEM DESCRIPTION		Amount
			Description of the Work and Unit Price Bid Written in Words and Numbers		
32847.2	10	Each	Memorial Sign Removed and Reset _____ Dollars (\$ _____) Per Each		\$ _____
32864.02	275	Square Foot	Pavement Arrows & Legends (Surface Applied Tape) _____ Dollars (\$ _____) Per Square Foot		\$ _____
32864.04	345	Square Foot	Pavement Arrows & Legends Reflective White Tape (Thermoplastic) _____ Dollars (\$ _____) Per Square Foot		\$ _____
32865.1	3,600	Square Foot	Cross Walks and Stop Lines Reflective White (Thermoplastic) _____ Dollars (\$ _____) Per Square Foot		\$ _____
32865.2	1,200	Square Foot	High Friction Surface Treatment _____ Dollars (\$ _____) Per Square Foot		\$ _____
32866.06	7,000	Linear Foot	6-inch Reflectorized White Line (Thermoplastic) _____ Dollars (\$ _____) Per Linear Foot		\$ _____

Bidder's Name _____
 Western Avenue
 Bid Documents

Item #	Estimated Quantity	Units	ITEM DESCRIPTION	
			Description of the Work and Unit Price Bid Written in Words and Numbers	Amount
32867.06	1,500	Linear Foot	6-inch Reflectorized Yellow Line (Thermoplastic) _____ Dollars (\$ _____) Per Linear Foot	\$ _____
32869	75	Square Foot	Gore Lines – Reflectorized Yellow (Thermoplastic) _____ Dollars (\$ _____) Per Square Foot	\$ _____
32874	60	Each	Street Name Sign _____ Dollars (\$ _____) Per Each	\$ _____
32878	5	Each	Parking Meter Post Furnished and Installed _____ Dollars (\$ _____) Per Each	\$ _____
32880	10	Each	Parking Meter Post Removed and Disposed _____ Dollars (\$ _____) Per Each	\$ _____
32900.01	1	Lump Sum	“Breaking Bread” Public Art Coordination _____ Dollars (\$ _____) Lump Sum	\$ _____

Bidder's Name _____
 Western Avenue
 Bid Documents

Item #	Estimated Quantity	Units	ITEM DESCRIPTION	
			Description of the Work and Unit Price Bid Written in Words and Numbers	Amount
32900.02	1	Lump Sum	"Breaking Bread" Art Installation _____ Dollars (\$ _____) Lump Sum	\$ _____
32900.03	1	Lump Sum	Bronze Tile Coordination _____ Dollars (\$ _____) Lump Sum	\$ _____
32900.04	12	Each	Bronze Tile Installation _____ Dollars (\$ _____) Per Each	\$ _____
32999	1	Lump Sum	Construction Layout _____ Dollars (\$ _____) Lump Sum	\$ _____
32999.1	5	Each	Temporary Access Ramps _____ Dollars (\$ _____) Per Each	\$ _____

Bidder's Name _____
 Western Avenue
 Bid Documents

ALTERNATE BID NO. 1- IRRIGATION SYSTEM – WESTERN AVE

Item #	Estimated Quantity	Units	<p align="center"><u>ITEM DESCRIPTION</u></p> <p align="center">Description of the Work and Unit Price Bid Written in Words and Numbers</p>	Amount
32381.03A	1	Lump Sum	Irrigation System – Western Avenue _____ Dollars (\$ _____) Per Lump Sum	\$ _____

Bidder's Name _____
 Western Avenue _____
 Bid Documents _____

Total amount of **BASE BID** items 1025.1 through 32999.10 based on Engineer's estimate of quantities (**Evaluated for Basis of Award**):

(Amount in Words)

(Amount in Figures)

Total amount of **ALTERNATE BID NO. 1- WESTERN AVENUE IRRIGATION SYSTEM** based on Engineer's estimate of quantities for Item 32381.03A

(Amount in Words)

(Amount in Figures)

Total amount of **BASE BID PLUS ALTERNATE BID NO. 1 – WESTERN AVENUE IRRIGATION SYSTEM** based on Engineer's estimate of quantities (**Evaluated for Basis of Award**):

(Amount in Words)

(Amount in Figures)

Also write the amount of the BID, in words and numbers, in the spaces provided for the on Page 00300-2 of the Form for General Bid.

Basis of Award will be on the Base Bid or Base Bid plus Alternate whichever are most favorable to the Owner, and at the sole discretion of the Owner.

Bidder's Name _____
Western Avenue _____
Bid Documents _____

FORM FOR GENERAL BID
00300-40

- I. The undersigned agrees if selected as General Contractor, within ten (10) working days after presentation thereof by the City, the Contractor will:
1. Execute a contract in accordance with the terms of this general bid;
 2. Furnish a performance bond and a labor and materials or payment bond;
 - a. of a surety company qualified to do business under the laws of the Commonwealth and satisfactory to the City;
 - b. in the sum of one hundred percent of the contract price;
 - c. premiums for each are to be paid by the General Contractor.
 3. provide an Insurance certificate specifying the City of Cambridge; Kleinfelder/S E A Consultants Inc; MWH Americas, Inc; and HDR Engineering, Inc., for the entire project and Harvard University for work related to the steam tunnel as **Additional Insured**, complying with the Insurance requirements set forth herein in the General Terms and Conditions of the contract, Article 8.
- J. Bidder understands that the Owner reserves the right to reject any or all bids and to waive any minor informalities in the bidding prices.
- K. Total amounts are to be shown in both words and figures. In case of discrepancy, the amount shown in words will govern.
- L. The bidder hereby certifies it shall comply with the minority workforce ratios and specific action contained in the Cambridge Employment Plan, the Cambridge Responsible Employer Plan, the Living Wage Ordinance and the Americans with Disabilities Act. The contractor receiving the award of the contract shall be required to obtain from each of its subcontractors and submit to the contracting or administering agency prior to the performance of any work under said contract a certification by said subcontractor, regardless of tier, that it will comply with same.
- M. The bidder agrees that this bid shall be good and may not be withdrawn for a period of 120 days after the scheduled closing time for receiving bids.
- N. The bid security attached in the sum of _____
 _____ (\$ _____) is to become the property of the Owner in the event the contract and bond are not executed within the time above set forth, as liquidated damages for the delay and additional expense to the Owner caused thereby.
- O. The undersigned certifies that it possesses the skill, ability and integrity necessary for the faithful performance of the work; that he is able to furnish labor that can work in harmony with all other elements of labor employed or to be employed in the work; that all employees to be employed at the worksite will have successfully completed a course in construction safety and health approved by the United States Occupational Safety and Health Administration that is at least 10 hours in duration at the time the employee begins work and who shall furnish documentation of successful completion of said

course with the first certified payroll report for each employee; and who, where the provisions of section 8B of chapter 29 apply, shall have been determined to be qualified thereunder; and who obtains within 10 days of the notification of contract award the security by bond required under section 29 of chapter 149; provided that for the purposes of this section the term "security by bond" shall mean the bond of a surety company qualified to do business under the laws of the commonwealth and satisfactory to the awarding authority.

- P. 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 this Contract, including compliance with the Minority/Woman Business Enterprise provisions 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 the certification by said subcontractor, regardless of tier, that it will comply with the minority workforce ratio and specific affirmative action steps contained in these EEO/AA contract provisions and submit it to the contracting agency prior to the award of such subcontract.
- Q. The undersigned certifies under penalties of perjury that this bid or proposal has been made and submitted in good faith and without collusion or fraud with any other person. As used in this certification, the "person" shall mean any natural person, joint venture, business, partnership, corporation, or other business or legal entity.
- R. "I certify under the penalties of perjury that I have complied with all of the laws of the Commonwealth of Massachusetts relating to taxes, reporting of employees and contractors, and withholding and remitting child support".
- S. The undersigned further certifies under penalty of perjury that the said undersigned is not presently debarred from doing public construction work in the Commonwealth under the provisions of section twenty-nine F of chapter twenty-nine, or any other applicable debarment provision of any other chapter of the General Laws or any rule or regulation promulgated thereunder.

Date _____

BY: _____
(Signature)

(Name of General Bidder)

(Title)

(Business Address)

(City and State)

Bidder's Name _____

CITY OF CAMBRIDGE, MASSACHUSETTS

BID BOND

We, the undersigned _____ as Principal, and _____ as Surety, are hereby held and firmly bound unto the CITY OF CAMBRIDGE, a municipality in the County of Middlesex and Commonwealth of Massachusetts, in the penal sum of _____ Dollars (\$ _____), for the payment of which, well and truly to be made. We hereby jointly and severally bind ourselves, our heirs, executors, administrators, successors and assigns.

Signed this _____ day of _____, _____.

THE CONDITION OF THE ABOVE OBLIGATION is such that whereas the Principal has submitted to the City of Cambridge, Massachusetts, a certain bid attached hereto and hereby made a part hereof to enter into a contract in writing for the **Cambridge, Massachusetts, Western Avenue Infrastructure Improvements Project.**

If the Principal fails to perform their agreement to execute a contract and furnish a performance bond and a labor and materials or payment bond as stated in their bid in accordance with the applicable state statute or fails in all other respects to perform the agreement created by the acceptance of said bid, their bid deposit shall become and be the property of the City of Cambridge as liquidated damages.

If said Bid shall be rejected because of death, disability, bona fide clerical or mechanical error of a substantial nature, or other similar unforeseen circumstances affecting the Principal, their bid bond shall be returned to their.

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

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

CONTRACTOR AS PRINCIPAL

SURETY

(Signature)

(Signature)

Name and Title:

Name and Title:

SEAL

SEAL

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SECTION 00311
MBE FORMS (CITY OF CAMBRIDGE)

MINORITY BUSINESS ENTERPRISE REQUIREMENTS

GENERAL

On June 30, 1983 the City of Cambridge put into effect a city wide Minority Business Enterprise (MBE) Program. To comply with the requirements of this program, a general contractor must submit the appropriate MBE Forms with its bid. The process is explained below. Failure to meet the requirements may result in automatic disqualification of the bidder. Upon request or upon its own initiative, the City may grant an extension of time for submission of the appropriate MBE Forms. Extensions shall be granted only upon a finding by the City that the bidder's failure to submit the appropriate MBE forms was excusable.

PROCEDURE

Steps you should take to comply with the City's MBE requirements are as follows:

1. Secure a copy of the State Office Minority and Women Business Assistance (SOMWBA) Certified Minority/Women Business Directory. Only MBE firms approved by SOMWBA will be accepted by the City of Cambridge.
2. Attempt to develop a bid that includes at least ten percent (10%) of your total bid price in the form of work subcontracted to (or materials purchased from) one or more Minority Businesses.
3. To make the attempt to secure at least 10% Minority business participation, you (the General Contractor) must contact as many of the subcontractors or suppliers in the SOMWBA directory as necessary. Please note that MBE FORM #3 – CONTRACT REQUEST-FOR-EXTENSION and MBE FORM #4 – INFORMATION ON UNSUCCESSFUL MBE CONTACT require you to provide a list of each firm contacted and other related information.
4. If you are successful in securing 10% or more Minority Businesses participation, you must:
 - A. Complete and submit MBE FORM #1 – CONTRACTOR CERTIFICATION OF COMPLIANCE.
 - B. Have your participating Minority Business each fill out MBE FORM #2 – LETTER OF INTENT TO PARTICIPATE, to be submitted with your bid.
5. If, after contacting all SOMWBA-approved firms in the trades or materials categories you should include in your bid, you have not been able to secure 10% Minority business participation, then complete and submit with your bid MBE FORM #3 – CONTRACTOR REQUEST FOR EXTENSION and MBE FORM #4 – INFORMATION ON UNSUCCESSFUL MBE CONTRACT.

If you have any questions about the above steps, please call Duane Brown, Minority Business Compliance Officer, at 349-4332.

MINORITY BUSINESS ENTERPRISE PROGRAM COMPLIANCE DETAILS

PERCENTAGE OF MBE PARTICIPATION - percentage of MBE participation shall be that percentage of the total bid price represented by the amount to be paid to MBE(s). The General Bidder's compliance with the percentage requirement shall continue to be determined by reference to the above-described method throughout the term of the contract, even though the actual project price may be greater or less than the bid price. The General Bidder shall submit to the Minority Business Compliance Officer signed copies of its subcontracts with all MBE's involved in meeting the percentage of Minority Business Enterprise Requirement.

ROLE OF THE MBE REVIEW COMMITTEE - The MBE Review Committee shall have referred to it by the Purchasing Agent and the Minority Business Compliance Officer all questions of interpretation of the MBE Program that arise during the Program's operation. The MBE Review Committee shall have the responsibility and authority to respond with binding answers to these questions. It also has the responsibility and authority to recommend to the City Manager whatever improvements it believes can be made in the program, based on operating experience.

CHANGES OF MBE STATUS - Any change or substitution of the officers or stockholders in a participating MBE company that reduces the minority ownership or control to less than the requisite percentage will immediately rescind the MBE designation given by SOMWBA. The General Bidder (Prime Contractor) shall immediately notify the Minority Business Compliance Officer upon learning of such a change in MBE status. In this event, the Prime Contractor shall submit to the Minority Business Compliance Officer a revised Contractor Certification of Compliance with MBE Requirements, showing how the lost MBE participation will be replaced.

SANCTIONS

- A. If the Prime Contractor does not comply with the terms of the Minority Business Enterprise requirements of the contract, the City may (1) suspend any payment for the activity that should have been performed by the MBE pursuant to the contract, or (2) require specific performance of the Prime Contractor's obligation by requiring the Prime Contractor to subcontract with any MBE for any contract or specialty item at the contract price established for that item in the proposal submitted by the Prime Contractor.
- B. To the extent that the Prime Contractor has not complied with the MBE requirements of the contract, the City may retain an amount determined by multiplying the bid price of this contract by the required percentage of MBE participation, less the amount of paid to MBEs for work performed under the contract and any payments already suspended under "A" above.
- C. In addition, or as an alternative, to the remedies under "A" and "B" above, the City may suspend, terminate or cancel this contract, in whole or in part, or may call upon the Prime Contractor's surety to perform all terms and conditions in the contract, unless the Prime Contractor is able to demonstrate its compliance with the MBE requirements, and may further deny to the Prime Contractor the right to participate in any future contracts awarded by the City for a period of up to three years.
- D. In any proceeding involving the imposition of sanctions by the City, no sanctions shall be imposed if the City finds that the Prime Contractor has taken every possible measure to comply with MBE requirements, or that some other justifiable reason exists for waiving the MBE requirements in whole or in part.
- E. Any bidder or contractor shall provide such information as is necessary in the judgment of the City to ascertain its compliance with the MBE Requirements.
- F. No sanctions shall be imposed by the City except in an adjudicatory proceeding under Chapter 30A of the General Laws.
- G. A Prime Contractor shall have the right to request suspension of any sanctions imposed by the City upon showing that it is once again in compliance with the MBE Requirements.

**FORM
1
M.B.E.**

CONTRACTOR CERTIFICATION OF COMPLIANCE

Minority Business Enterprise Requirements

Name and Address of Participating Minority Bus. Enterprise	Name of Participant	Dollar Value
1.		
2.		
3.		
4.		
5.		
6.		
7.	GRAND TOTAL FOR MINORITY BUSINESS COMMITMENT	
	\$ _____	
8.	PERCENTAGE MBE PARTICIPATION (Line 7 Divided by total bid price) _____%	

The below-signed bidder certifies that it will honor the above Minority Business Enterprise Commitment and that it understands that a breach of this commitment constitutes a breach of the contract.

Date

General Contractor

Authorized Signature

Business Address

LETTER OF INTENT TO PARTICIPATE

Minority Business Enterprise Requirements

TO: _____
(Name of General Bidder)

1. My company intends to perform work under the above-identified contract as:

- _____ an individual
- _____ a partnership
- _____ a corporation
- _____ a joint venture with _____
- _____ other (explain) _____

2. My company has been certified by the State Office of Minority and Women Business Assistance (SOMWBA) as a Minority Business Enterprise and is listed as such in the most recently issued SOMWBA Minority/Women Business Directory. I hereby certify that my company's qualification as a Minority Business Enterprise have not changed since its application was submitted to SOMWBA. I further certify that my company will give immediate notification in writing to both SOMWBA and your Company in the event that its minority ownership, control, or management should change.

3. My company understands that if your company is awarded the contract, your company intends to enter into an agreement with my company to perform the activity described below for the prices indicated. My firm also understands that your firm , as General Bidder, will make substitutions and quantity changes only as allowed or required by the provisions of the contract with the City of Cambridge.

ITEM NO.	DESCRIPTION OF MY COMPANY'S ACTIVITY*	QUANTITY	UNIT PRICE	AMOUNT

TOTAL AMOUNT \$ _____

* Description of activity should include notations such as "Labor Only", "Material Only", etc.

Date

MBE Name

MBE Authorized Signature

Business Address

CONTRACTOR REQUEST FOR EXTENSION

Minority Business Enterprise Requirements

CONTRACTOR REQUEST-FOR-EXTENSION OF MINORITY BUSINESS ENTERPRISE
REQUIREMENTS

The below signed General Bidder certifies that it made a good faith effort to develop the required ten percent (10%) Minority Business Enterprise participation in this contract, but was able to develop only _____%.

The below-signed General Bidder further certifies that it contacted the below-listed firms from the SOMWBA MINORITY/WOMEN BUSINESS DIRECTORY that said contacts were bona fide efforts to develop the required Minority Business Enterprise participation in the above-identified contract but were unsuccessful due to circumstances beyond the control of the General Bidder; and that the information given on the following pages about each contract has made is accurate and complete.

MBE Companies Contacted

- | | |
|----------|-----------|
| 1. _____ | 6. _____ |
| 2. _____ | 7. _____ |
| 3. _____ | 8. _____ |
| 4. _____ | 9. _____ |
| 5. _____ | 10. _____ |

The below-signed General Bidder therefore requests that the City of Cambridge grant an extension of ten working days in order to provide the General Bidder an opportunity to secure the required percentage of Minority Business participation.

Date

General Contractor

Authorized Signature

Business Address

**FORM
4
M.B.E.**

INFORMATION ON UNSUCCESSFUL M.B.E. CONTACT

Minority Business Enterprise Requirements

Additional copies of this information form shall be prepared by the General Bidder in the quantity necessary to comply with bidding requirements.

ITEM NUMBER ON REQUEST-FOR-EXTENSION _____

NAME OF MBE COMPANY CONTACTED _____

ADDRESS OF COMPANY CONTACTED _____

TELEPHONE NO. OF COMPANY CONTACTED _____

DATE OF INITIAL CONTACT _____

HOW WAS CONTACT MADE? (Check appropriate answer) TELEPHONE _____
IN-PERSON _____

SUB-CONTRACT WORK OFFERED TO THIS MBE COMPANY _____

RESULT OF CONTACT (check appropriate answer) MBE Firm Declined Job _____;
MBE Firm offered to do job at price of \$ _____, which was determined by our company to
be too high _____; MBE offered to do the job at a price of \$ _____, which was
satisfactory, but the MBE company was judged by our company to be unqualified for the job _____

NAME AND TITLE OF THE MBE COMPANY OFFICER WHO CAN VERIFY ABOVE
INFORMATION AS TO MBE COMPANY'S RESPONSE

It is certified herewith by the below-signed officer of the General Bidder that the above information is accurate and complete.

Date

General Contractor

Authorized Signature

Business Address

SECTION 00312

NOTARIZED STATEMENT OF BIDDER'S QUALIFICATIONS

THIS FORM MUST BE SUBMITTED WITH YOUR BID

THIS STATEMENT MUST BE NOTARIZED

BIDDER SHALL PROVIDE CLEAR AND CONCISE RESPONSES TO ALL QUESTIONS IN THIS STATEMENT. BIDDER SHALL USE THIS FORM, OR A FORM WITH THE SAME FORMATTING AS THE CITY'S STATEMENT OF BIDDER QUALIFICATIONS AND SHALL NOT USE SEPARATE SHEETS TO RESPOND TO THESE QUESTIONS.

The bidder must provide references including telephone number and contact names in response to the questions in this section. References will be used in determining the responsibility of the bidder. The city reserves the right to use itself as a reference.

1. The names, titles, residences of all persons and parties interested in this Proposal as principals are as follows:

Note: Give the first and last names in full. In the case of corporation, give names of officers and directors; in the case of a partnership, give names of all partners.

IMPORTANT: Be sure residences are listed below.

Name	Title	Home Address
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

2. When organized.

3. If a corporation, where incorporated.

Bidder's Name: _____

4. Indicate the general nature of work normally performed by your company.

5. Has your present organization ever failed to complete any work awarded to it? If so, state when, where, and why.

6. Has your present organization ever defaulted on a contract? If so, state when, where, and why.

7. Qualification Requirements – As a minimum, the Bidder must demonstrate that it is qualified to bid on this Contract by adequately providing responses to the following qualification requirements:

7A Qualification Requirement for Large Utilities in Urban Setting:

Within the last 10 years, the Contractor must have successfully completed at least 3 projects involving, as a minimum, the construction of water mains, sanitary sewers, large diameter (48 inches or greater) storm drains, and precast concrete structures (12ftx8ft wide x15ft high, or greater), in streets and sidewalks within a crowded urban setting; including traffic and pedestrian management, removal of concrete road slab, rail tracks, and utility relocation and coordination. The dollar value of one project must be at least 17 million dollars and 8 million dollars for two projects. Provide the following details.

Project #7A-1: _____
Project Name:

Bidder's Name: _____

Start date: _____ Completion date: _____
Name and address of Owner for whom the work was done: _____

Name of Owner's Representative (for Reference): _____
Owner's Representative's Current Telephone #: _____
Dollar Value of Contract _____
Location of urban setting impacted by project: _____

Description of work performed that demonstrates that the above requirements have been fulfilled:

Project # 7A-2:

Project Name: _____
Start date: _____ Completion date: _____
Name and address of Owner for whom the work was done: _____

Name of Owner's Representative (for Reference): _____
Owner's Representative's Current Telephone #: _____
Dollar Value of Contract: _____
Location of urban setting impacted by project: _____

Description of work performed that demonstrates that the above requirements have been fulfilled:

Project # 7A-3:

Project Name: _____
Start date: _____ Completion date: _____

Bidder's Name: _____

Name and address of Owner for whom the work was done:

Name of Owner's Representative (for Reference): _____

Owner's Representative's Current Telephone #: _____

Dollar Value of Contract: _____

Location of urban setting impacted by project: _____

Description of work performed that demonstrates that the above requirements have been fulfilled:

7B Qualification Requirement for Traffic Management in Congested Urban Setting:

Within the last 10 years, the Contractor must have successfully completed at least 3 projects involving, as a minimum, work on state/city highways in an urban setting with heavy volumes of motor vehicle, bicycle, pedestrian and handicap traffic that required rerouting of traffic and transportation and coordination with state and/or city police, fire, parking, traffic and handicap compliance departments. The dollar value of one project must be at least 17 million dollars and 8 million dollars for two projects. Provide the following details.

Project #7B-1:

Project Name: _____

Start date: _____ Completion date: _____

Name and address of Owner for whom the work was done:

Name of Owner's Representative (for Reference): _____

Owner's Representative's Current Telephone #: _____

Dollar Value of Contract: _____

State/City highway and location of urban setting impacted by project:

Description of work performed that demonstrates that the above requirements have been fulfilled:

Bidder's Name: _____

Project #7B-2:

Project Name: _____

Start date: _____ Completion date: _____

Name and address of Owner for whom the work was done:

Name of Owner's Representative (for Reference): _____

Owner's Representative's Current Telephone #: _____

Dollar Value of Contract: _____

State/City highway and location of urban setting impacted by project:

Description of work performed that demonstrates that the above requirements have been fulfilled:

Project # 7B-3:

Project Name: _____

Start date: _____ Completion date: _____

Name and address of Owner for whom the work was done:

Name of Owner's Representative (for Reference): _____

Owner's Representative's Current Telephone #: _____

Dollar Value of Contract: _____

Bidder's Name: _____

State/City highway and location of urban setting impacted by project:

Description of work performed that demonstrates that the above requirements have been fulfilled:

7C Qualification Requirement for Community Sensitivities:

Within the last 10 years, the Contractor must have successfully completed at least 3 projects that demonstrated sensitivity to community issues, which could include but is not limited to designation of a community liaison, demonstration of work coordination with a community, and attendance and participation at community meetings. The dollar value of one project must be at least 17 million dollars and 8 million dollars for two projects. Provide the following details.

Project #7C-1:

Project Name: _____

Start date: _____ Completion date: _____

Name and address of Owner for whom the work was done:

Name of Owner's Representative (for Reference): _____

Owner's Representative's Current Telephone #: _____

Dollar Value of Contract: _____

Description of work performed that demonstrates that the above requirements have been fulfilled:

Project #7C-2:

Project Name: _____

Start date: _____ Completion date: _____

Name and address of Owner for whom the work was done:

Bidder's Name: _____

Name of Owner's Representative (for Reference): _____

Owner's Representative's Current Telephone #: _____

Dollar Value of Contract: _____

Description of work performed that demonstrates that the above requirements have been fulfilled:

Project #7C-3:

Project Name: _____

Start date: _____ Completion date: _____

Name and address of Owner for whom the work was done:

Name of Owner's Representative (for Reference): _____

Owner's Representative's Current Telephone #: _____

Dollar Value of Contract: _____

Description of work performed that demonstrates that the above requirements have been fulfilled:

7D Qualification Requirement for Support of Excavations and Geotechnical Monitoring:

Within the last 10 years, the Contractor must have successfully completed at least 3 projects involving, as a minimum, the design and installation of temporary earth support system similar in length, depth and method of installation to that required by this Contract as well as involving Geotechnical Monitoring similar to that required by this Contract. The dollar value of one project must be at least 17 million dollars and 8 million dollars for two projects. Provide the following details.

Project #7D-1:

Bidder's Name: _____

Project Name: _____

Start date: _____ Completion date: _____

Name and address of Owner for whom the work was done:

Name of Owner's Representative (for Reference): _____

Owner's Representative's Current Telephone #: _____

Dollar Value of Contract: _____

Description of work performed that demonstrates that the above requirements have been fulfilled:

Project #7D-2:

Project Name: _____

Start date: _____ Completion date: _____

Name and address of Owner for whom the work was done:

Name of Owner's Representative (for Reference): _____

Owner's Representative's Current Telephone #: _____

Dollar Value of Contract: _____

Description of work performed that demonstrates that the above requirements have been fulfilled:

Project #7D-3:

Project Name: _____

Start date: _____ Completion date: _____

Name and address of Owner for whom the work was done:

Bidder's Name: _____

Name of Owner's Representative (for Reference): _____
Owner's Representative's Current Telephone #: _____
Dollar Value of Contract: _____

Description of work performed that demonstrates that the above requirements have been fulfilled:

7-E Qualification Requirement for Environmental Protection:

Within the last 10 years, the Contractor must have successfully completed at least 3 projects or combination of projects each involving environmentally sensitive resource areas including but not limited to control, treatment, and monitoring of site runoff and trench dewatering discharge to Class B waters; and restoration of wetland and upland plantings along river bank, shorefront, and adjacent areas. The dollar value of each project must have been at least one million dollars. Within the last 10 years, the Contractor must have successfully completed the installation of at least 1 storm drainage outfall of at least 36 inches in size along river banks or shorefront. Provide the following details.

Project #7E-1:

Project Name: _____
Start date: _____ Completion date: _____
Name and address of Owner for whom the work was done:

Name of Owner's Representative (for Reference): _____
Owner's Representative's Current Telephone #: _____
Dollar Value of Contract: _____
Class B Water receiving site runoff or trench dewatering discharge: _____

Description of work performed that demonstrates that the above requirements have been fulfilled:

Bidder's Name: _____

Project #7E-2:

Project Name: _____

Start date: _____ Completion date: _____

Name and address of Owner for whom the work was done:

Name of Owner's Representative (for Reference): _____

Owner's Representative's Current Telephone #: _____

Dollar Value of Contract: _____

Class B Water receiving site runoff or trench dewatering discharge: _____

Description of work performed that demonstrates that the above requirements have been fulfilled:

Project #7E-3:

Project Name: _____

Start date: _____ Completion date: _____

Name and address of Owner for whom the work was done:

Name of Owner's Representative (for Reference): _____

Owner's Representative's Current Telephone #: _____

Dollar Value of Contract: _____

Class B Water receiving site runoff or trench dewatering discharge: _____

Description of work performed that demonstrates that the above requirements have been fulfilled:

Bidder's Name: _____

7-F Qualification Requirement for Reconstruction of Roadways and Sidewalks:

Within the last 10 years, the Contractor must have successfully completed at least 3 projects involving, as a minimum, the reconstruction of municipal roadways and Architectural Access Board compliant sidewalks, traffic signals, street lighting, line striping, surface improvements and landscaping. The dollar value of one project must be at least 6 million dollars and 3 million dollars for two projects. Provide the following details.

Project #7F-1:

Project Name: _____

Start date: _____ Completion date: _____

Name and address of Owner for whom the work was done:

Name of Owner's Representative (for Reference): _____

Owner's Representative's Current Telephone #: _____

Dollar Value of Contract: _____

State/City highway and name of location of compliant sidewalk work:

Description of work performed that demonstrates that the above requirements have been fulfilled:

Project # 7F-2:

Project Name: _____

Start date: _____ Completion date: _____

Name and address of Owner for whom the work was done:

Name of Owner's Representative (for Reference): _____

Owner's Representative's Current Telephone #: _____

Dollar Value of Contract: _____

State/City highway and name of location of compliant sidewalk work:

Bidder's Name: _____

Description of work performed that demonstrates that the above requirements have been fulfilled:

Project # 7F-3:

Project Name: _____

Start date: _____ Completion date: _____

Name and address of Owner for whom the work was done:

Name of Owner's Representative (for Reference): _____

Owner's Representative's Current Telephone #: _____

Dollar Value of Contract: _____

State/City highway and name of location of compliant sidewalk work:

Description of work performed that demonstrates that the above requirements have been fulfilled:

7-G Qualification Requirement for Pipeline Renewal:

Within the last 10 years, the Contractor must have successfully completed at least 3 projects in the United States of 48 inch diameter or greater sewer and/or drain renewal using cured-in-place pipelining of at least 1,000 continuous linear feet with on-site wet out of the liner tube; and design of a 48 inch diameter or greater liner tube wall thickness based on a fully deteriorated condition.

Bidder's Name: _____

Project #7G-1:

Project Name: _____

Start date: _____ Completion date: _____

Name and address of Owner for whom the work was done:

Name of Owner's Representative (for Reference): _____

Owner's Representative's Current Telephone #: _____

Dollar Value of Contract: _____

Description of work performed that demonstrates that the above requirements have been fulfilled:

Project # 7G-2:

Project Name: _____

Start date: _____ Completion date: _____

Name and address of Owner for whom the work was done:

Name of Owner's Representative (for Reference): _____

Owner's Representative's Current Telephone #: _____

Dollar Value of Contract: _____

Description of work performed that demonstrates that the above requirements have been fulfilled:

Project # 7G-3:

Project Name: _____

Start date: _____ Completion date: _____

Name and address of Owner for whom the work was done:

Bidder's Name: _____

Name of Owner's Representative (for Reference): _____
Owner's Representative's Current Telephone #: _____
Dollar Value of Contract: _____

Description of work performed that demonstrates that the above requirements have been fulfilled:

8. What project, most similar to the proposed Contract, has your present organization successfully completed? Please provide the following information:

Project #8-1:

Project Name: _____

Start date: _____ Completion date: _____

Name and Address of Owner for Whom the Work was done:

Name of Owner's Representative (for Reference): _____

Owner's Representative's Current Telephone #: _____

Dollar Value of Contract : _____

Was work being done as contractor or sub-contractor? _____

Description of work performed that demonstrates the similarity of the project to the proposed Contract:

9. List all projects for which your organization has received a Notice of Intent to Award or a Notice to Proceed and that your organization expects to perform during Years 2012-2014. Rank the list according to decreasing dollar value of work to be done in Years 2012-2014. On the following "TABLE OF PROJECTED WORK LOAD", indicate the first 10 projects from that list and provide information on the name of the project, the type of project, owner of the project, dollar value of work, and the estimated completion date. Under Project No. 11 on the following

Bidder's Name: _____

TABLE, indicate the number of projects and the sum of the dollar value of work that you expect to perform in Years 2012-2014 for all the remaining projects in the list.

Bidder's Name: _____

TABLE OF PROJECTED WORK LOAD

<u>Proj. No.</u>	<u>Name and Type of Project</u>	<u>Owner of Project</u>	<u>Dollar value of work to be done in YR 2012-2014</u>	<u>Estimated Completion Date of Project</u>
<u>1</u>				
<u>2</u>				
<u>3</u>				
<u>4</u>				
<u>5</u>				
<u>6</u>				
<u>7</u>				
<u>8</u>				
<u>9</u>				
<u>10</u>				
<u>11</u>	Enter the number of remaining project>>	<u>XXXXXXXX</u>	Enter cumulative dollar value of remaining projects: _____	<u>XXXXXXXX</u>

Bidder's Name: _____

10. Describe equipment available for the performance of this contract by setting forth make, model and year, size, number, and type for each such piece of equipment (a) owned, (b) currently rented or (c) to be rented. Bidder must set forth description of all equipment it plans to use whether rented or owned.

(a) Owned

(b) Currently Rented

(b) To Be Rented

11. Background and experience of the principal members of your organization, including the officers.

Bidder's Name: _____

12. Provide the name of the Contractor's Project Manager that will be assigned to the proposed Contract. The Project Manager must have a minimum of 10 years construction experience. The Project Manager must also have demonstrated the ability to manage construction budgets, to prepare schedules, and to perform contract administration for 1 project of at least one 17 million dollars and two projects of at least 8 million dollars.

Name: _____

Project #12-1:

Project Name: _____

Start date: _____ Completion date: _____

Name and Address of Owner for Whom the Work was done:

Name of Owner's Representative (for Reference): _____

Owner's Representative's Telephone #: _____

Dollar Value of Contract: _____

Description of work that demonstrates minimum experience requirements have been fulfilled:

Project #12-2:

Project Name: _____

Start date: _____ Completion date: _____

Name and Address of Owner for Whom the Work is being done:

Name of Owner's Representative (for Reference): _____

Owner's Representative's Telephone #: _____

Dollar Value of Contract : _____

Description of work that demonstrates minimum experience requirements have been fulfilled:

Bidder's Name: _____

Project #12-3

Project Name: _____

Start date: _____ Completion date: _____

Name and Address of Owner for Whom the Work is being done:

Name of Owner's Representative (for Reference): _____

Owner's Representative's Telephone #: _____

Dollar Value of Contract: _____

Description of work that demonstrates minimum experience requirements have been fulfilled:

13. Provide the name of the Contractor's fulltime On-Site Superintendent that will be assigned to the proposed Contract. The Project Superintendent must have a minimum of 10 years construction experience similar in size, nature and complexity as the proposed project; demonstrated ability to manage a minimum of one 17 million dollar and two 8 million dollar construction budgets, schedule, and crew coordination; have demonstrated experience in traffic management in heavily traveled streets; have experience with community relations with local businesses and residents and has coordinated with utilities. Provide details on 3 projects on which the proposed person has worked as On-Site Superintendent and that demonstrate that these requirements have been fulfilled:

Name: _____

Project #13-1:

Project Name: _____

Start date: _____ Completion date: _____

Name and Address of Owner for Whom the Work was done:

Name of Owner's Representative (for Reference): _____

Owner's Representative's Telephone #: _____

Dollar Value of Contract: _____

Description of work that demonstrates minimum experience requirements have been fulfilled:

Bidder's Name: _____

Project #13-2:

Project Name: _____

Start date: _____ Completion date: _____

Name and Address of Owner for Whom the Work is being done:

Name of Owner's Representative (for Reference): _____

Owner's Representative's Telephone #: _____

Dollar Value of Contract : _____

Description of work that demonstrates minimum experience requirements have been fulfilled:

Project #13-3

Project Name: _____

Start date: _____ Completion date: _____

Name and Address of Owner for Whom the Work is being done:

Name of Owner's Representative (for Reference): _____

Owner's Representative's Telephone #: _____

Dollar Value of Contract: _____

Description of work that demonstrates minimum experience requirements have been fulfilled:

Bidder's Name: _____

14. Give below the name and address of one or more banks which have information that would enable them to advise regarding the financial ability of your company.

Name of Bank	Address	Telephone #
--------------	---------	-------------

15. Federal Identification No.

16. Name, Signature, and Title of officer preparing this proposal.

Name _____

Signature _____

Title _____

17. The undersigned hereby authorizes and requests any person, firm or corporation to furnish any information requested by the Cambridge Department of Public Works in verification of the recitals comprising this Statement of Bidder's Qualifications.

Dated at _____ this _____ day of _____, 20__

(Signature)

Tel. No. _____

BY _____

Title _____

State of _____)

County of _____)

Bidder's Name: _____

_____, being duly sworn,
deposes and says that he/she is _____ of

(Name of Organization)

and that the answers to the foregoing questions and all statements therein contained are true and correct.

Subscribed and sworn to before me this _____ day of _____, 2012

(Notary Public)

My commission expires on _____, 20____

- END OF SECTION 00312 -

Bidder's Name: _____

SECTION 00313
GENERAL CONTRACTOR'S CERTIFICATION

A contractor will not be eligible for award of a contract unless such contractor has submitted the following certification, which is deemed a part of the resulting contract:

GENERAL CONTRACTOR'S CERTIFICATION

_____ (General Contractor) certifies that:

1. it shall obtain from each of its subcontractors and submit to the contracting or administering agency prior to the performance of any work under said subcontract a certification by each subcontractor, regardless of tier, that it will comply with the Minority/Women/Resident workforce ratio;
2. it read, understands and shall comply with the Minority/Women/Resident hiring requirements set forth in the Cambridge Employment Plan, Cambridge Municipal Code §2.66.060, et seq.;
3. it is aware that failure to comply with the Cambridge Employment Plan will result in, at minimum, the following: 1) it will be ineligible to bid for future contracts with the City of Cambridge, and 2) the City of Cambridge will notify DCAM of such failure which may affect the contractor's future qualification to bid for public contracts throughout the Commonwealth;
4. it has read, understands and shall comply with all the pertinent provisions of the Americans with Disabilities Act and will be subject to sanctions for failure to do so;
5. it has read, understands and shall comply with all the provisions of the Supplemental Equal Employment Opportunity Anti-Discrimination and Affirmative Action Program and will be subject to sanctions for failure to do so;
6. it intends to use the following listed construction trades in the work under contract.

Signed under the penalties of perjury.

Signature of authorized representative of contractor

Print name of authorized representative of contractor

Dated

Submit this form with your bid

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SECTION 00314
SUBCONTRACTOR'S CERTIFICATION

Prior to the award of any subcontract, regardless of tier, the prospective subcontractor must execute and submit to the General Contractor the following certification, which will be deemed a part of the resulting subcontract:

SUBCONTRACTOR'S CERTIFICATION

_____ (Subcontractor) certifies that:

1. it will obtain from each of its subcontractors prior to the award of any subcontract under this subcontract the subcontractor certification required by these bid conditions;
2. it read, understands and shall comply with the Minority/Women/Resident hiring requirements set forth in Cambridge Municipal Code $\text{c}2.66.060$, et seq.;
3. it is aware that failure to comply with the Cambridge Employment Plan will result in, at minimum, the following: 1) it will be ineligible to bid for future contracts with the City of Cambridge, and 2) the City of Cambridge will notify DCAM of such failure which may affect the contractor's future qualification to bid for public contracts throughout the Commonwealth;
4. it has read, understands and shall comply with all the pertinent provisions of the Americans with Disabilities Act and will be subject to sanctions for failure to do so;
5. it has read, understands and shall comply with all the provisions of the Supplemental Equal Employment Opportunity Anti-Discrimination and Affirmative Action Program and will be subject to sanctions for failure to do so;
6. it intends to use the following listed construction trades in the work under contract.

Signed under the penalty of perjury.

Signature of authorized representative of subcontractor

Print name of authorized representative of subcontractor

Dated

In order to ensure that the subcontractor's certification becomes part of all subcontracts under the prime contract, no subcontract shall be executed until an authorized representative of the City agency (or agencies) administering this project or the Affirmative Action Officer has determined, in writing, that the said certification has been incorporated in such subcontract, regardless of tier. Any subcontract executed without such written approval shall be void.

SECTION 00315
PROJECTED WORKFORCE CERTIFICATION

THIS FORM MUST BE SUBMITTED WITH YOUR BID

PROJECTED WORKFORCE CERTIFICATION

I, _____

Certify that the following is my projected workforce for this contract:

GENERAL CONTRACTOR	ESTIMATED # OF NEW HIRES

SUBTRADE	ESTIMATED # OF NEW HIRES

Signed under penalties of perjury,

General Contractor

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SECTION 00316
CREP GENERAL CONTRACTOR'S CERTIFICATION FORM

CAMBRIDGE RESPONSIBLE EMPLOYER PLAN

GENERAL CONTRACTOR'S CERTIFICATION - BID FORM

_____ hereby certifies that it, (Name of General Bidder)
and all its subcontractors who are not filed sub bidders shall:

(1) comply with the Cambridge Employment Plan as it currently exists and as it may be, from time to time, amended, and specifically shall comply with the worker hours requirements of §2.66.060(A);

(2) comply with the obligations established under M.G.L. c.149 and G.L. c30§39M to pay the appropriate lawful prevailing wage rates to its employees;

(3) maintain or participate in a bona fide apprentice training program as defined by c.23 §§ 11H and 11I for each apprenticeable trade or occupation represented in its workforce that is approved by the Division of Apprentice Training of the Department of Labor and Industries and shall abide by the apprentice to journeymen ratio for each trade prescribed therein in the performance of the contract;

(4) furnish, at its expense, hospitalization and medical benefits for all its employees employed on the project and/or coverage at least comparable in value to the hospitalization and medical benefits provided by the health and welfare plans in the applicable craft recognized by M.G.L. c.149, §26 and G.L. c30§39M in establishing minimum wage rates;

(5) maintain appropriate industrial accident insurance coverage for all its employees employed on the project in accordance with M.G.L. c. 152;

(6) properly classify employees as employees rather than independent contractors and treat them accordingly for purposes of workers' compensation insurance, unemployment taxes, social security taxes and income tax withholding; and

(7) certify under oath and in writing on a weekly basis for the entire duration of its work on the project, that it is in compliance with the above obligations.

Signed under the penalties of perjury. _____ (date)

Signature of authorized representative of contractor

Print name of authorized representative of contractor

**THIS CERTIFICATE APPLIES ONLY TO GENERAL BIDS OVER \$100,000 INCLUDING
ALL ALTERNATES, IF ANY.**

RETURN THIS FORM WITH YOUR BID

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SECTION 00317

CREP GENERAL CONTRACTOR'S CERTIFICATION – WEEKLY FORM

Project: _____

Contract#: _____

**CAMBRIDGE RESPONSIBLE EMPLOYER PLAN
GENERAL CONTRACTOR'S CERTIFICATION - WEEKLY CONTRACT FORM**

_____ hereby certifies that it, (Name of General Contractor) and all its subcontractors who are not filed sub bidders:

(1) are complying with the Cambridge Employment Plan as it currently exists and as it may be, from time to time, amended, and specifically are complying with the worker hours requirements of §2.66.060(A);

(2) are complying with the obligations established under M.G.L. c.149 and G.L. c30§39M to pay the appropriate lawful prevailing wage rates to its employees;

(3) are maintaining or participating in a bona fide apprentice training program as defined by c.23 §§ 11H and 11I for each apprenticeable trade or occupation represented in its workforce that is approved by the Division of Apprentice Training of the Department of Labor and Industries and are abiding by the apprentice to journeymen ratio for each trade prescribed therein in the performance of the contract;

(4) are furnishing, at its expense, hospitalization and medical benefits for all its employees employed on the project and/or coverage at least comparable in value to the hospitalization and medical benefits provided by the health and welfare plans in the applicable craft recognized by M.G.L.c.149, §26 and G.L. c30§39M in establishing minimum wage rates;

(5) are maintaining appropriate industrial accident insurance coverage for all its employees employed on the project in accordance with M.G.L. c.152; and

(6) are properly classifying employees as employees rather than independent contractors and treat them accordingly for purposes of workers' compensation insurance, unemployment taxes, social security taxes and income tax withholding.

The General Contractor certifies under oath that it is in compliance with the above obligations.

Signed under the penalties of perjury, week of: _____(date)

Signature of authorized representative of contractor

Print name of authorized representative of contractor

**THIS FORM MUST BE SUBMITTED TO THE CITY OF CAMBRIDGE
PURCHASING DEPARTMENT ON A WEEKLY BASIS FOR THE LIFE OF THE
PROJECT**

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SECTION 00320
CREP SUBCONTRACTOR CERTIFICATION FORM

**CAMBRIDGE RESPONSIBLE EMPLOYER PLAN
NON-FILED SUB-CONTRACTOR'S CERTIFICATION - BID FORM**

_____ hereby certifies that it shall:
(Name of Sub-Contractor)

(1) comply with the Cambridge Employment Plan as it currently exists and as it may be, from time to time, amended, and specifically shall comply with the worker hours requirements of §2.66.060(A);

(2) comply with the obligations established under M.G.L. c.149 and G.L. c30§39M to pay the appropriate lawful prevailing wage rates to its employees;

(3) maintain or participate in a bona fide apprentice training program as defined by c.23 §§ 11H and 11I for each apprenticable trade or occupation represented in its workforce that is approved by the Division of Apprentice Training of the Department of Labor and Industries and shall abide by the apprentice to journeymen ratio for each trade prescribed therein in the performance of the contract;

(4) furnish, at its expense, hospitalization and medical benefits for all its employees employed on the project and/or coverage at least comparable in value to the hospitalization and medical benefits provided by the health and welfare plans in the applicable craft recognized by M.G.L. c.149, §26 and G.L. c30§39M in establishing minimum wage rates;

(5) maintain appropriate industrial accident insurance coverage for all its employees employed on the project in accordance with M.G.L. c.152;

(6) properly classify employees as employees rather than independent contractors and treat them

accordingly for purposes of workers' compensation insurance, unemployment taxes, social security taxes and income tax withholding; and

(7) certify under oath and in writing on a weekly basis for the entire duration of its work on the project, that it is in compliance with the above obligations.

Signed under the penalties of perjury. _____(date)

Signature of authorized representative of contractor

Print name of authorized representative of contractor

**THIS CERTIFICATE APPLIES ONLY TO FILED SUBBIDS \$25,000 AND OVER -
INCLUDING ALL ALTERNATES, IF ANY.**

RETURN THIS FORM WITH YOUR BID

SECTION 00321

CREP SUBCONTRACTOR CERTIFICATION – WEEKLY FORM

Project: _____

Contract#: _____

**CAMBRIDGE RESPONSIBLE EMPLOYER PLAN
NONFILED SUBBIDDER’S CERTIFICATION - WEEKLY CONTRACT FORM**

_____ hereby certifies that it, (Name of General Contractor) and all its subcontractors who are not filed subbidders:

(1) are complying with the Cambridge Employment Plan as it currently exists and as it may be, from time to time, amended, and specifically are complying with the worker hours requirements of §2.66.060(A);

(2) are complying with the obligations established under M.G.L. c.149 and G.L. c30§39M to pay the appropriate lawful prevailing wage rates to its employees;

(3) are maintaining or participating in a bona fide apprentice training program as defined by c.23 §§ 11H and 11I for each apprenticable trade or occupation represented in its workforce that is approved by the Division of Apprentice Training of the Department of Labor and Industries and are abiding by the apprentice to journeymen ratio for each trade prescribed therein in the performance of the contract;

(4) are furnishing, at its expense, hospitalization and medical benefits for all its employees employed on the project and/or coverage at least comparable in value to the hospitalization and medical benefits provided by the health and welfare plans in the applicable craft recognized by M.G.L.c.149, §26 and G.L. c30§39M in establishing minimum wage rates;

(5) are maintaining appropriate industrial accident insurance coverage for all its employees employed on the project in accordance with M.G.L. c.152; and

(6) are properly classifying employees as employees rather than independent contractors and treat them accordingly for purposes of workers' compensation insurance, unemployment taxes, social security taxes and income tax withholding.

The General Contractor certifies under oath that it is in compliance with the above obligations.

Signed under the penalties of perjury, week of: _____(date)

Signature of authorized representative of contractor

Print name of authorized representative of contractor

**THIS FORM MUST BE SUBMITTED TO THE CITY OF CAMBRIDGE
PURCHASING DEPARTMENT ON A WEEKLY BASIS FOR THE LIFE OF THE
PROJECT**

SECTION 00322
CORI COMPLIANCE FORM

CORI COMPLIANCE FORM

Persons and businesses supplying goods and/or services to the City of Cambridge (“Vendors”), who are required by law to perform CORI checks, are further required by Section 2.112.060 of the Cambridge Municipal Code to employ fair policies, practices and standards relating to the screening and identification of persons with criminal backgrounds through the CORI system. Such Vendors, when entering into contracts with the City of Cambridge, must affirm that their policies, practices and standards regarding CORI information are consistent with the policies, practices and standards employed by the City of Cambridge as set forth in the City of Cambridge CORI Policy (“CORI Policy”) attached hereto.

CERTIFICATION

The undersigned certifies under penalties of perjury that the Vendor employs CORI related policies, practices and standards that are consistent with the provisions of the attached CORI Policy. **All Vendors must check one of the three lines below.**

1. _____ CORI checks are not performed on any Applicants.
2. _____ CORI checks are performed on some or all Applicants. The Vendor, by affixing a signature below, affirms under penalties of perjury that its CORI policies, practices and standards are consistent with the policies, practices and standards set forth in the attached CORI Policy.
3. _____ CORI checks are performed on some or all Applicants. The Vendor’s CORI policies, practices and standards are not consistent with the attached CORI Policy. Please explain on a separate sheet of paper.

(Typed or printed name of person
signing quotation, bid or Proposal)

Signature

(Name of Business)

NOTE:

The City Manager, in his sole discretion may grant a waiver to any Vendor on a contract by contract basis.

Instructions for Completing CORI Compliance Form:

A Vendor should not check Line 1 unless it performs NO CORI checks on ANY applicant. A Vendor who checks Line 2 certifies that the Vendor’s CORI policy conforms to the policies, practices and standards set forth in the City’s CORI Policy. A Vendor with a CORI policy that does NOT conform to the City’s CORI Policy must check Line 3 and explain the reasons for its nonconformance in writing. Vendors, who check Line 3, will not be permitted to enter into contracts with the City, absent a waiver by the City Manager.

This form must be submitted with your bid

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SECTION 00323
OSHA GENERAL CONTRACTOR CERTIFICATION FORM

Chapter 306 of the Acts of 2004
An Act Relative to the Health and Safety on Construction Projects

GENERAL CONTRACTOR'S CERTIFICATION - BID FORM

_____ (Name of General Bidder) hereby certifies that it, and all its subcontractors who are not filed sub bidders shall:

- (1) who shall certify that all employees to be employed at the worksite will have successfully completed a course in construction safety and health approved by the United States Occupational Safety and Health Administration that is a least 10 hours in duration at the time the employee begins work and who shall furnish documentation of successful completion of said course with the first certified payroll report for each employee.

Signed under the penalties of perjury. _____ (date)

Signature of authorized representative of contractor

Print name of authorized representative of contractor

RETURN THIS FORM WITH YOUR BID

SECTION 00324
OSHA SUBCONTRACTOR CERTIFICATION FORM

Chapter 306 of the Acts of 2004
An Act Relative to the Health and Safety on Construction Projects

NON-FILED SUBBIDDERS CERTIFICATION - BID FORM

_____ (Name of Sub Bidder) hereby certifies that
it, and all its subcontractors who are not filed subbidders shall:

- (1) who shall certify that all employees to be employed at the worksite will have successfully completed a course in construction safety and health approved by the United States Occupational Safety and Health Administration that is at least 10 hours in duration at the time the employee begins work and who shall furnish documentation of successful completion of said course with the first certified payroll report each employee.

Signed under the penalties of perjury. _____ (date)

Signature of authorized representative of contractor

Print name of authorized representative of contractor

RETURN THIS FORM WITH YOUR BID

SECTION 00325

MASSACHUSETTS DIESEL RETROFIT PROGRAM STATEMENT OF
INTENT TO COMPLY

The Department of Environmental Protection has developed the Massachusetts Diesel Retrofit Program (MDRP) in response to increasing health concerns with the emissions from diesels engines and vehicles. To control these emissions, the MADRP has identified oxidation catalyst retrofits as the control technology of choice. These retrofits consist of either an in-line replacement engine muffler system or an add-on control device. Compliance with the MDRP is technology based, such that installation of an EPA-certified (or equivalent) control device will constitute full compliance.

Statement of Intent to Comply

This form must be signed and submitted by the Bidder as part of the bid.

Local Governmental Unit: City of Cambridge Public Works

Contract No.:

Contract Title: Western Avenue Infrastructure Improvements Project

Bidder : _____

The undersigned, on behalf of the above-named Bidder, agrees that, if awarded the contract, the Bidder will comply with the Massachusetts Diesel Retrofit Program (MDRP) by having all of the off-road (non-registered) diesel vehicles/equipment used on the Contract equipped with, or retrofitted with, after-engine emission controls that are EPA certified or equivalent.

Signed under penalties of perjury.

Signature of authorized representative of contractor

Print name of authorized representative of contractor

Date

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SECTION 00326

AMERICANS WITH DISABILITIES ACT (42 U.S.C. 12131)
Section 504 of the Rehabilitation Act of 1973

The American with Disabilities Act ("the Act") applies to all employers of fifteen or more employees. All Contractors that are subject to the Act must comply with its provisions. In further compliance with the Act, all Contractors who enter into contracts with the City are prohibited from discrimination against the City's employees, regardless of the size of the Contractor.

The Act protects against discrimination on the basis of "disability", which is defined as a physical or mental impairment that substantially limits at least one "major life activity"; discrimination against a person having a history or has a record of such impairment; and discrimination against an individual regarded - even if inaccurately - as having such an impairment. The Act also expressly prohibits job discrimination that is based on an individual's relationship or association with a disabled person.

The bidder shall not discriminate against any qualified employee or job applicant with a disability and will make the activities, programs and services covered by any contract awarded through this procurement readily accessible to and usable by individuals with disabilities. To be qualified for a job, or to avail oneself of the bidder's services, the individual with the disability must meet the essential eligibility requirements for receipt of the bidder's services or participation in the bidder's programs or activities with or without: 1) reasonable modifications to the bidder's rules, policies and practices; 2) removal of architectural, communication, or transportation barriers; or, 3) provisions of auxiliary aids and services.

By submitting its bid, the bidder certifies to the City of Cambridge that it understands and will comply with all applicable provisions of the Act, including compliance with applicable provisions of Section 504 of the Rehabilitation Act of 1973, if the bidder is receiving federal funds.

Date: _____

(Print Name of person signing bid)

(Signature & Title)

END OF SECTION 00326

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File No. _____

**AGREEMENT BETWEEN THE CITY OF CAMBRIDGE
AND
CONTRACTOR**

The City of Cambridge (“the City”), a municipal corporation, acting through its City Manager, and

_____ (“the contractor”),

_____ (address)

agree as follows:

THE CONTRACT DOCUMENTS

The Contract Documents form the Contract between the City and the Contractor and consist only of those documents listed under the definition of “Contract Documents” in the General Terms and Conditions of the Contract. The Contract represents the entire and integrated agreement between the parties and supersedes any prior negotiations, representations, or agreements, whether oral or written.

THE WORK

The Contractor shall perform the Work as specified in the Contract Documents entitled:

Western Avenue Infrastructure Improvements Project

CONTRACT TIME

The Contract Time shall be no later than **720 calendar days** commencing on or before ten (10) calendar days following the date set forth in the Notice to Proceed.

The Contractor agrees that the Work shall be prosecuted regularly, diligently, uninterruptedly and at such rate of progress as will insure full completion thereof within the Contract Time. It is expressly understood and agreed that the Contract Time is reasonable for the completion of the Work, taking all factors into consideration.

BIDDER’s NAME _____

CONTRACT SUM

The City will pay the Contractor for performance of the Work in accordance with the Contract Documents the sum of \$ _____ as set forth on the Contractor's bid form.

The City shall not be liable for any claims or requests for payment by the Contractor which would cause the total claims or payments under this Contract to exceed by the City Auditor as being appropriated for this contract.

LIQUIDATED DAMAGES

The City and the Contractor recognize that time is of the essence of this Contract and that the City will suffer financial loss if the Work is not completed within the Contract Time plus any authorized extensions. They also recognize the delay, expense, and difficulty involved in proving the actual loss suffered by the City if the Work is not completed within the Contract Time. Accordingly, instead of requiring any such proof, the City and the Contractor agree that the Contractor shall pay to the City as liquidated damages, not as a penalty, the sum of **\$3,600** per day for each calendar day of delay until the Work is completed. The Contractor agrees to allow the City to deduct any such amounts from progress payments and retainage.

This Contract is effective as of _____, the date the Agreement is signed by the City Manager.

THE CITY OF CAMBRIDGE

THE CONTRACTOR

Robert W. Healy, City Manager

Signature

APPROVED AS TO FORM:

BY:

Print Name and Title

Nancy E. Glowa, Acting City Solicitor

(Corporate Seal)

APPROVED AS TO THE AVAILABILITY OF APPROPRIATION OF FUNDS:

Budget Code: _____

James D. Monagle, City Auditor

Cynthia H. Griffin, Purchasing Agent

BIDDER's NAME _____

SECTION 00550
NOTICE OF AWARD

TO: _____

PROJECT DESCRIPTION: WESTERN INFRASTRUCTURE
IMPROVEMENTS PROJECT

The Owner has considered the Proposal submitted by you for the above described Work on _____ 20__ in response to its Advertisement for Bids and Instructions to Bidders.

You are hereby notified that your Proposal has been accepted for Items totalling the amount of \$_____.

You are required by the Instructions to Bidders to execute the Contract Agreement and furnish the required Contractor's Performance Bond, Payment Bond and certificates of insurance within ten (10) days from the date of this Notice of Award.

If you fail to execute said Agreement and to furnish said Bonds and Insurance within ten (10) days from the date of this Notice, said Owner will be entitled to consider all your rights arising out of the Owner's acceptance of your Proposal as abandoned and as a forfeiture of your Bid Bond. The Owner will be entitled to such other rights as may be granted by law.

You are required to return an acknowledged copy of this Notice Of Award to the Owner.

Dated this _____ day of _____, 20_____.

(Owner)
By _____
Title _____

ACCEPTANCE OF NOTICE

Receipt of the above Notice of Award is hereby acknowledged, this the _____ day of _____, 20__.

By _____
Title _____

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SECTION 00560

NOTICE TO PROCEED

To: _____ Date: _____
(Contractor)

Project: WESTERN AVENUE
INFRASTRUCTURE
IMPROVEMENTS PROJECT

You are hereby notified to commence the Work in accordance with the Agreement dated _____, 20____, on or before _____, 20____, and you are to complete all work within 720 calendar days thereafter. The date of completion of all work is therefore, _____, 20_____.

(Owner)

By _____

Title _____

ACCEPTANCE OF NOTICE

Receipt of the above Notice to Proceed is hereby acknowledged, this the _____
day of _____, 20__.

By _____

Title _____

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SECTION 00610
PERFORMANCE BOND

We, the undersigned, _____

_____,
(Name of Contractor)

(Address of Contractor)

_____ (Corporation, Partnership, or Individual), hereinafter
called Principal, and _____

_____,
(Name of Surety)

_____,
(Address of Surety) hereinafter called Surety, are held and firmly bound unto the CITY OF
CAMBRIDGE, 795 Massachusetts Avenue, Cambridge, MA 02139, 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 hereby jointly and severally bind ourselves, our heirs, executors,
administrators, successors and assigns.

The condition of this obligation is such that the Principal entered into a certain contract with
the Owner, dated the ____ day of _____, 20____, a copy of which is attached
hereto and made a part hereof, for the project known as "WESTERN AVENUE
INFRASTRUCTURE IMPROVEMENTS PROJECT," and the Principal and Surety bind
themselves to the Owner for the performance of the contract.

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 during the guaranty period set forth in the contract, and if it shall satisfy all claims
and demands incurred under such contract, and shall fully indemnify and save harmless the Owner,
its officers and agents from any and all costs and damages which it may suffer by a 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, this bond shall remain in full force and effect; provided, further, that the said Surety for value received hereby agrees that no change, extension of time, alteration or addition to the terms of the contract or to the work to be performed thereunder of the Specifications accompanying the same shall in any way affect its obligation on this Bond, and it does hereby waive notice of any such change, extension of time, alteration or addition to the terms of 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, this instrument is executed on this _____ day of _____, _____.

CONTRACTOR AS PRINCIPAL

SURETY

(Signature)
Name and Title:

(Signature)
Name and Title:

SEAL

SEAL

Address

Telephone No.

Fax No.

SECTION 00620
PAYMENT BOND

We, the undersigned, _____

(Name of Contractor)

(Address of Contractor)

_____ (Corporation, Partnership or Individual), hereinafter called

Principal, and _____

(Name of Surety)

(Address of Surety)

hereinafter called Surety, are held and firmly bound unto the CITY OF CAMBRIDGE, 795 Massachusetts Avenue, Cambridge, MA 02139, 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 hereby jointly and severally bind ourselves, our heirs, executors, administrators, successors and assigns.

The condition of this obligation is such that the Principal entered into a certain contract with the Owner, dated the ____ day of _____ 20__, a copy of which is attached hereto and made a part hereof, for the project known as "WESTERN AVENUE INFRASTRUCTURE IMPROVEMENTS PROJECT"

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 all materials used in connection with the 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 this bond is to remain in full force and effect.

Provided, further, that the said Surety for value received hereby agrees that no change,

extension of time, alteration or addition to the terms of the contract or to the work to be performed thereunder of the Specifications accompanying the same shall in any way affect its obligation on this Bond, and it does hereby waive notice of any such change, extension of time, alteration or addition to the terms of 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, this instrument is executed on this ____ day of _____, _____.

CONTRACTOR AS PRINCIPAL

SURETY

(Signature)
Name and Title:

(Signature)
Name and Title:

SEAL

SEAL

Address

Telephone No.

Fax No.

SECTION 00630
CERTIFICATE OF AUTHORITY

MEETING OF THE BOARD OF DIRECTORS

CERTIFICATE OF AUTHORITY

At a meeting of the Directors of the _____
_____ duly called
and held at _____ on the _____ day
of _____ 20____, at which a quorum was present and acting, it was
VOICED THAT _____ the
_____ of this corporation is hereby authorized
and empowered to make, enter into, sign, seal and deliver, in behalf of this corporation, a Contract
for

___ with the City of Cambridge, and performance and payment bonds (each in the full amount of the
Contract) in connection with such Contract.

I DO 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 on this date, and that
_____ is duly elected
_____ of this corporation.

ATTEST:

Clerk or Secretary of the Corporation
(Affix Corporate Seal Here)

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SECTION 00670

DIVISION OF LABOR AND WAGE RATES

Prevailing wage rates to be applied for work performed under this Contract are shown on the following pages.

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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

JOANNE F. GOLDSTEIN
Secretary

HEATHER E. ROWE
Director

DEVAL L. PATRICK
Governor

TIMOTHY P. MURRAY
Lt. Governor

Awarding Authority: City of Cambridge Purchasing Department
Contract Number: 5816 **City/Town:** CAMBRIDGE
Description of Work: Infrastructure Improvements - Includes, but is not limited to the construction of sewers & drains ranging in size from 10inch to 48inch in diameter;
Job Location: Western Avenue

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
Construction						
(2 AXLE) DRIVER - EQUIPMENT <i>TEAMSTERS JOINT COUNCIL NO. 10 ZONE A</i>	12/01/2011	\$30.95	\$8.56	\$7.27	0.00	\$46.78
	06/01/2012	\$31.25	\$8.56	\$7.27	0.00	\$47.08
	08/01/2012	\$31.25	\$8.91	\$7.27	0.00	\$47.43
	12/01/2012	\$31.55	\$8.91	\$8.00	0.00	\$48.46
(3 AXLE) DRIVER - EQUIPMENT <i>TEAMSTERS JOINT COUNCIL NO. 10 ZONE A</i>	12/01/2011	\$31.02	\$8.56	\$7.27	0.00	\$46.85
	06/01/2012	\$31.32	\$8.56	\$7.27	0.00	\$47.15
	08/01/2012	\$31.32	\$8.91	\$7.27	0.00	\$47.50
	12/01/2012	\$31.62	\$8.91	\$8.00	0.00	\$48.53
(4 & 5 AXLE) DRIVER - EQUIPMENT <i>TEAMSTERS JOINT COUNCIL NO. 10 ZONE A</i>	12/01/2011	\$31.14	\$8.56	\$7.27	0.00	\$46.97
	06/01/2012	\$31.44	\$8.56	\$7.27	0.00	\$47.27
	08/01/2012	\$31.44	\$8.91	\$7.27	0.00	\$47.62
	12/01/2012	\$31.74	\$8.91	\$8.00	0.00	\$48.65
ADS/SUBMERSIBLE PILOT <i>PILE DRIVER LOCAL 56 (ZONE 1)</i>	08/01/2011	\$80.43	\$9.80	\$17.12	0.00	\$107.35
AIR TRACK OPERATOR <i>LABORERS - ZONE 1</i>	12/01/2011	\$32.55	\$7.10	\$12.45	0.00	\$52.10
ASBESTOS REMOVER - PIPE / MECH. EQUIPT. <i>ASBESTOS WORKERS LOCAL 6 (BOSTON)</i>	12/01/2011	\$28.40	\$9.90	\$5.95	0.00	\$44.25
ASPHALT RAKER <i>LABORERS - ZONE 1</i>	12/01/2011	\$32.05	\$7.10	\$12.45	0.00	\$51.60
ASPHALT/CONCRETE/CRUSHER PLANT-ON SITE <i>OPERATING ENGINEERS LOCAL 4</i>	12/01/2011	\$39.52	\$10.00	\$12.40	0.00	\$61.92
	06/01/2012	\$40.09	\$10.00	\$12.40	0.00	\$62.49
	12/01/2012	\$40.71	\$10.00	\$12.40	0.00	\$63.11
	06/01/2013	\$41.49	\$10.00	\$12.40	0.00	\$63.89
	12/01/2013	\$42.27	\$10.00	\$12.40	0.00	\$64.67

This wage schedule must be posted by the contractor at the work site in accordance with M.G.L. ch. 149, sec. 27. Failure of the employer to pay "prevailing wage rates," which are the "total rates" listed above, on public works projects is a violation of M.G.L. ch. 149, sec. 27. Contractors with questions about the wage rates or classifications included on the wage schedule have an affirmative obligation to inquire with DLS at www.mass.gov/dols or at 617-626-6952. Employees not receiving such rates should report the violation to the Fair Labor Division of the Office of the Attorney General, 100 Cambridge Street, Boston, MA 02108; Tel:



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

JOANNE F. GOLDSTEIN
Secretary

HEATHER E. ROWE
Director

DEVAL L. PATRICK
Governor

TIMOTHY P. MURRAY
Lt. Governor

Awarding Authority: City of Cambridge Purchasing Department
Contract Number: 5816 **City/Town:** CAMBRIDGE
Description of Work: Infrastructure Improvements - Includes, but is not limited to the construction of sewers & drains ranging in size from 10inch to 48inch in diameter;
Job Location: Western Avenue

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
BACKHOE/FRONT-END LOADER <i>OPERATING ENGINEERS LOCAL 4</i>	12/01/2011	\$39.52	\$10.00	\$12.40	0.00	\$61.92
	06/01/2012	\$40.09	\$10.00	\$12.40	0.00	\$62.49
	12/01/2012	\$40.71	\$10.00	\$12.40	0.00	\$63.11
	06/01/2013	\$41.49	\$10.00	\$12.40	0.00	\$63.89
	12/01/2013	\$42.27	\$10.00	\$12.40	0.00	\$64.67
BARCO-TYPE JUMPING TAMPER <i>LABORERS - ZONE 1</i>	12/01/2011	\$32.05	\$7.10	\$12.45	0.00	\$51.60
BLOCK PAVER, RAMMER / CURB SETTER <i>LABORERS - ZONE 1</i>	12/01/2011	\$32.55	\$7.10	\$12.45	0.00	\$52.10
BOILER MAKER <i>BOILERMAKERS LOCAL 29</i>	01/01/2010	\$37.70	\$6.97	\$11.18	0.00	\$55.85

Apprentice - BOILERMAKER - Local 29

Effective Date - 01/01/2010

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	65	\$24.51	\$6.97	11.18	\$0.00	\$42.66
2	65	\$24.51	\$6.97	11.18	\$0.00	\$42.66
3	70	\$26.39	\$6.97	11.18	\$0.00	\$44.54
4	75	\$28.28	\$6.97	11.18	\$0.00	\$46.43
5	80	\$30.16	\$6.97	11.18	\$0.00	\$48.31
6	85	\$32.05	\$6.97	11.18	\$0.00	\$50.20
7	90	\$33.93	\$6.97	11.18	\$0.00	\$52.08
8	95	\$35.82	\$6.97	11.18	\$0.00	\$53.97

Notes:

Apprentice to Journeyworker Ratio:1:5

This wage schedule must be posted by the contractor at the work site in accordance with M.G.L. ch. 149, sec. 27. Failure of the employer to pay "prevailing wage rates," which are the "total rates" listed above, on public works projects is a violation of M.G.L. ch. 149, sec. 27. Contractors with questions about the wage rates or classifications included on the wage schedule have an affirmative obligation to inquire with DLS at www.mass.gov/dols or at 617-626-6952. Employees not receiving such rates should report the violation to the Fair Labor Division of the Office of the Attorney General, 100 Cambridge Street, Boston, MA 02108; Tel:



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

JOANNE F. GOLDSTEIN
Secretary

HEATHER E. ROWE
Director

DEVAL L. PATRICK
Governor

TIMOTHY P. MURRAY
Lt. Governor

Awarding Authority: City of Cambridge Purchasing Department
Contract Number: 5816 **City/Town:** CAMBRIDGE
Description of Work: Infrastructure Improvements - Includes, but is not limited to the construction of sewers & drains ranging in size from 10inch to 48inch in diameter;
Job Location: Western Avenue

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
BRICK/STONE/ARTIFICIAL MASONRY (INCL. MASONRY WATERPROOFING) <i>BRICKLAYERS LOCAL 3 (BOSTON)</i>	03/01/2012	\$46.56	\$10.18	\$17.25	0.00	\$73.99

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

Effective Date - 03/01/2012

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$23.28	\$10.18	17.25	\$0.00	\$50.71
2	60	\$27.94	\$10.18	17.25	\$0.00	\$55.37
3	70	\$32.59	\$10.18	17.25	\$0.00	\$60.02
4	80	\$37.25	\$10.18	17.25	\$0.00	\$64.68
5	90	\$41.90	\$10.18	17.25	\$0.00	\$69.33

Notes:

Apprentice to Journeyworker Ratio:1:5

BULLDOZER/GRADER/SCRAPER <i>OPERATING ENGINEERS LOCAL 4</i>	12/01/2011	\$39.16	\$10.00	\$12.40	0.00	\$61.56
	06/01/2012	\$39.72	\$10.00	\$12.40	0.00	\$62.12
	12/01/2012	\$40.34	\$10.00	\$12.40	0.00	\$62.74
	06/01/2013	\$41.11	\$10.00	\$12.40	0.00	\$63.51
	12/01/2013	\$41.89	\$10.00	\$12.40	0.00	\$64.29
CAISSON & UNDERPINNING BOTTOM MAN <i>LABORERS - FOUNDATION AND MARINE</i>	12/01/2011	\$32.80	\$7.10	\$12.60	0.00	\$52.50
CAISSON & UNDERPINNING LABORER <i>LABORERS - FOUNDATION AND MARINE</i>	12/01/2011	\$31.65	\$7.10	\$12.60	0.00	\$51.35
CAISSON & UNDERPINNING TOP MAN <i>LABORERS - FOUNDATION AND MARINE</i>	12/01/2011	\$31.65	\$7.10	\$12.60	0.00	\$51.35

This wage schedule must be posted by the contractor at the work site in accordance with M.G.L. ch. 149, sec. 27. Failure of the employer to pay "prevailing wage rates," which are the "total rates" listed above, on public works projects is a violation of M.G.L. ch. 149, sec. 27. Contractors with questions about the wage rates or classifications included on the wage schedule have an affirmative obligation to inquire with DLS at www.mass.gov/dols or at 617-626-6952. Employees not receiving such rates should report the violation to the Fair Labor Division of the Office of the Attorney General, 100 Cambridge Street, Boston, MA 02108; Tel:



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

JOANNE F. GOLDSTEIN
Secretary

HEATHER E. ROWE
Director

DEVAL L. PATRICK
Governor

TIMOTHY P. MURRAY
Lt. Governor

Awarding Authority: City of Cambridge Purchasing Department
Contract Number: 5816 **City/Town:** CAMBRIDGE
Description of Work: Infrastructure Improvements - Includes, but is not limited to the construction of sewers & drains ranging in size from 10inch to 48inch in diameter;
Job Location: Western Avenue

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
CARBIDE CORE DRILL OPERATOR <i>LABORERS - ZONE 1</i>	12/01/2011	\$32.05	\$7.10	\$12.45	0.00	\$51.60
CARPENTER <i>CARPENTERS -ZONE 1 (Metro Boston)</i>	03/01/2012	\$38.22	\$9.80	\$15.61	0.00	\$63.63

Apprentice - CARPENTER - Zone 1 Metro Boston

Effective Date - 03/01/2012

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$19.11	\$9.80	1.57	\$0.00	\$30.48
2	60	\$22.93	\$9.80	1.57	\$0.00	\$34.30
3	70	\$26.75	\$9.80	10.90	\$0.00	\$47.45
4	75	\$28.67	\$9.80	10.90	\$0.00	\$49.37
5	80	\$30.58	\$9.80	12.47	\$0.00	\$52.85
6	80	\$30.58	\$9.80	12.47	\$0.00	\$52.85
7	90	\$34.40	\$9.80	14.04	\$0.00	\$58.24
8	90	\$34.40	\$9.80	14.04	\$0.00	\$58.24

Notes:

Apprentice to Journeyworker Ratio:1:5

CEMENT MASONRY/PLASTERING <i>BRICKLAYERS LOCAL 3 (BOSTON)</i>	02/01/2012	\$45.10	\$9.93	\$16.51	0.00	\$71.54
CHAIN SAW OPERATOR <i>LABORERS - ZONE 1</i>	12/01/2011	\$32.05	\$7.10	\$12.45	0.00	\$51.60

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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

JOANNE F. GOLDSTEIN
Secretary

HEATHER E. ROWE
Director

DEVAL L. PATRICK
Governor

TIMOTHY P. MURRAY
Lt. Governor

Awarding Authority: City of Cambridge Purchasing Department

Contract Number: 5816

City/Town: CAMBRIDGE

Description of Work: Infrastructure Improvements - Includes, but is not limited to the construction of sewers & drains ranging in size from 10inch to 48inch in diameter;

Job Location: Western Avenue

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
CLAM SHELLS/SLURRY BUCKETS/HEADING MACHINES <i>OPERATING ENGINEERS LOCAL 4</i>	12/01/2011	\$40.52	\$10.00	\$12.40	0.00	\$62.92
	06/01/2012	\$41.09	\$10.00	\$12.40	0.00	\$63.49
	12/01/2012	\$41.71	\$10.00	\$12.40	0.00	\$64.11
	06/01/2013	\$42.49	\$10.00	\$12.40	0.00	\$64.89
	12/01/2013	\$43.27	\$10.00	\$12.40	0.00	\$65.67
COMPRESSOR OPERATOR <i>OPERATING ENGINEERS LOCAL 4</i>	12/01/2011	\$27.95	\$10.00	\$12.40	0.00	\$50.35
	06/01/2012	\$28.34	\$10.00	\$12.40	0.00	\$50.74
	12/01/2012	\$28.79	\$10.00	\$12.40	0.00	\$51.19
	06/01/2013	\$29.34	\$10.00	\$12.40	0.00	\$51.74
	12/01/2013	\$29.89	\$10.00	\$12.40	0.00	\$52.29
DELEADER (BRIDGE) <i>PAINTERS LOCAL 35 - ZONE 1</i>	01/01/2012	\$44.01	\$7.80	\$14.60	0.00	\$66.41
	07/01/2012	\$44.51	\$7.80	\$15.10	0.00	\$67.41
	01/01/2013	\$45.01	\$7.80	\$15.60	0.00	\$68.41

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TIMOTHY P. MURRAY
Lt. Governor

Awarding Authority: City of Cambridge Purchasing Department
Contract Number: 5816 **City/Town:** CAMBRIDGE
Description of Work: Infrastructure Improvements - Includes, but is not limited to the construction of sewers & drains ranging in size from 10inch to 48inch in diameter;
Job Location: Western Avenue

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
Apprentice - PAINTER Local 35 - BRIDGES/TANKS						
Effective Date - 01/01/2012						
Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$22.01	\$7.80	0.00	\$0.00	\$29.81
2	55	\$24.21	\$7.80	3.25	\$0.00	\$35.26
3	60	\$26.41	\$7.80	3.54	\$0.00	\$37.75
4	65	\$28.61	\$7.80	3.84	\$0.00	\$40.25
5	70	\$30.81	\$7.80	12.83	\$0.00	\$51.44
6	75	\$33.01	\$7.80	13.13	\$0.00	\$53.94
7	80	\$35.21	\$7.80	13.42	\$0.00	\$56.43
8	90	\$39.61	\$7.80	14.01	\$0.00	\$61.42
Effective Date - 07/01/2012						
Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$22.26	\$7.80	0.00	\$0.00	\$30.06
2	55	\$24.48	\$7.80	3.38	\$0.00	\$35.66
3	60	\$26.71	\$7.80	3.69	\$0.00	\$38.20
4	65	\$28.93	\$7.80	4.00	\$0.00	\$40.73
5	70	\$31.16	\$7.80	13.26	\$0.00	\$52.22
6	75	\$33.38	\$7.80	13.56	\$0.00	\$54.74
7	80	\$35.61	\$7.80	13.87	\$0.00	\$57.28
8	90	\$40.06	\$7.80	14.49	\$0.00	\$62.35

Notes:
Steps are 750 hrs.

Apprentice to Journeyworker Ratio:1:1

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 DEPARTMENT OF LABOR STANDARDS

Prevailing Wage Rates

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 Massachusetts General Laws, Chapter 149, Sections 26 to 27H

JOANNE F. GOLDSTEIN
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HEATHER E. ROWE
 Director

DEVAL L. PATRICK
 Governor

TIMOTHY P. MURRAY
 Lt. Governor

Awarding Authority: City of Cambridge Purchasing Department
Contract Number: 5816 **City/Town:** CAMBRIDGE
Description of Work: Infrastructure Improvements - Includes, but is not limited to the construction of sewers & drains ranging in size from 10inch to 48inch in diameter;
Job Location: Western Avenue

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
DEMO: ADZEMAN LABORERS - ZONE 1	12/01/2011	\$31.80	\$7.10	\$12.45	0.00	\$51.35

Apprentice - LABORER Demo (Group 1)

Effective Date - 12/01/2011

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	60	\$19.08	\$7.10	12.45	\$0.00	\$38.63
2	70	\$22.26	\$7.10	12.45	\$0.00	\$41.81
3	80	\$25.44	\$7.10	12.45	\$0.00	\$44.99
4	90	\$28.62	\$7.10	12.45	\$0.00	\$48.17

Notes:

Apprentice to Journeyworker Ratio:1:5

DEMO: BACKHOE/LOADER/HAMMER OPERATOR LABORERS - ZONE 1	12/01/2011	\$32.80	\$7.10	\$12.45	0.00	\$52.35
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DEVAL L. PATRICK
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TIMOTHY P. MURRAY
Lt. Governor

Awarding Authority: City of Cambridge Purchasing Department
Contract Number: 5816 **City/Town:** CAMBRIDGE
Description of Work: Infrastructure Improvements - Includes, but is not limited to the construction of sewers & drains ranging in size from 10inch to 48inch in diameter;
Job Location: Western Avenue

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
Apprentice - LABORER Demo (Group 3)						
Effective Date - 12/01/2011						
Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	60	\$19.68	\$7.10	12.45	\$0.00	\$39.23
2	70	\$22.96	\$7.10	12.45	\$0.00	\$42.51
3	80	\$26.24	\$7.10	12.45	\$0.00	\$45.79
4	90	\$29.52	\$7.10	12.45	\$0.00	\$49.07
Notes:						
Apprentice to Journeyworker Ratio:1:5						
DEMO: BURNERS	12/01/2011	\$32.55	\$7.10	\$12.45	0.00	\$52.10
LABORERS - ZONE 1						

Apprentice - LABORER Demo (Group 2)

Effective Date - 12/01/2011

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	60	\$19.53	\$7.10	12.45	\$0.00	\$39.08
2	70	\$22.79	\$7.10	12.45	\$0.00	\$42.34
3	80	\$26.04	\$7.10	12.45	\$0.00	\$45.59
4	90	\$29.30	\$7.10	12.45	\$0.00	\$48.85

Notes:

Apprentice to Journeyworker Ratio:1:5

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Awarding Authority: City of Cambridge Purchasing Department
Contract Number: 5816 **City/Town:** CAMBRIDGE
Description of Work: Infrastructure Improvements - Includes, but is not limited to the construction of sewers & drains ranging in size from 10inch to 48inch in diameter;
Job Location: Western Avenue

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
DEMO: CONCRETE CUTTER/SAWYER LABORERS - ZONE 1	12/01/2011	\$32.80	\$7.10	\$12.45	0.00	\$52.35

Apprentice - LABORER Demo (Group 3)

Effective Date - 12/01/2011

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	60	\$19.68	\$7.10	12.45	\$0.00	\$39.23
2	70	\$22.96	\$7.10	12.45	\$0.00	\$42.51
3	80	\$26.24	\$7.10	12.45	\$0.00	\$45.79
4	90	\$29.52	\$7.10	12.45	\$0.00	\$49.07

Notes:

Apprentice to Journeyworker Ratio:1:5

DEMO: JACKHAMMER OPERATOR LABORERS - ZONE 1	12/01/2011	\$32.55	\$7.10	\$12.45	0.00	\$52.10
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Awarding Authority: City of Cambridge Purchasing Department
Contract Number: 5816 **City/Town:** CAMBRIDGE
Description of Work: Infrastructure Improvements - Includes, but is not limited to the construction of sewers & drains ranging in size from 10inch to 48inch in diameter;
Job Location: Western Avenue

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
Apprentice - LABORER Demo (Group 2)						
Effective Date - 12/01/2011						
Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	60	\$19.53	\$7.10	12.45	\$0.00	\$39.08
2	70	\$22.79	\$7.10	12.45	\$0.00	\$42.34
3	80	\$26.04	\$7.10	12.45	\$0.00	\$45.59
4	90	\$29.30	\$7.10	12.45	\$0.00	\$48.85
Notes:						
Apprentice to Journeyworker Ratio:1:5						
DEMO: WRECKING LABORER LABORERS - ZONE I	12/01/2011	\$31.80	\$7.10	\$12.45	0.00	\$51.35

Apprentice - LABORER Demo (Group 1)

Effective Date - 12/01/2011

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	60	\$19.08	\$7.10	12.45	\$0.00	\$38.63
2	70	\$22.26	\$7.10	12.45	\$0.00	\$41.81
3	80	\$25.44	\$7.10	12.45	\$0.00	\$44.99
4	90	\$28.62	\$7.10	12.45	\$0.00	\$48.17

Notes:

Apprentice to Journeyworker Ratio:1:5

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Contract Number: 5816 **City/Town:** CAMBRIDGE
Description of Work: Infrastructure Improvements - Includes, but is not limited to the construction of sewers & drains ranging in size from 10inch to 48inch in diameter;
Job Location: Western Avenue

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
DIRECTIONAL DRILL MACHINE OPERATOR <i>OPERATING ENGINEERS LOCAL 4</i>	12/01/2011	\$39.16	\$10.00	\$12.40	0.00	\$61.56
	06/01/2012	\$39.72	\$10.00	\$12.40	0.00	\$62.12
	12/01/2012	\$40.34	\$10.00	\$12.40	0.00	\$62.74
	06/01/2013	\$41.11	\$10.00	\$12.40	0.00	\$63.51
	12/01/2013	\$41.89	\$10.00	\$12.40	0.00	\$64.29
DIVER <i>PILE DRIVER LOCAL 56 (ZONE 1)</i>	08/01/2011	\$53.62	\$9.80	\$17.12	0.00	\$80.54
DIVER TENDER <i>PILE DRIVER LOCAL 56 (ZONE 1)</i>	08/01/2011	\$38.30	\$9.80	\$17.12	0.00	\$65.22
DIVER TENDER (EFFLUENT) <i>PILE DRIVER LOCAL 56 (ZONE 1)</i>	08/01/2011	\$57.45	\$9.80	\$17.12	0.00	\$84.37
DIVER/SLURRY (EFFLUENT) <i>PILE DRIVER LOCAL 56 (ZONE 1)</i>	08/01/2011	\$80.43	\$9.80	\$17.12	0.00	\$107.35
ELECTRICIAN <i>ELECTRICIANS LOCAL 103</i>	03/01/2012	\$42.37	\$13.00	\$13.87	0.00	\$69.24
	09/01/2012	\$43.05	\$13.00	\$13.89	0.00	\$69.94
	03/01/2013	\$43.77	\$13.00	\$13.91	0.00	\$70.68
	09/01/2013	\$44.45	\$13.00	\$13.93	0.00	\$71.38
	03/01/2014	\$45.17	\$13.00	\$13.95	0.00	\$72.12
	09/01/2014	\$45.84	\$13.00	\$13.97	0.00	\$72.81
	03/01/2015	\$46.55	\$13.00	\$14.00	0.00	\$73.55
	09/01/2015	\$47.51	\$13.00	\$14.03	0.00	\$74.54
	03/01/2016	\$48.47	\$13.00	\$14.05	0.00	\$75.52

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Awarding Authority: City of Cambridge Purchasing Department
Contract Number: 5816 **City/Town:** CAMBRIDGE
Description of Work: Infrastructure Improvements - Includes, but is not limited to the construction of sewers & drains ranging in size from 10inch to 48inch in diameter;
Job Location: Western Avenue

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
Apprentice - ELECTRICIAN - Local 103						
Effective Date - 03/01/2012						
Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	40	\$16.95	\$13.00	7.81	\$0.00	\$37.76
2	40	\$16.95	\$13.00	7.81	\$0.00	\$37.76
3	45	\$19.07	\$13.00	10.26	\$0.00	\$42.33
4	45	\$19.07	\$13.00	10.26	\$0.00	\$42.33
5	50	\$21.19	\$13.00	10.59	\$0.00	\$44.78
6	55	\$23.30	\$13.00	10.92	\$0.00	\$47.22
7	60	\$25.42	\$13.00	11.24	\$0.00	\$49.66
8	65	\$27.54	\$13.00	11.58	\$0.00	\$52.12
9	70	\$29.66	\$13.00	11.90	\$0.00	\$54.56
10	75	\$31.78	\$13.00	12.23	\$0.00	\$57.01
Effective Date - 09/01/2012						
Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	40	\$17.22	\$13.00	7.82	\$0.00	\$38.04
2	40	\$17.22	\$13.00	7.82	\$0.00	\$38.04
3	45	\$19.37	\$13.00	10.27	\$0.00	\$42.64
4	45	\$19.37	\$13.00	10.27	\$0.00	\$42.64
5	50	\$21.53	\$13.00	10.60	\$0.00	\$45.13
6	55	\$23.68	\$13.00	10.93	\$0.00	\$47.61
7	60	\$25.83	\$13.00	11.25	\$0.00	\$50.08
8	65	\$27.98	\$13.00	11.59	\$0.00	\$52.57
9	70	\$30.14	\$13.00	11.91	\$0.00	\$55.05
10	75	\$32.29	\$13.00	12.25	\$0.00	\$57.54

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Awarding Authority: City of Cambridge Purchasing Department
Contract Number: 5816 **City/Town:** CAMBRIDGE
Description of Work: Infrastructure Improvements - Includes, but is not limited to the construction of sewers & drains ranging in size from 10inch to 48inch in diameter;
Job Location: Western Avenue

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
Notes: : App Prior 1/1/03; 30/35/40/45/50/55/65/70/75/80 Apprentice to Journeyworker Ratio:2:3***						
ELEVATOR CONSTRUCTOR <i>ELEVATOR CONSTRUCTORS LOCAL 4</i>	01/01/2012	\$52.45	\$8.78	\$6.96	0.00	\$68.19

Apprentice - ELEVATOR CONSTRUCTOR - Local 4

Effective Date - 01/01/2012

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$26.23	\$8.78	0.00	\$0.00	\$35.01
2	55	\$28.85	\$8.78	6.96	\$0.00	\$44.59
3	65	\$34.09	\$8.78	6.96	\$0.00	\$49.83
4	70	\$36.72	\$8.78	6.96	\$0.00	\$52.46
5	80	\$41.96	\$8.78	6.96	\$0.00	\$57.70

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

Apprentice to Journeyworker Ratio:1:1

ELEVATOR CONSTRUCTOR HELPER <i>ELEVATOR CONSTRUCTORS LOCAL 4</i>	01/01/2012	\$38.59	\$8.78	\$6.96	0.00	\$54.33
FENCE & GUARD RAIL ERECTOR <i>LABORERS - ZONE 1</i>	12/01/2011	\$32.05	\$7.10	\$12.45	0.00	\$51.60
FIELD ENG.INST.PERSON-BLDG,SITE,HVY/HWY <i>OPERATING ENGINEERS LOCAL 4</i>	05/01/2012	\$37.90	\$10.00	\$12.40	0.00	\$60.30
	11/01/2012	\$38.51	\$10.00	\$12.40	0.00	\$60.91
	05/01/2013	\$39.12	\$10.00	\$12.40	0.00	\$61.52
	11/01/2013	\$39.88	\$10.00	\$12.40	0.00	\$62.28
	05/01/2014	\$40.65	\$10.00	\$12.40	0.00	\$63.05

This wage schedule must be posted by the contractor at the work site in accordance with M.G.L. ch. 149, sec. 27. Failure of the employer to pay "prevailing wage rates," which are the "total rates" listed above, on public works projects is a violation of M.G.L. ch. 149, sec. 27. Contractors with questions about the wage rates or classifications included on the wage schedule have an affirmative obligation to inquire with DLS at www.mass.gov/dols or at 617-626-6952. Employees not receiving such rates should report the violation to the Fair Labor Division of the Office of the Attorney General, 100 Cambridge Street, Boston, MA 02108; Tel:



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

JOANNE F. GOLDSTEIN
Secretary

HEATHER E. ROWE
Director

DEVAL L. PATRICK
Governor

TIMOTHY P. MURRAY
Lt. Governor

Awarding Authority: City of Cambridge Purchasing Department

Contract Number: 5816

City/Town: CAMBRIDGE

Description of Work: Infrastructure Improvements - Includes, but is not limited to the construction of sewers & drains ranging in size from 10inch to 48inch in diameter;

Job Location: Western Avenue

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
FIELD ENG.PARTY CHIEF-BLDG,SITE,HVY/HWY <i>OPERATING ENGINEERS LOCAL 4</i>	05/01/2012	\$39.29	\$10.00	\$12.40	0.00	\$61.69
	11/01/2012	\$39.91	\$10.00	\$12.40	0.00	\$62.31
	05/01/2013	\$40.53	\$10.00	\$12.40	0.00	\$62.93
	11/01/2013	\$41.30	\$10.00	\$12.40	0.00	\$63.70
	05/01/2014	\$42.07	\$10.00	\$12.40	0.00	\$64.47
FIELD ENG.ROD PERSON-BLDG,SITE,HVY/HWY <i>OPERATING ENGINEERS LOCAL 4</i>	05/01/2012	\$21.07	\$10.00	\$12.40	0.00	\$43.47
	11/01/2012	\$21.43	\$10.00	\$12.40	0.00	\$43.83
	05/01/2013	\$21.79	\$10.00	\$12.40	0.00	\$44.19
	11/01/2013	\$22.25	\$10.00	\$12.40	0.00	\$44.65
	05/01/2014	\$22.70	\$10.00	\$12.40	0.00	\$45.10
FIRE ALARM INSTALLER <i>ELECTRICIANS LOCAL 103</i>	03/01/2012	\$42.37	\$13.00	\$13.87	0.00	\$69.24
	09/01/2012	\$43.05	\$13.00	\$13.89	0.00	\$69.94
	03/01/2013	\$43.77	\$13.00	\$13.91	0.00	\$70.68
	09/01/2013	\$44.45	\$13.00	\$13.93	0.00	\$71.38
	03/01/2014	\$45.17	\$13.00	\$13.95	0.00	\$72.12
	09/01/2014	\$45.84	\$13.00	\$13.97	0.00	\$72.81
	03/01/2015	\$46.55	\$13.00	\$14.00	0.00	\$73.55
	09/01/2015	\$47.51	\$13.00	\$14.03	0.00	\$74.54
FIRE ALARM REPAIR / MAINTENANCE <i>LOCAL 103</i> / COMMISSIONING <i>ELECTRICIANS</i>	03/01/2012	\$31.78	\$13.00	\$12.23	0.00	\$57.01
	09/01/2012	\$32.29	\$13.00	\$12.25	0.00	\$57.54
	03/01/2013	\$32.83	\$13.00	\$12.26	0.00	\$58.09
	09/01/2013	\$33.34	\$13.00	\$12.28	0.00	\$58.62
	03/01/2014	\$33.88	\$13.00	\$12.30	0.00	\$59.18
	09/01/2014	\$34.38	\$13.00	\$12.31	0.00	\$59.69
	03/01/2015	\$34.91	\$13.00	\$12.33	0.00	\$60.24
	09/01/2015	\$35.63	\$13.00	\$12.35	0.00	\$60.98
	03/01/2016	\$36.35	\$13.00	\$12.37	0.00	\$61.72

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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

JOANNE F. GOLDSTEIN
Secretary

HEATHER E. ROWE
Director

DEVAL L. PATRICK
Governor

TIMOTHY P. MURRAY
Lt. Governor

Awarding Authority: City of Cambridge Purchasing Department
Contract Number: 5816 **City/Town:** CAMBRIDGE
Description of Work: Infrastructure Improvements - Includes, but is not limited to the construction of sewers & drains ranging in size from 10inch to 48inch in diameter;
Job Location: Western Avenue

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
FIREMAN (ASST. ENGINEER) <i>OPERATING ENGINEERS LOCAL 4</i>	12/01/2011	\$33.23	\$10.00	\$12.40	0.00	\$55.63
	06/01/2012	\$33.70	\$10.00	\$12.40	0.00	\$56.10
	12/01/2012	\$34.23	\$10.00	\$12.40	0.00	\$56.63
	06/01/2013	\$34.88	\$10.00	\$12.40	0.00	\$57.28
	12/01/2013	\$35.54	\$10.00	\$12.40	0.00	\$57.94
FLAGGER & SIGNALER <i>LABORERS - ZONE 1</i>	12/01/2011	\$20.50	\$7.10	\$12.45	0.00	\$40.05
FLOORCOVERER <i>FLOORCOVERERS LOCAL 2168 ZONE 1</i>	03/01/2012	\$37.20	\$9.80	\$16.61	0.00	\$63.61

Apprentice - FLOORCOVERER - Local 2168 Zone 1

Effective Date - 03/01/2012

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$18.60	\$9.80	1.79	\$0.00	\$30.19
2	55	\$20.46	\$9.80	1.79	\$0.00	\$32.05
3	60	\$22.32	\$9.80	11.24	\$0.00	\$43.36
4	65	\$24.18	\$9.80	11.24	\$0.00	\$45.22
5	70	\$26.04	\$9.80	13.03	\$0.00	\$48.87
6	75	\$27.90	\$9.80	13.03	\$0.00	\$50.73
7	80	\$29.76	\$9.80	14.82	\$0.00	\$54.38
8	85	\$31.62	\$9.80	14.82	\$0.00	\$56.24

Notes:

Steps are 750 hrs.

Apprentice to Journeyworker Ratio:1:1

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DEVAL L. PATRICK
Governor

TIMOTHY P. MURRAY
Lt. Governor

Awarding Authority: City of Cambridge Purchasing Department
Contract Number: 5816 **City/Town:** CAMBRIDGE
Description of Work: Infrastructure Improvements - Includes, but is not limited to the construction of sewers & drains ranging in size from 10inch to 48inch in diameter;
Job Location: Western Avenue

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
FORK LIFT/CHERRY PICKER <i>OPERATING ENGINEERS LOCAL 4</i>	12/01/2011	\$39.52	\$10.00	\$12.40	0.00	\$61.92
	06/01/2012	\$40.09	\$10.00	\$12.40	0.00	\$62.49
	12/01/2012	\$40.71	\$10.00	\$12.40	0.00	\$63.11
	06/01/2013	\$41.49	\$10.00	\$12.40	0.00	\$63.89
	12/01/2013	\$42.27	\$10.00	\$12.40	0.00	\$64.67
GENERATOR/LIGHTING PLANT/HEATERS <i>OPERATING ENGINEERS LOCAL 4</i>	12/01/2011	\$27.95	\$10.00	\$12.40	0.00	\$50.35
	06/01/2012	\$28.34	\$10.00	\$12.40	0.00	\$50.74
	12/01/2012	\$28.79	\$10.00	\$12.40	0.00	\$51.19
	06/01/2013	\$29.34	\$10.00	\$12.40	0.00	\$51.74
	12/01/2013	\$29.89	\$10.00	\$12.40	0.00	\$52.29
GLAZIER (GLASS PLANK/AIR BARRIER/INTERIOR SYSTEMS) <i>GLAZIERS LOCAL 35 (ZONE 1)</i>	01/01/2012	\$39.30	\$7.80	\$14.60	0.00	\$61.70
	07/01/2012	\$40.30	\$7.80	\$14.60	0.00	\$62.70
	01/01/2013	\$41.40	\$7.80	\$14.60	0.00	\$63.80

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Lt. Governor

Awarding Authority: City of Cambridge Purchasing Department
Contract Number: 5816 **City/Town:** CAMBRIDGE
Description of Work: Infrastructure Improvements - Includes, but is not limited to the construction of sewers & drains ranging in size from 10inch to 48inch in diameter;
Job Location: Western Avenue

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
Apprentice - GLAZIER - Local 35 Zone 1						
Effective Date - 01/01/2012						
Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$19.65	\$7.80	0.00	\$0.00	\$27.45
2	55	\$21.62	\$7.80	3.25	\$0.00	\$32.67
3	60	\$23.58	\$7.80	3.54	\$0.00	\$34.92
4	65	\$25.55	\$7.80	3.84	\$0.00	\$37.19
5	70	\$27.51	\$7.80	12.83	\$0.00	\$48.14
6	75	\$29.48	\$7.80	13.13	\$0.00	\$50.41
7	80	\$31.44	\$7.80	13.42	\$0.00	\$52.66
8	90	\$35.37	\$7.80	14.01	\$0.00	\$57.18
Effective Date - 07/01/2012						
Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$20.15	\$7.80	0.00	\$0.00	\$27.95
2	55	\$22.17	\$7.80	3.25	\$0.00	\$33.22
3	60	\$24.18	\$7.80	3.54	\$0.00	\$35.52
4	65	\$26.20	\$7.80	3.84	\$0.00	\$37.84
5	70	\$28.21	\$7.80	12.83	\$0.00	\$48.84
6	75	\$30.23	\$7.80	13.13	\$0.00	\$51.16
7	80	\$32.24	\$7.80	13.42	\$0.00	\$53.46
8	90	\$36.27	\$7.80	14.01	\$0.00	\$58.08

Notes:
Steps are 750 hrs.

Apprentice to Journeyworker Ratio:1:1

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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

JOANNE F. GOLDSTEIN
Secretary

HEATHER E. ROWE
Director

Awarding Authority: City of Cambridge Purchasing Department

Contract Number: 5816

City/Town: CAMBRIDGE

Description of Work: Infrastructure Improvements - Includes, but is not limited to the construction of sewers & drains ranging in size from 10inch to 48inch in diameter;

Job Location: Western Avenue

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
HOISTING ENGINEER/CRANES/GRADALLS <i>OPERATING ENGINEERS LOCAL 4</i>	12/01/2011	\$39.52	\$10.00	\$12.40	0.00	\$61.92
	06/01/2012	\$40.09	\$10.00	\$12.40	0.00	\$62.49
	12/01/2012	\$40.71	\$10.00	\$12.40	0.00	\$63.11
	06/01/2013	\$41.49	\$10.00	\$12.40	0.00	\$63.89
	12/01/2013	\$42.27	\$10.00	\$12.40	0.00	\$64.67

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Awarding Authority: City of Cambridge Purchasing Department
Contract Number: 5816 **City/Town:** CAMBRIDGE
Description of Work: Infrastructure Improvements - Includes, but is not limited to the construction of sewers & drains ranging in size from 10inch to 48inch in diameter;
Job Location: Western Avenue

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
Apprentice - HOIST/PORT. ENG.- Local 4						
Effective Date - 12/01/2011						
Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	55	\$21.74	\$10.00	0.00	\$0.00	\$31.74
2	60	\$23.71	\$10.00	12.40	\$0.00	\$46.11
3	65	\$25.69	\$10.00	12.40	\$0.00	\$48.09
4	70	\$27.66	\$10.00	12.40	\$0.00	\$50.06
5	75	\$29.64	\$10.00	12.40	\$0.00	\$52.04
6	80	\$31.62	\$10.00	12.40	\$0.00	\$54.02
7	85	\$33.59	\$10.00	12.40	\$0.00	\$55.99
8	90	\$35.57	\$10.00	12.40	\$0.00	\$57.97
Effective Date - 06/01/2012						
Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	55	\$22.05	\$10.00	0.00	\$0.00	\$32.05
2	60	\$24.05	\$10.00	12.40	\$0.00	\$46.45
3	65	\$26.06	\$10.00	12.40	\$0.00	\$48.46
4	70	\$28.06	\$10.00	12.40	\$0.00	\$50.46
5	75	\$30.07	\$10.00	12.40	\$0.00	\$52.47
6	80	\$32.07	\$10.00	12.40	\$0.00	\$54.47
7	85	\$34.08	\$10.00	12.40	\$0.00	\$56.48
8	90	\$36.08	\$10.00	12.40	\$0.00	\$58.48

Notes:

Apprentice to Journeyworker Ratio:1:6

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TIMOTHY P. MURRAY
Lt. Governor

Awarding Authority: City of Cambridge Purchasing Department

Contract Number: 5816

City/Town: CAMBRIDGE

Description of Work: Infrastructure Improvements - Includes, but is not limited to the construction of sewers & drains ranging in size from 10inch to 48inch in diameter;

Job Location: Western Avenue

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
HVAC (DUCTWORK) <i>SHEETMETAL WORKERS LOCAL 17 - A</i>	02/01/2012	\$40.79	\$9.82	\$17.34	2.04	\$69.99
	08/01/2012	\$42.04	\$9.82	\$17.34	2.08	\$71.28
	02/01/2013	\$43.29	\$9.82	\$17.34	2.11	\$72.56
HVAC (ELECTRICAL CONTROLS) <i>ELECTRICIANS LOCAL 103</i>	03/01/2012	\$42.37	\$13.00	\$13.87	0.00	\$69.24
	09/01/2012	\$43.05	\$13.00	\$13.89	0.00	\$69.94
	03/01/2013	\$43.77	\$13.00	\$13.91	0.00	\$70.68
	09/01/2013	\$44.45	\$13.00	\$13.93	0.00	\$71.38
	03/01/2014	\$45.17	\$13.00	\$13.95	0.00	\$72.12
	09/01/2014	\$45.84	\$13.00	\$13.97	0.00	\$72.81
	03/01/2015	\$46.55	\$13.00	\$14.00	0.00	\$73.55
	09/01/2015	\$47.51	\$13.00	\$14.03	0.00	\$74.54
	03/01/2016	\$48.47	\$13.00	\$14.05	0.00	\$75.52
HVAC (TESTING AND BALANCING - AIR) <i>SHEETMETAL WORKERS LOCAL 17 - A</i>	02/01/2012	\$40.79	\$9.82	\$17.34	2.04	\$69.99
	08/01/2012	\$42.04	\$9.82	\$17.34	2.08	\$71.28
	02/01/2013	\$43.29	\$9.82	\$17.34	2.11	\$72.56
HVAC (TESTING AND BALANCING - WATER) <i>PIPEFITTERS LOCAL 537</i>	03/01/2012	\$46.84	\$8.75	\$14.39	0.00	\$69.98
	09/01/2012	\$48.09	\$8.75	\$14.39	0.00	\$71.23
	03/01/2013	\$49.34	\$8.75	\$14.39	0.00	\$72.48
HVAC MECHANIC <i>PIPEFITTERS LOCAL 537</i>	03/01/2012	\$46.84	\$8.75	\$14.39	0.00	\$69.98
	09/01/2012	\$48.09	\$8.75	\$14.39	0.00	\$71.23
	03/01/2013	\$49.34	\$8.75	\$14.39	0.00	\$72.48
HYDRAULIC DRILLS <i>LABORERS - ZONE 1</i>	12/01/2011	\$32.55	\$7.10	\$12.45	0.00	\$52.10
INSULATOR (PIPES & TANKS) <i>ASBESTOS WORKERS LOCAL 6 (BOSTON)</i>	09/01/2011	\$40.66	\$10.40	\$11.20	0.00	\$62.26
	09/01/2012	\$42.06	\$10.40	\$11.20	0.00	\$63.66
	09/01/2013	\$43.66	\$10.40	\$11.20	0.00	\$65.26
	09/01/2014	\$45.66	\$10.40	\$11.20	0.00	\$67.26

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Awarding Authority: City of Cambridge Purchasing Department
Contract Number: 5816 **City/Town:** CAMBRIDGE
Description of Work: Infrastructure Improvements - Includes, but is not limited to the construction of sewers & drains ranging in size from 10inch to 48inch in diameter;
Job Location: Western Avenue

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
Apprentice - ASBESTOS INSULATOR (Pipes & Tanks) - Local 6 Boston						
Effective Date - 09/01/2011						
Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$20.33	\$10.40	8.30	\$0.00	\$39.03
2	60	\$24.40	\$10.40	8.88	\$0.00	\$43.68
3	70	\$28.46	\$10.40	9.46	\$0.00	\$48.32
4	80	\$32.53	\$10.40	10.04	\$0.00	\$52.97
Effective Date - 09/01/2012						
Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$21.03	\$10.40	8.30	\$0.00	\$39.73
2	60	\$25.24	\$10.40	8.88	\$0.00	\$44.52
3	70	\$29.44	\$10.40	9.46	\$0.00	\$49.30
4	80	\$33.65	\$10.40	10.04	\$0.00	\$54.09
Notes: Steps are 1 year						
Apprentice to Journeyworker Ratio:1:4						

IRONWORKER/WELDER	04/02/2012	\$37.99	\$7.70	\$18.35	0.00	\$64.04
IRONWORKERS LOCAL 7	09/16/2012	\$38.99	\$7.70	\$18.35	0.00	\$65.04
	03/16/2013	\$40.24	\$7.70	\$18.35	0.00	\$66.29

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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

JOANNE F. GOLDSTEIN
Secretary

HEATHER E. ROWE
Director

DEVAL L. PATRICK
Governor

TIMOTHY P. MURRAY
Lt. Governor

Awarding Authority: City of Cambridge Purchasing Department
Contract Number: 5816 **City/Town:** CAMBRIDGE
Description of Work: Infrastructure Improvements - Includes, but is not limited to the construction of sewers & drains ranging in size from 10inch to 48inch in diameter;
Job Location: Western Avenue

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
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Apprentice - IRONWORKER - Local 7 Boston

Effective Date - 04/02/2012

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	60	\$22.79	\$7.70	18.35	\$0.00	\$48.84
2	70	\$26.59	\$7.70	18.35	\$0.00	\$52.64
3	75	\$28.49	\$7.70	18.35	\$0.00	\$54.54
4	80	\$30.39	\$7.70	18.35	\$0.00	\$56.44
5	85	\$32.29	\$7.70	18.35	\$0.00	\$58.34
6	90	\$34.19	\$7.70	18.35	\$0.00	\$60.24

Effective Date - 09/16/2012

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	60	\$23.39	\$7.70	18.35	\$0.00	\$49.44
2	70	\$27.29	\$7.70	18.35	\$0.00	\$53.34
3	75	\$29.24	\$7.70	18.35	\$0.00	\$55.29
4	80	\$31.19	\$7.70	18.35	\$0.00	\$57.24
5	85	\$33.14	\$7.70	18.35	\$0.00	\$59.19
6	90	\$35.09	\$7.70	18.35	\$0.00	\$61.14

Notes:

** Structural 1:6; Ornamental 1:4

Apprentice to Journeyworker Ratio:**

JACKHAMMER & PAVING BREAKER OPERATOR LABORERS - ZONE 1	12/01/2011	\$32.05	\$7.10	\$12.45	0.00	\$51.60
LABORER LABORERS - ZONE 1	12/01/2011	\$31.80	\$7.10	\$12.45	0.00	\$51.35

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Massachusetts General Laws, Chapter 149, Sections 26 to 27H

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DEVAL L. PATRICK
Governor
TIMOTHY P. MURRAY
Lt. Governor

Awarding Authority: City of Cambridge Purchasing Department
Contract Number: 5816 **City/Town:** CAMBRIDGE
Description of Work: Infrastructure Improvements - Includes, but is not limited to the construction of sewers & drains ranging in size from 10inch to 48inch in diameter;
Job Location: Western Avenue

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
Apprentice - LABORER - Zone 1						
Effective Date - 12/01/2011						
Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	60	\$19.08	\$7.10	12.45	\$0.00	\$38.63
2	70	\$22.26	\$7.10	12.45	\$0.00	\$41.81
3	80	\$25.44	\$7.10	12.45	\$0.00	\$44.99
4	90	\$28.62	\$7.10	12.45	\$0.00	\$48.17

Notes:

Apprentice to Journeyworker Ratio:1:5

LABORER: CARPENTER TENDER LABORERS - ZONE 1	12/01/2011	\$31.80	\$7.10	\$12.45	0.00	\$51.35
LABORER: CEMENT FINISHER TENDER LABORERS - ZONE 1	12/01/2011	\$31.80	\$7.10	\$12.45	0.00	\$51.35
LABORER: HAZARDOUS WASTE/ASBESTOS REMOVER LABORERS - ZONE 1	12/01/2011	\$31.80	\$7.10	\$12.45	0.00	\$51.35
LABORER: MASON TENDER LABORERS - ZONE 1	12/01/2011	\$32.05	\$7.10	\$12.45	0.00	\$51.60
LABORER: MULTI-TRADE TENDER LABORERS - ZONE 1	12/01/2011	\$31.80	\$7.10	\$12.45	0.00	\$51.35
LABORER: TREE REMOVER LABORERS - ZONE 1	12/01/2011	\$31.80	\$7.10	\$12.45	0.00	\$51.35
This classification applies to the wholesale removal of standing trees including all associated trimming of branches and limbs, and applies to the removal of branches at locations not on or around utility lines.						
LASER BEAM OPERATOR LABORERS - ZONE 1	12/01/2011	\$32.05	\$7.10	\$12.45	0.00	\$51.60

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Prevailing Wage Rates

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TIMOTHY P. MURRAY
Lt. Governor

Awarding Authority: City of Cambridge Purchasing Department
Contract Number: 5816 **City/Town:** CAMBRIDGE
Description of Work: Infrastructure Improvements - Includes, but is not limited to the construction of sewers & drains ranging in size from 10inch to 48inch in diameter;
Job Location: Western Avenue

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
MARBLE & TILE FINISHERS <i>BRICKLAYERS LOCAL 3 - MARBLE & TILE</i>	03/01/2012	\$35.52	\$10.18	\$16.04	0.00	\$61.74

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

Effective Date - 03/01/2012

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$17.76	\$10.18	16.04	\$0.00	\$43.98
2	60	\$21.31	\$10.18	16.04	\$0.00	\$47.53
3	70	\$24.86	\$10.18	16.04	\$0.00	\$51.08
4	80	\$28.42	\$10.18	16.04	\$0.00	\$54.64
5	90	\$31.97	\$10.18	16.04	\$0.00	\$58.19

Notes:
Steps are 800 hrs.

Apprentice to Journeyworker Ratio:1:3

MARBLE MASONS, TILELAYERS & TERRAZZO MECH <i>BRICKLAYERS LOCAL 3 - MARBLE & TILE</i>	03/01/2012	\$46.60	\$10.18	\$17.25	0.00	\$74.03
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Awarding Authority: City of Cambridge Purchasing Department
Contract Number: 5816 **City/Town:** CAMBRIDGE
Description of Work: Infrastructure Improvements - Includes, but is not limited to the construction of sewers & drains ranging in size from 10inch to 48inch in diameter;
Job Location: Western Avenue

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
Apprentice - MARBLE-TILE-TERRAZZO MECHANIC - Local 3 Marble & Tile						
Effective Date - 03/01/2012						
Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$23.30	\$10.18	17.25	\$0.00	\$50.73
2	60	\$27.96	\$10.18	17.25	\$0.00	\$55.39
3	70	\$32.62	\$10.18	17.25	\$0.00	\$60.05
4	80	\$37.28	\$10.18	17.25	\$0.00	\$64.71
5	90	\$41.94	\$10.18	17.25	\$0.00	\$69.37

Notes:

Apprentice to Journeyworker Ratio:1:3

MECH. SWEEPER OPERATOR (ON CONST. SITES) <i>OPERATING ENGINEERS LOCAL 4</i>	12/01/2011	\$39.16	\$10.00	\$12.40	0.00	\$61.56
	06/01/2012	\$39.72	\$10.00	\$12.40	0.00	\$62.12
	12/01/2012	\$40.34	\$10.00	\$12.40	0.00	\$62.74
	06/01/2013	\$41.11	\$10.00	\$12.40	0.00	\$63.51
	12/01/2013	\$41.89	\$10.00	\$12.40	0.00	\$64.29
MECHANICS MAINTENANCE <i>OPERATING ENGINEERS LOCAL 4</i>	12/01/2011	\$39.16	\$10.00	\$12.40	0.00	\$61.56
	06/01/2012	\$39.72	\$10.00	\$12.40	0.00	\$62.12
	12/01/2012	\$40.34	\$10.00	\$12.40	0.00	\$62.74
	06/01/2013	\$41.11	\$10.00	\$12.40	0.00	\$63.51
	12/01/2013	\$41.89	\$10.00	\$12.40	0.00	\$64.29
MILLWRIGHT (Zone 1) <i>MILLWRIGHTS LOCAL 1121 - Zone 1</i>	04/01/2011	\$33.57	\$8.67	\$15.61	0.00	\$57.85

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HEATHER E. ROWE
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DEVAL L. PATRICK
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TIMOTHY P. MURRAY
Lt. Governor

Awarding Authority: City of Cambridge Purchasing Department
Contract Number: 5816 **City/Town:** CAMBRIDGE
Description of Work: Infrastructure Improvements - Includes, but is not limited to the construction of sewers & drains ranging in size from 10inch to 48inch in diameter;
Job Location: Western Avenue

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
Apprentice - MILLWRIGHT - Local 1121 Zone 1						
Effective Date - 04/01/2011						
Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$16.79	\$8.67	11.64	\$0.00	\$37.10
2	55	\$18.46	\$8.67	11.64	\$0.00	\$38.77
3	60	\$20.14	\$8.67	13.23	\$0.00	\$42.04
4	65	\$21.82	\$8.67	13.23	\$0.00	\$43.72
5	70	\$23.50	\$8.67	14.02	\$0.00	\$46.19
6	75	\$25.18	\$8.67	14.02	\$0.00	\$47.87
7	80	\$26.86	\$8.67	14.82	\$0.00	\$50.35
8	85	\$28.53	\$8.67	14.82	\$0.00	\$52.02

Notes:

Apprentice to Journeyworker Ratio:1:5

MORTAR MIXER LABORERS - ZONE 1	12/01/2011	\$32.05	\$7.10	\$12.45	0.00	\$51.60
OILER (OTHER THAN TRUCK CRANES,GRADALLS) OPERATING ENGINEERS LOCAL 4	12/01/2011	\$21.28	\$10.00	\$12.40	0.00	\$43.68
	06/01/2012	\$21.56	\$10.00	\$12.40	0.00	\$43.96
	12/01/2012	\$21.90	\$10.00	\$12.40	0.00	\$44.30
	06/01/2013	\$22.32	\$10.00	\$12.40	0.00	\$44.72
	12/01/2013	\$22.74	\$10.00	\$12.40	0.00	\$45.14

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Lt. Governor

Awarding Authority: City of Cambridge Purchasing Department
Contract Number: 5816 **City/Town:** CAMBRIDGE
Description of Work: Infrastructure Improvements - Includes, but is not limited to the construction of sewers & drains ranging in size from 10inch to 48inch in diameter;
Job Location: Western Avenue

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
OILER (TRUCK CRANES, GRADALLS) <i>OPERATING ENGINEERS LOCAL 4</i>	12/01/2011	\$24.51	\$10.00	\$12.40	0.00	\$46.91
	06/01/2012	\$24.85	\$10.00	\$12.40	0.00	\$47.25
	12/01/2012	\$25.24	\$10.00	\$12.40	0.00	\$47.64
	06/01/2013	\$25.72	\$10.00	\$12.40	0.00	\$48.12
	12/01/2013	\$26.21	\$10.00	\$12.40	0.00	\$48.61
OTHER POWER DRIVEN EQUIPMENT - CLASS II <i>OPERATING ENGINEERS LOCAL 4</i>	12/01/2011	\$39.16	\$10.00	\$12.40	0.00	\$61.56
	06/01/2012	\$39.72	\$10.00	\$12.40	0.00	\$62.12
	12/01/2012	\$40.34	\$10.00	\$12.40	0.00	\$62.74
	06/01/2013	\$41.11	\$10.00	\$12.40	0.00	\$63.51
	12/01/2013	\$41.89	\$10.00	\$12.40	0.00	\$64.29
PAINTER (BRIDGES/TANKS) <i>PAINTERS LOCAL 35 - ZONE 1</i>	01/01/2012	\$44.01	\$7.80	\$14.60	0.00	\$66.41
	07/01/2012	\$44.51	\$7.80	\$15.10	0.00	\$67.41
	01/01/2013	\$45.01	\$7.80	\$15.60	0.00	\$68.41

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Awarding Authority: City of Cambridge Purchasing Department
Contract Number: 5816 **City/Town:** CAMBRIDGE
Description of Work: Infrastructure Improvements - Includes, but is not limited to the construction of sewers & drains ranging in size from 10inch to 48inch in diameter;
Job Location: Western Avenue

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
Apprentice - PAINTER Local 35 - BRIDGES/TANKS						
Effective Date - 01/01/2012						
Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$22.01	\$7.80	0.00	\$0.00	\$29.81
2	55	\$24.21	\$7.80	3.25	\$0.00	\$35.26
3	60	\$26.41	\$7.80	3.54	\$0.00	\$37.75
4	65	\$28.61	\$7.80	3.84	\$0.00	\$40.25
5	70	\$30.81	\$7.80	12.83	\$0.00	\$51.44
6	75	\$33.01	\$7.80	13.13	\$0.00	\$53.94
7	80	\$35.21	\$7.80	13.42	\$0.00	\$56.43
8	90	\$39.61	\$7.80	14.01	\$0.00	\$61.42
Effective Date - 07/01/2012						
Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$22.26	\$7.80	0.00	\$0.00	\$30.06
2	55	\$24.48	\$7.80	3.38	\$0.00	\$35.66
3	60	\$26.71	\$7.80	3.69	\$0.00	\$38.20
4	65	\$28.93	\$7.80	4.00	\$0.00	\$40.73
5	70	\$31.16	\$7.80	13.26	\$0.00	\$52.22
6	75	\$33.38	\$7.80	13.56	\$0.00	\$54.74
7	80	\$35.61	\$7.80	13.87	\$0.00	\$57.28
8	90	\$40.06	\$7.80	14.49	\$0.00	\$62.35

Notes:
Steps are 750 hrs.

Apprentice to Journeyworker Ratio:1:1

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Awarding Authority: City of Cambridge Purchasing Department
Contract Number: 5816 **City/Town:** CAMBRIDGE
Description of Work: Infrastructure Improvements - Includes, but is not limited to the construction of sewers & drains ranging in size from 10inch to 48inch in diameter;
Job Location: Western Avenue

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
Painter (Spray or Sandblast, New) *	01/01/2012	\$40.70	\$7.80	\$14.60	0.00	\$63.10
* If 30% or more of surfaces to be painted are new construction, NEW paint rate shall be used. PAINTERS LOCAL 35 - ZONE 1	07/01/2012	\$41.20	\$7.80	\$15.10	0.00	\$64.10
	01/01/2013	\$41.70	\$7.80	\$15.60	0.00	\$65.10

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Contract Number: 5816 **City/Town:** CAMBRIDGE
Description of Work: Infrastructure Improvements - Includes, but is not limited to the construction of sewers & drains ranging in size from 10inch to 48inch in diameter;
Job Location: Western Avenue

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
Apprentice - PAINTER Local 35 Zone 1 - Spray/Sandblast - New						
Effective Date - 01/01/2012						
Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$20.35	\$7.80	0.00	\$0.00	\$28.15
2	55	\$22.39	\$7.80	3.25	\$0.00	\$33.44
3	60	\$24.42	\$7.80	3.54	\$0.00	\$35.76
4	65	\$26.46	\$7.80	3.84	\$0.00	\$38.10
5	70	\$28.49	\$7.80	12.83	\$0.00	\$49.12
6	75	\$30.53	\$7.80	13.13	\$0.00	\$51.46
7	80	\$32.56	\$7.80	13.42	\$0.00	\$53.78
8	90	\$36.63	\$7.80	14.01	\$0.00	\$58.44
Effective Date - 07/01/2012						
Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$20.60	\$7.80	0.00	\$0.00	\$28.40
2	55	\$22.66	\$7.80	3.38	\$0.00	\$33.84
3	60	\$24.72	\$7.80	3.69	\$0.00	\$36.21
4	65	\$26.78	\$7.80	4.00	\$0.00	\$38.58
5	70	\$28.84	\$7.80	13.26	\$0.00	\$49.90
6	75	\$30.90	\$7.80	13.56	\$0.00	\$52.26
7	80	\$32.96	\$7.80	13.87	\$0.00	\$54.63
8	90	\$37.08	\$7.80	14.49	\$0.00	\$59.37

Notes:

Apprentice to Journeyworker Ratio:1:1

This wage schedule must be posted by the contractor at the work site in accordance with M.G.L. ch. 149, sec. 27. Failure of the employer to pay "prevailing wage rates," which are the "total rates" listed above, on public works projects is a violation of M.G.L. ch. 149, sec. 27. Contractors with questions about the wage rates or classifications included on the wage schedule have an affirmative obligation to inquire with DLS at www.mass.gov/dols or at 617-626-6952. Employees not receiving such rates should report the violation to the Fair Labor Division of the Office of the Attorney General, 100 Cambridge Street, Boston, MA 02108; Tel:



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

JOANNE F. GOLDSTEIN
 Secretary

HEATHER E. ROWE
 Director

DEVAL L. PATRICK
 Governor

TIMOTHY P. MURRAY
 Lt. Governor

Awarding Authority: City of Cambridge Purchasing Department
Contract Number: 5816 **City/Town:** CAMBRIDGE
Description of Work: Infrastructure Improvements - Includes, but is not limited to the construction of sewers & drains ranging in size from 10inch to 48inch in diameter;
Job Location: Western Avenue

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
PAINTER (SPRAY OR SANDBLAST, REPAINT) <i>PAINTERS LOCAL 35 - ZONE 1</i>	01/01/2012	\$38.76	\$7.80	\$14.60	0.00	\$61.16
	07/01/2012	\$39.26	\$7.80	\$15.10	0.00	\$62.16
	01/01/2013	\$39.76	\$7.80	\$15.60	0.00	\$63.16

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Awarding Authority: City of Cambridge Purchasing Department
Contract Number: 5816 **City/Town:** CAMBRIDGE
Description of Work: Infrastructure Improvements - Includes, but is not limited to the construction of sewers & drains ranging in size from 10inch to 48inch in diameter;
Job Location: Western Avenue

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
Apprentice - PAINTER Local 35 Zone 1 - Spray/Sandblast - Repaint						
Effective Date - 01/01/2012						
Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$19.38	\$7.80	0.00	\$0.00	\$27.18
2	55	\$21.32	\$7.80	3.25	\$0.00	\$32.37
3	60	\$23.26	\$7.80	3.54	\$0.00	\$34.60
4	65	\$25.19	\$7.80	3.84	\$0.00	\$36.83
5	70	\$27.13	\$7.80	12.83	\$0.00	\$47.76
6	75	\$29.07	\$7.80	13.13	\$0.00	\$50.00
7	80	\$31.01	\$7.80	13.42	\$0.00	\$52.23
8	90	\$34.88	\$7.80	14.01	\$0.00	\$56.69
Effective Date - 07/01/2012						
Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$19.63	\$7.80	0.00	\$0.00	\$27.43
2	55	\$21.59	\$7.80	3.38	\$0.00	\$32.77
3	60	\$23.56	\$7.80	3.69	\$0.00	\$35.05
4	65	\$25.52	\$7.80	4.00	\$0.00	\$37.32
5	70	\$27.48	\$7.80	13.26	\$0.00	\$48.54
6	75	\$29.45	\$7.80	13.56	\$0.00	\$50.81
7	80	\$31.41	\$7.80	13.87	\$0.00	\$53.08
8	90	\$35.33	\$7.80	14.49	\$0.00	\$57.62

Notes:

Apprentice to Journeyworker Ratio:1:1

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Awarding Authority: City of Cambridge Purchasing Department
Contract Number: 5816 **City/Town:** CAMBRIDGE
Description of Work: Infrastructure Improvements - Includes, but is not limited to the construction of sewers & drains ranging in size from 10inch to 48inch in diameter;
Job Location: Western Avenue

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
PAINTER (TRAFFIC MARKINGS) <i>LABORERS - ZONE 1</i>	12/01/2011	\$31.80	\$7.10	\$12.45	0.00	\$51.35
PAINTER / TAPER (BRUSH, NEW) *	01/01/2012	\$39.30	\$7.80	\$14.60	0.00	\$61.70
* If 30% or more of surfaces to be painted are new construction, NEW paint rate shall be used. <i>PAINTERS LOCAL 35 - ZONE 1</i>	07/01/2012	\$39.80	\$7.80	\$15.10	0.00	\$62.70
	01/01/2013	\$40.30	\$7.80	\$15.60	0.00	\$63.70

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Awarding Authority: City of Cambridge Purchasing Department
Contract Number: 5816 **City/Town:** CAMBRIDGE
Description of Work: Infrastructure Improvements - Includes, but is not limited to the construction of sewers & drains ranging in size from 10inch to 48inch in diameter;
Job Location: Western Avenue

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
Apprentice - PAINTER - Local 35 Zone 1 - BRUSH NEW						
Effective Date - 01/01/2012						
Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$19.65	\$7.80	0.00	\$0.00	\$27.45
2	55	\$21.62	\$7.80	3.25	\$0.00	\$32.67
3	60	\$23.58	\$7.80	3.54	\$0.00	\$34.92
4	65	\$25.55	\$7.80	3.84	\$0.00	\$37.19
5	70	\$27.51	\$7.80	12.83	\$0.00	\$48.14
6	75	\$29.48	\$7.80	13.13	\$0.00	\$50.41
7	80	\$31.44	\$7.80	13.42	\$0.00	\$52.66
8	90	\$35.37	\$7.80	14.01	\$0.00	\$57.18
Effective Date - 07/01/2012						
Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$19.90	\$7.80	0.00	\$0.00	\$27.70
2	55	\$21.89	\$7.80	3.38	\$0.00	\$33.07
3	60	\$23.88	\$7.80	3.69	\$0.00	\$35.37
4	65	\$25.87	\$7.80	4.00	\$0.00	\$37.67
5	70	\$27.86	\$7.80	13.26	\$0.00	\$48.92
6	75	\$29.85	\$7.80	13.49	\$0.00	\$51.14
7	80	\$31.84	\$7.80	13.87	\$0.00	\$53.51
8	90	\$35.82	\$7.80	14.49	\$0.00	\$58.11

Notes:
Steps are 750 hrs.

Apprentice to Journeyworker Ratio:1:1

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Prevailing Wage Rates

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

JOANNE F. GOLDSTEIN
Secretary

HEATHER E. ROWE
Director

Awarding Authority: City of Cambridge Purchasing Department

Contract Number: 5816

City/Town: CAMBRIDGE

Description of Work: Infrastructure Improvements - Includes, but is not limited to the construction of sewers & drains ranging in size from 10inch to 48inch in diameter;

Job Location: Western Avenue

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
PAINTER / TAPER (BRUSH, REPAINT) <i>PAINTERS LOCAL 35 - ZONE 1</i>	01/01/2012	\$37.36	\$7.80	\$14.60	0.00	\$59.76
	07/01/2012	\$37.86	\$7.80	\$15.10	0.00	\$60.76
	01/01/2013	\$38.36	\$7.80	\$15.60	0.00	\$61.76

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Awarding Authority: City of Cambridge Purchasing Department
Contract Number: 5816 **City/Town:** CAMBRIDGE
Description of Work: Infrastructure Improvements - Includes, but is not limited to the construction of sewers & drains ranging in size from 10inch to 48inch in diameter;
Job Location: Western Avenue

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
Apprentice - PAINTER Local 35 Zone 1 - BRUSH REPAINT						
Effective Date - 01/01/2012						
Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$18.68	\$7.80	0.00	\$0.00	\$26.48
2	55	\$20.55	\$7.80	3.25	\$0.00	\$31.60
3	60	\$22.42	\$7.80	3.54	\$0.00	\$33.76
4	65	\$24.28	\$7.80	3.84	\$0.00	\$35.92
5	70	\$26.15	\$7.80	12.83	\$0.00	\$46.78
6	75	\$28.02	\$7.80	13.13	\$0.00	\$48.95
7	80	\$29.89	\$7.80	13.42	\$0.00	\$51.11
8	90	\$33.62	\$7.80	14.01	\$0.00	\$55.43
Effective Date - 07/01/2012						
Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$18.93	\$7.80	0.00	\$0.00	\$26.73
2	55	\$20.82	\$7.80	3.38	\$0.00	\$32.00
3	60	\$22.72	\$7.80	3.69	\$0.00	\$34.21
4	65	\$24.61	\$7.80	4.00	\$0.00	\$36.41
5	70	\$26.50	\$7.80	13.26	\$0.00	\$47.56
6	75	\$28.40	\$7.80	13.56	\$0.00	\$49.76
7	80	\$30.29	\$7.80	13.87	\$0.00	\$51.96
8	90	\$34.07	\$7.80	14.49	\$0.00	\$56.36

Notes:

Steps are 750 hrs.

Apprentice to Journeyworker Ratio:1:1

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Awarding Authority: City of Cambridge Purchasing Department
Contract Number: 5816 **City/Town:** CAMBRIDGE
Description of Work: Infrastructure Improvements - Includes, but is not limited to the construction of sewers & drains ranging in size from 10inch to 48inch in diameter;
Job Location: Western Avenue

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
PANEL & PICKUP TRUCKS DRIVER <i>TEAMSTERS JOINT COUNCIL NO. 10 ZONE A</i>	12/01/2011	\$30.78	\$8.56	\$7.27	0.00	\$46.61
	06/01/2012	\$31.08	\$8.56	\$7.27	0.00	\$46.91
	08/01/2012	\$31.08	\$8.91	\$7.27	0.00	\$47.26
	12/01/2012	\$31.38	\$8.91	\$8.00	0.00	\$48.29
PIER AND DOCK CONSTRUCTOR (UNDERPINNING AND DECK) <i>PILE DRIVER LOCAL 56 (ZONE 1)</i>	08/01/2011	\$38.30	\$9.80	\$17.12	0.00	\$65.22
PILE DRIVER <i>PILE DRIVER LOCAL 56 (ZONE 1)</i>	08/01/2011	\$38.30	\$9.80	\$17.12	0.00	\$65.22

Apprentice - PILE DRIVER - Local 56 Zone 1

Effective Date - 08/01/2011

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	60	\$22.98	\$8.08	17.12	\$0.00	\$48.18
2	65	\$24.90	\$8.08	17.12	\$0.00	\$50.10
3	70	\$26.81	\$8.08	17.12	\$0.00	\$52.01
4	75	\$28.73	\$8.08	17.12	\$0.00	\$53.93
5	80	\$30.64	\$8.08	17.12	\$0.00	\$55.84
6	85	\$32.56	\$8.08	17.12	\$0.00	\$57.76
7	90	\$34.47	\$8.08	17.12	\$0.00	\$59.67
8	95	\$36.39	\$8.08	17.12	\$0.00	\$61.59

Notes:

Apprentice to Journeyworker Ratio:1:3

PIPEFITTER & STEAMFITTER <i>PIPEFITTERS LOCAL 537</i>	03/01/2012	\$46.84	\$8.75	\$14.39	0.00	\$69.98
	09/01/2012	\$48.09	\$8.75	\$14.39	0.00	\$71.23
	03/01/2013	\$49.34	\$8.75	\$14.39	0.00	\$72.48

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Awarding Authority: City of Cambridge Purchasing Department
Contract Number: 5816 **City/Town:** CAMBRIDGE
Description of Work: Infrastructure Improvements - Includes, but is not limited to the construction of sewers & drains ranging in size from 10inch to 48inch in diameter;
Job Location: Western Avenue

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
Apprentice - PIPEFITTER - Local 537						
Effective Date - 03/01/2012						
Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	40	\$18.74	\$8.75	6.50	\$0.00	\$33.99
2	45	\$21.08	\$8.75	14.39	\$0.00	\$44.22
3	60	\$28.10	\$8.75	14.39	\$0.00	\$51.24
4	70	\$32.79	\$8.75	14.39	\$0.00	\$55.93
5	80	\$37.47	\$8.75	14.39	\$0.00	\$60.61
Effective Date - 09/01/2012						
Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	40	\$19.24	\$8.75	6.50	\$0.00	\$34.49
2	45	\$21.64	\$8.75	14.39	\$0.00	\$44.78
3	60	\$28.85	\$8.75	14.39	\$0.00	\$51.99
4	70	\$33.66	\$8.75	14.39	\$0.00	\$56.80
5	80	\$38.47	\$8.75	14.39	\$0.00	\$61.61
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	12/01/2011	\$32.05	\$7.10	\$12.45	0.00	\$51.60
PLUMBERS & GASFITTERS PLUMBERS & GASFITTERS LOCAL 12	03/01/2012	\$46.81	\$9.32	\$13.29	0.00	\$69.42
	09/01/2012	\$48.06	\$9.32	\$13.29	0.00	\$70.67
	03/01/2013	\$49.31	\$9.32	\$13.29	0.00	\$71.92

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Awarding Authority: City of Cambridge Purchasing Department
Contract Number: 5816 **City/Town:** CAMBRIDGE
Description of Work: Infrastructure Improvements - Includes, but is not limited to the construction of sewers & drains ranging in size from 10inch to 48inch in diameter;
Job Location: Western Avenue

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
Apprentice - PLUMBER - Local 12						
Effective Date - 03/01/2012						
Step percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate	
1 35	\$16.38	\$9.32	4.97	\$0.00	\$30.67	
2 40	\$18.72	\$9.32	5.61	\$0.00	\$33.65	
3 55	\$25.75	\$9.32	7.53	\$0.00	\$42.60	
4 65	\$30.43	\$9.32	8.81	\$0.00	\$48.56	
5 75	\$35.11	\$9.32	10.09	\$0.00	\$54.52	
Effective Date - 09/01/2012						
Step percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate	
1 35	\$16.82	\$9.32	4.97	\$0.00	\$31.11	
2 40	\$19.22	\$9.32	5.61	\$0.00	\$34.15	
3 55	\$26.43	\$9.32	7.53	\$0.00	\$43.28	
4 65	\$31.24	\$9.32	8.81	\$0.00	\$49.37	
5 75	\$36.05	\$9.32	10.09	\$0.00	\$55.46	

Notes:
** 1:2; 2:6; 3:10; 4:14; 5:19/Steps are 1 yr
Step4 with lic\$51.54 Step5 with lic\$57.49

Apprentice to Journeyworker Ratio:**

PNEUMATIC CONTROLS (TEMP.) PIPEFITTERS LOCAL 537	03/01/2012	\$46.84	\$8.75	\$14.39	0.00	\$69.98
	09/01/2012	\$48.09	\$8.75	\$14.39	0.00	\$71.23
	03/01/2013	\$49.34	\$8.75	\$14.39	0.00	\$72.48
PNEUMATIC DRILL/TOOL OPERATOR LABORERS - ZONE 1	12/01/2011	\$32.05	\$7.10	\$12.45	0.00	\$51.60
POWDERMAN & BLASTER LABORERS - ZONE 1	12/01/2011	\$32.80	\$7.10	\$12.45	0.00	\$52.35

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Awarding Authority: City of Cambridge Purchasing Department
Contract Number: 5816 **City/Town:** CAMBRIDGE
Description of Work: Infrastructure Improvements - Includes, but is not limited to the construction of sewers & drains ranging in size from 10inch to 48inch in diameter;
Job Location: Western Avenue

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
POWER SHOVEL/DERRICK/TRENCHING MACHINE <i>OPERATING ENGINEERS LOCAL 4</i>	12/01/2011	\$39.52	\$10.00	\$12.40	0.00	\$61.92
	06/01/2012	\$40.09	\$10.00	\$12.40	0.00	\$62.49
	12/01/2012	\$40.71	\$10.00	\$12.40	0.00	\$63.11
	06/01/2013	\$41.49	\$10.00	\$12.40	0.00	\$63.89
	12/01/2013	\$42.27	\$10.00	\$12.40	0.00	\$64.67
PUMP OPERATOR (CONCRETE) <i>OPERATING ENGINEERS LOCAL 4</i>	12/01/2011	\$39.52	\$10.00	\$12.40	0.00	\$61.92
	06/01/2012	\$40.09	\$10.00	\$12.40	0.00	\$62.49
	12/01/2012	\$40.71	\$10.00	\$12.40	0.00	\$63.11
	06/01/2013	\$41.49	\$10.00	\$12.40	0.00	\$63.89
	12/01/2013	\$42.27	\$10.00	\$12.40	0.00	\$64.67
PUMP OPERATOR (DEWATERING, OTHER) <i>OPERATING ENGINEERS LOCAL 4</i>	12/01/2011	\$27.95	\$10.00	\$12.40	0.00	\$50.35
	06/01/2012	\$28.34	\$10.00	\$12.40	0.00	\$50.74
	12/01/2012	\$28.79	\$10.00	\$12.40	0.00	\$51.19
	06/01/2013	\$29.34	\$10.00	\$12.40	0.00	\$51.74
	12/01/2013	\$29.89	\$10.00	\$12.40	0.00	\$52.29
READY-MIX CONCRETE DRIVER <i>TEAMSTERS LOCAL 25a</i>	05/01/2011	\$29.99	\$7.75	\$5.91	0.00	\$43.65
RECLAIMERS <i>OPERATING ENGINEERS LOCAL 4</i>	12/01/2011	\$39.16	\$10.00	\$12.40	0.00	\$61.56
	06/01/2012	\$39.72	\$10.00	\$12.40	0.00	\$62.12
	12/01/2012	\$40.34	\$10.00	\$12.40	0.00	\$62.74
	06/01/2013	\$41.11	\$10.00	\$12.40	0.00	\$63.51
	12/01/2013	\$41.89	\$10.00	\$12.40	0.00	\$64.29
RESIDENTIAL WOOD FRAME (All Other Work) <i>CARPENTERS -ZONE 1 (Residential Wood)</i>	04/01/2011	\$37.25	\$8.67	\$15.51	0.00	\$61.43
RESIDENTIAL WOOD FRAME CARPENTER **	05/01/2011	\$27.49	\$6.34	\$6.23	0.00	\$40.06

** The Residential Wood Frame Carpenter classification applies only to the construction of new, wood frame residences that do not exceed four stories including the basement. *CARPENTERS -ZONE 1 (Residential Wood)*

As of 9/1/09 Carpentry work on wood-frame residential WEATHERIZATION projects shall be paid the RESIDENTIAL WOOD FRAME CARPENTER rate.

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JOANNE F. GOLDSTEIN
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DEVAL L. PATRICK
Governor

TIMOTHY P. MURRAY
Lt. Governor

Awarding Authority: City of Cambridge Purchasing Department
Contract Number: 5816 **City/Town:** CAMBRIDGE
Description of Work: Infrastructure Improvements - Includes, but is not limited to the construction of sewers & drains ranging in size from 10inch to 48inch in diameter;
Job Location: Western Avenue

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
Apprentice - CARPENTER (Residential Wood Frame) - Zone 1						
Effective Date - 05/01/2011						
Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	60	\$16.49	\$6.34	0.00	\$0.00	\$22.83
2	60	\$16.49	\$6.34	6.23	\$0.00	\$29.06
3	65	\$17.87	\$6.34	6.23	\$0.00	\$30.44
4	70	\$19.24	\$6.34	6.23	\$0.00	\$31.81
5	75	\$20.62	\$6.34	6.23	\$0.00	\$33.19
6	80	\$21.99	\$6.34	6.23	\$0.00	\$34.56
7	85	\$23.37	\$6.34	6.23	\$0.00	\$35.94
8	90	\$24.74	\$6.34	6.23	\$0.00	\$37.31

Notes:

Apprentice to Journeyworker Ratio:1:5

RIDE-ON MOTORIZED BUGGY OPERATOR LABORERS - ZONE 1	12/01/2011	\$32.05	\$7.10	\$12.45	0.00	\$51.60
ROLLER/SPREADER/MULCHING MACHINE OPERATING ENGINEERS LOCAL 4	12/01/2011	\$39.16	\$10.00	\$12.40	0.00	\$61.56
	06/01/2012	\$39.72	\$10.00	\$12.40	0.00	\$62.12
	12/01/2012	\$40.34	\$10.00	\$12.40	0.00	\$62.74
	06/01/2013	\$41.11	\$10.00	\$12.40	0.00	\$63.51
	12/01/2013	\$41.89	\$10.00	\$12.40	0.00	\$64.29
ROOFER (Inc.Roofers Waterproofing &Roofers Damproofing) ROOFERS LOCAL 33	02/01/2012	\$35.56	\$10.50	\$10.70	0.00	\$56.76
	08/01/2012	\$36.56	\$10.50	\$10.70	0.00	\$57.76
	02/01/2013	\$37.56	\$10.50	\$10.70	0.00	\$58.76

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JOANNE F. GOLDSTEIN
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HEATHER E. ROWE
Director

DEVAL L. PATRICK
Governor
TIMOTHY P. MURRAY
Lt. Governor

Awarding Authority: City of Cambridge Purchasing Department
Contract Number: 5816 **City/Town:** CAMBRIDGE
Description of Work: Infrastructure Improvements - Includes, but is not limited to the construction of sewers & drains ranging in size from 10inch to 48inch in diameter;
Job Location: Western Avenue

Classification **Effective Date** **Base Wage** **Health** **Pension** **Supplemental Unemployment** **Total Rate**

Apprentice - ROOFER - Local 33

Effective Date - 02/01/2012

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$17.78	\$10.50	3.38	\$0.00	\$31.66
2	60	\$21.34	\$10.50	10.70	\$0.00	\$42.54
3	65	\$23.11	\$10.50	10.70	\$0.00	\$44.31
4	75	\$26.67	\$10.50	10.70	\$0.00	\$47.87
5	85	\$30.23	\$10.50	10.70	\$0.00	\$51.43

Effective Date - 08/01/2012

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$18.28	\$10.50	3.38	\$0.00	\$32.16
2	60	\$21.94	\$10.50	10.70	\$0.00	\$43.14
3	65	\$23.76	\$10.50	10.70	\$0.00	\$44.96
4	75	\$27.42	\$10.50	10.70	\$0.00	\$48.62
5	85	\$31.08	\$10.50	10.70	\$0.00	\$52.28

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.

Apprentice to Journeyworker Ratio:**

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
ROOFER SLATE / TILE / PRECAST CONCRETE	02/01/2012	\$35.81	\$10.50	\$10.70	0.00	\$57.01
ROOFERS LOCAL 33	08/01/2012	\$36.81	\$10.50	\$10.70	0.00	\$58.01
	02/01/2013	\$37.81	\$10.50	\$10.70	0.00	\$59.01

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Lt. Governor

Awarding Authority: City of Cambridge Purchasing Department
Contract Number: 5816 **City/Town:** CAMBRIDGE
Description of Work: Infrastructure Improvements - Includes, but is not limited to the construction of sewers & drains ranging in size from 10inch to 48inch in diameter;
Job Location: Western Avenue

Classification **Effective Date** **Base Wage** **Health** **Pension** **Supplemental Unemployment** **Total Rate**

Apprentice - ROOFER (Slate/Tile/Precast Concrete) - Local 33

Effective Date - 02/01/2012

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$17.91	\$10.50	3.38	\$0.00	\$31.79
2	60	\$21.49	\$10.50	10.70	\$0.00	\$42.69
3	65	\$23.28	\$10.50	10.70	\$0.00	\$44.48
4	75	\$26.86	\$10.50	10.70	\$0.00	\$48.06
5	85	\$30.44	\$10.50	10.70	\$0.00	\$51.64

Effective Date - 08/01/2012

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$18.41	\$10.50	3.38	\$0.00	\$32.29
2	60	\$22.09	\$10.50	10.70	\$0.00	\$43.29
3	65	\$23.93	\$10.50	10.70	\$0.00	\$45.13
4	75	\$27.61	\$10.50	10.70	\$0.00	\$48.81
5	85	\$31.29	\$10.50	10.70	\$0.00	\$52.49

Notes:

Apprentice to Journeyworker Ratio:**

SHEETMETAL WORKER	02/01/2012	\$40.79	\$9.82	\$17.34	2.04	\$69.99
SHEETMETAL WORKERS LOCAL 17 - A	08/01/2012	\$42.04	\$9.82	\$17.34	2.08	\$71.28
	02/01/2013	\$43.29	\$9.82	\$17.34	2.11	\$72.56

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Awarding Authority: City of Cambridge Purchasing Department
Contract Number: 5816 **City/Town:** CAMBRIDGE
Description of Work: Infrastructure Improvements - Includes, but is not limited to the construction of sewers & drains ranging in size from 10inch to 48inch in diameter;
Job Location: Western Avenue

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
Apprentice - SHEET METAL WORKER - Local 17-A						
Effective Date - 02/01/2012						
Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	40	\$16.32	\$9.82	3.74	\$0.00	\$29.88
2	45	\$18.36	\$9.82	7.45	\$1.07	\$36.70
3	50	\$20.40	\$9.82	8.42	\$1.16	\$39.80
4	60	\$24.47	\$9.82	9.60	\$1.32	\$45.21
5	65	\$26.51	\$9.82	10.32	\$1.40	\$48.05
6	75	\$30.59	\$9.82	11.76	\$1.57	\$53.74
7	85	\$34.67	\$9.82	12.69	\$1.72	\$58.90
Effective Date - 08/01/2012						
Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	40	\$16.82	\$9.82	3.74	\$0.00	\$30.38
2	45	\$18.92	\$9.82	7.45	\$1.09	\$37.28
3	50	\$21.02	\$9.82	8.42	\$1.18	\$40.44
4	60	\$25.22	\$9.82	9.60	\$1.34	\$45.98
5	65	\$27.33	\$9.82	10.32	\$1.42	\$48.89
6	75	\$31.53	\$9.82	11.76	\$1.59	\$54.70
7	85	\$35.73	\$9.82	12.69	\$1.75	\$59.99

Notes:
Steps 1-3 are 1 year; Steps 4-7 are 6 mos.

Apprentice to Journeyworker Ratio:1:4

SIGN ERECTOR PAINTERS LOCAL 35 - ZONE 1	06/01/2009	\$24.81	\$7.07	\$5.90	0.00	\$37.78
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DEVAL L. PATRICK
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Awarding Authority: City of Cambridge Purchasing Department
Contract Number: 5816 **City/Town:** CAMBRIDGE
Description of Work: Infrastructure Improvements - Includes, but is not limited to the construction of sewers & drains ranging in size from 10inch to 48inch in diameter;
Job Location: Western Avenue

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
Apprentice - SIGN ERECTOR - Local 35 Zone 1						
Effective Date - 06/01/2009						
Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$12.41	\$7.07	0.00	\$0.00	\$19.48
2	55	\$13.65	\$7.07	2.40	\$0.00	\$23.12
3	60	\$14.89	\$7.07	2.40	\$0.00	\$24.36
4	65	\$16.13	\$7.07	2.40	\$0.00	\$25.60
5	70	\$17.37	\$7.07	5.90	\$0.00	\$30.34
6	75	\$18.61	\$7.07	5.90	\$0.00	\$31.58
7	80	\$19.85	\$7.07	5.90	\$0.00	\$32.82
8	85	\$21.09	\$7.07	5.90	\$0.00	\$34.06
9	90	\$22.33	\$7.07	5.90	\$0.00	\$35.30

Notes:
Steps are 4 mos.

Apprentice to Journeyworker Ratio:1:1

SPECIALIZED EARTH MOVING EQUIP < 35 TONS <i>TEAMSTERS JOINT COUNCIL NO. 10 ZONE A</i>	12/01/2011	\$31.24	\$8.56	\$7.27	0.00	\$47.07
	06/01/2012	\$31.54	\$8.56	\$7.27	0.00	\$47.37
	08/01/2012	\$31.54	\$8.91	\$7.27	0.00	\$47.72
	12/01/2012	\$31.84	\$8.91	\$8.00	0.00	\$48.75
SPECIALIZED EARTH MOVING EQUIP > 35 TONS <i>TEAMSTERS JOINT COUNCIL NO. 10 ZONE A</i>	12/01/2011	\$31.53	\$8.56	\$7.27	0.00	\$47.36
	06/01/2012	\$31.83	\$8.56	\$7.27	0.00	\$47.66
	08/01/2012	\$31.83	\$8.91	\$7.27	0.00	\$48.01
	12/01/2012	\$32.13	\$8.91	\$8.00	0.00	\$49.04

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Awarding Authority: City of Cambridge Purchasing Department
Contract Number: 5816 **City/Town:** CAMBRIDGE
Description of Work: Infrastructure Improvements - Includes, but is not limited to the construction of sewers & drains ranging in size from 10inch to 48inch in diameter;
Job Location: Western Avenue

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
SPRINKLER FITTER	03/01/2012	\$51.58	\$8.42	\$11.60	0.00	\$71.60
<i>SPRINKLER FITTERS LOCAL 550</i>	09/01/2012	\$52.58	\$8.42	\$11.60	0.00	\$72.60
	03/01/2013	\$53.58	\$8.42	\$11.60	0.00	\$73.60

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Contract Number: 5816 **City/Town:** CAMBRIDGE
Description of Work: Infrastructure Improvements - Includes, but is not limited to the construction of sewers & drains ranging in size from 10inch to 48inch in diameter;
Job Location: Western Avenue

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
Apprentice - SPRINKLER FITTER - Local 550						
Effective Date - 03/01/2012						
Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	35	\$18.05	\$8.42	7.85	\$0.00	\$34.32
2	40	\$20.63	\$8.42	7.85	\$0.00	\$36.90
3	45	\$23.21	\$8.42	7.85	\$0.00	\$39.48
4	50	\$25.79	\$8.42	7.85	\$0.00	\$42.06
5	55	\$28.37	\$8.42	7.85	\$0.00	\$44.64
6	60	\$30.95	\$8.42	7.85	\$0.00	\$47.22
7	65	\$33.53	\$8.42	7.85	\$0.00	\$49.80
8	70	\$36.11	\$8.42	7.85	\$0.00	\$52.38
9	75	\$38.69	\$8.42	7.85	\$0.00	\$54.96
10	80	\$41.26	\$8.42	7.85	\$0.00	\$57.53
Effective Date - 09/01/2012						
Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	35	\$18.40	\$8.42	7.85	\$0.00	\$34.67
2	40	\$21.03	\$8.42	7.85	\$0.00	\$37.30
3	45	\$23.66	\$8.42	7.85	\$0.00	\$39.93
4	50	\$26.29	\$8.42	7.85	\$0.00	\$42.56
5	55	\$28.92	\$8.42	7.85	\$0.00	\$45.19
6	60	\$31.55	\$8.42	7.85	\$0.00	\$47.82
7	65	\$34.18	\$8.42	7.85	\$0.00	\$50.45
8	70	\$36.81	\$8.42	7.85	\$0.00	\$53.08
9	75	\$39.44	\$8.42	7.85	\$0.00	\$55.71
10	80	\$42.06	\$8.42	7.85	\$0.00	\$58.33

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Awarding Authority: City of Cambridge Purchasing Department
Contract Number: 5816 **City/Town:** CAMBRIDGE
Description of Work: Infrastructure Improvements - Includes, but is not limited to the construction of sewers & drains ranging in size from 10inch to 48inch in diameter;
Job Location: Western Avenue

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
Notes:						
Apprentice to Journeyworker Ratio:1:1						

STEAM BOILER OPERATOR <i>OPERATING ENGINEERS LOCAL 4</i>	12/01/2011	\$39.16	\$10.00	\$12.40	0.00	\$61.56
	06/01/2012	\$39.72	\$10.00	\$12.40	0.00	\$62.12
	12/01/2012	\$40.34	\$10.00	\$12.40	0.00	\$62.74
	06/01/2013	\$41.11	\$10.00	\$12.40	0.00	\$63.51
	12/01/2013	\$41.89	\$10.00	\$12.40	0.00	\$64.29
TAMPERS, SELF-PROPELLED OR TRACTOR DRAWN <i>OPERATING ENGINEERS LOCAL 4</i>	12/01/2011	\$39.16	\$10.00	\$12.40	0.00	\$61.56
	06/01/2012	\$39.72	\$10.00	\$12.40	0.00	\$62.12
	12/01/2012	\$40.34	\$10.00	\$12.40	0.00	\$62.74
	06/01/2013	\$41.11	\$10.00	\$12.40	0.00	\$63.51
	12/01/2013	\$41.89	\$10.00	\$12.40	0.00	\$64.29
TELECOMMUNICATION TECHNICIAN <i>ELECTRICIANS LOCAL 103</i>	03/01/2012	\$31.78	\$13.00	\$12.23	0.00	\$57.01
	09/01/2012	\$32.29	\$13.00	\$12.25	0.00	\$57.54
	03/01/2013	\$32.83	\$13.00	\$12.26	0.00	\$58.09
	09/01/2013	\$33.34	\$13.00	\$12.28	0.00	\$58.62
	03/01/2014	\$33.88	\$13.00	\$12.30	0.00	\$59.18
	09/01/2014	\$34.38	\$13.00	\$12.31	0.00	\$59.69
	03/01/2015	\$34.91	\$13.00	\$12.33	0.00	\$60.24
	09/01/2015	\$35.63	\$13.00	\$12.35	0.00	\$60.98
03/01/2016	\$36.35	\$13.00	\$12.37	0.00	\$61.72	

This wage schedule must be posted by the contractor at the work site in accordance with M.G.L. ch. 149, sec. 27. Failure of the employer to pay "prevailing wage rates," which are the "total rates" listed above, on public works projects is a violation of M.G.L. ch. 149, sec. 27. Contractors with questions about the wage rates or classifications included on the wage schedule have an affirmative obligation to inquire with DLS at www.mass.gov/dols or at 617-626-6952. Employees not receiving such rates should report the violation to the Fair Labor Division of the Office of the Attorney General, 100 Cambridge Street, Boston, MA 02108; Tel:



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

JOANNE F. GOLDSTEIN
Secretary

HEATHER E. ROWE
Director

DEVAL L. PATRICK
Governor

TIMOTHY P. MURRAY
Lt. Governor

Awarding Authority: City of Cambridge Purchasing Department
Contract Number: 5816 **City/Town:** CAMBRIDGE
Description of Work: Infrastructure Improvements - Includes, but is not limited to the construction of sewers & drains ranging in size from 10inch to 48inch in diameter;
Job Location: Western Avenue

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
Apprentice - TELECOMMUNICATION TECHNICIAN - Local 103						
Effective Date - 03/01/2012						
Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	40	\$12.71	\$13.00	9.27	\$0.00	\$34.98
2	40	\$12.71	\$13.00	9.27	\$0.00	\$34.98
3	45	\$14.30	\$13.00	9.51	\$0.00	\$36.81
4	45	\$14.30	\$13.00	9.51	\$0.00	\$36.81
5	50	\$15.89	\$13.00	9.76	\$0.00	\$38.65
6	55	\$17.48	\$13.00	10.01	\$0.00	\$40.49
7	60	\$19.07	\$13.00	10.26	\$0.00	\$42.33
8	65	\$20.66	\$13.00	10.50	\$0.00	\$44.16
9	70	\$22.25	\$13.00	10.75	\$0.00	\$46.00
10	75	\$23.84	\$13.00	11.00	\$0.00	\$47.84
Effective Date - 09/01/2012						
Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	40	\$12.92	\$13.00	9.28	\$0.00	\$35.20
2	40	\$12.92	\$13.00	9.28	\$0.00	\$35.20
3	45	\$14.53	\$13.00	9.53	\$0.00	\$37.06
4	45	\$14.53	\$13.00	9.53	\$0.00	\$37.06
5	50	\$16.15	\$13.00	9.77	\$0.00	\$38.92
6	55	\$17.76	\$13.00	10.02	\$0.00	\$40.78
7	60	\$19.37	\$13.00	10.27	\$0.00	\$42.64
8	65	\$20.99	\$13.00	10.52	\$0.00	\$44.51
9	70	\$22.60	\$13.00	10.77	\$0.00	\$46.37
10	75	\$24.22	\$13.00	11.02	\$0.00	\$48.24

This wage schedule must be posted by the contractor at the work site in accordance with M.G.L. ch. 149, sec. 27. Failure of the employer to pay "prevailing wage rates," which are the "total rates" listed above, on public works projects is a violation of M.G.L. ch. 149, sec. 27. Contractors with questions about the wage rates or classifications included on the wage schedule have an affirmative obligation to inquire with DLS at www.mass.gov/dols or at 617-626-6952. Employees not receiving such rates should report the violation to the Fair Labor Division of the Office of the Attorney General, 100 Cambridge Street, Boston, MA 02108; Tel:



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Awarding Authority: City of Cambridge Purchasing Department
Contract Number: 5816 **City/Town:** CAMBRIDGE
Description of Work: Infrastructure Improvements - Includes, but is not limited to the construction of sewers & drains ranging in size from 10inch to 48inch in diameter;
Job Location: Western Avenue

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
Notes:						
Apprentice to Journeyworker Ratio:1:1						
TERRAZZO FINISHERS BRICKLAYERS LOCAL 3 - MARBLE & TILE	03/01/2012	\$45.50	\$10.18	\$17.25	0.00	\$72.93

Apprentice - TERRAZZO FINISHER - Local 3 Marble & Tile

Effective Date - 03/01/2012

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$22.75	\$10.18	17.25	\$0.00	\$50.18
2	60	\$27.30	\$10.18	17.25	\$0.00	\$54.73
3	70	\$31.85	\$10.18	17.25	\$0.00	\$59.28
4	80	\$36.40	\$10.18	17.25	\$0.00	\$63.83
5	90	\$40.95	\$10.18	17.25	\$0.00	\$68.38

Notes:
Steps are 800 hrs.

Apprentice to Journeyworker Ratio:1:3

TEST BORING DRILLER LABORERS - FOUNDATION AND MARINE	12/01/2011	\$33.05	\$7.10	\$12.60	0.00	\$52.75
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Contract Number: 5816 **City/Town:** CAMBRIDGE
Description of Work: Infrastructure Improvements - Includes, but is not limited to the construction of sewers & drains ranging in size from 10inch to 48inch in diameter;
Job Location: Western Avenue

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
Apprentice - TEST BORING DRILLER (Laborers Foundation & Marine)						
Effective Date - 12/01/2011						
Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	60	\$19.83	\$7.10	12.60	\$0.00	\$39.53
2	70	\$23.14	\$7.10	12.60	\$0.00	\$42.84
3	80	\$26.44	\$7.10	12.60	\$0.00	\$46.14
4	90	\$29.75	\$7.10	12.60	\$0.00	\$49.45
Notes:						
Apprentice to Journeyworker Ratio:1:3						
TEST BORING DRILLER HELPER LABORERS - FOUNDATION AND MARINE	12/01/2011	\$31.77	\$7.10	\$12.60	0.00	\$51.47
TEST BORING LABORER LABORERS - FOUNDATION AND MARINE	12/01/2011	\$31.65	\$7.10	\$12.60	0.00	\$51.35

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Awarding Authority: City of Cambridge Purchasing Department
Contract Number: 5816 **City/Town:** CAMBRIDGE
Description of Work: Infrastructure Improvements - Includes, but is not limited to the construction of sewers & drains ranging in size from 10inch to 48inch in diameter;
Job Location: Western Avenue

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
Apprentice - TEST BORING LABORER (Laborers Foundation & Marine)						
Effective Date - 12/01/2011						
Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	60	\$18.99	\$7.10	12.60	\$0.00	\$38.69
2	70	\$22.16	\$7.10	12.60	\$0.00	\$41.86
3	80	\$25.32	\$7.10	12.60	\$0.00	\$45.02
4	90	\$28.49	\$7.10	12.60	\$0.00	\$48.19

Notes:

Apprentice to Journeyworker Ratio:1:3

TRACTORS/PORTABLE STEAM GENERATORS <i>OPERATING ENGINEERS LOCAL 4</i>	12/01/2011	\$39.16	\$10.00	\$12.40	0.00	\$61.56
	06/01/2012	\$39.72	\$10.00	\$12.40	0.00	\$62.12
	12/01/2012	\$40.34	\$10.00	\$12.40	0.00	\$62.74
	06/01/2013	\$41.11	\$10.00	\$12.40	0.00	\$63.51
	12/01/2013	\$41.89	\$10.00	\$12.40	0.00	\$64.29
TRAILERS FOR EARTH MOVING EQUIPMENT <i>TEAMSTERS JOINT COUNCIL NO. 10 ZONE A</i>	12/01/2011	\$31.82	\$8.56	\$7.27	0.00	\$47.65
	06/01/2012	\$32.12	\$8.56	\$7.27	0.00	\$47.95
	08/01/2012	\$32.12	\$8.91	\$7.27	0.00	\$48.30
	12/01/2012	\$32.42	\$9.07	\$8.00	0.00	\$49.49
TUNNEL WORK - COMPRESSED AIR <i>LABORERS (COMPRESSED AIR)</i>	12/01/2011	\$44.08	\$7.10	\$13.00	0.00	\$64.18
TUNNEL WORK - COMPRESSED AIR (HAZ. WASTE) <i>LABORERS (COMPRESSED AIR)</i>	12/01/2011	\$46.08	\$7.10	\$13.00	0.00	\$66.18
TUNNEL WORK - FREE AIR <i>LABORERS (FREE AIR TUNNEL)</i>	12/01/2011	\$36.15	\$7.10	\$13.00	0.00	\$56.25

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Awarding Authority: City of Cambridge Purchasing Department
Contract Number: 5816 **City/Town:** CAMBRIDGE
Description of Work: Infrastructure Improvements - Includes, but is not limited to the construction of sewers & drains ranging in size from 10inch to 48inch in diameter;
Job Location: Western Avenue

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
TUNNEL WORK - FREE AIR (HAZ. WASTE) <i>LABORERS (FREE AIR TUNNEL)</i>	12/01/2011	\$38.15	\$7.10	\$13.00	0.00	\$58.25
VAC-HAUL <i>TEAMSTERS JOINT COUNCIL NO. 10 ZONE A</i>	12/01/2011	\$31.24	\$8.56	\$7.27	0.00	\$47.07
	06/01/2012	\$31.54	\$8.56	\$7.27	0.00	\$47.37
	08/01/2012	\$31.54	\$8.91	\$7.27	0.00	\$47.72
	12/01/2012	\$31.84	\$8.91	\$8.00	0.00	\$48.75
WAGON DRILL OPERATOR <i>LABORERS - ZONE 1</i>	12/01/2011	\$32.05	\$7.10	\$12.45	0.00	\$51.60
WASTE WATER PUMP OPERATOR <i>OPERATING ENGINEERS LOCAL 4</i>	12/01/2011	\$39.52	\$10.00	\$12.40	0.00	\$61.92
	06/01/2012	\$40.09	\$10.00	\$12.40	0.00	\$62.49
	12/01/2012	\$40.71	\$10.00	\$12.40	0.00	\$63.11
	06/01/2013	\$41.49	\$10.00	\$12.40	0.00	\$63.89
	12/01/2013	\$42.27	\$10.00	\$12.40	0.00	\$64.67
WATER METER INSTALLER <i>PLUMBERS & GASFITTERS LOCAL 12</i>	03/01/2012	\$46.81	\$9.32	\$13.29	0.00	\$69.42
	09/01/2012	\$48.06	\$9.32	\$13.29	0.00	\$70.67
	03/01/2013	\$49.31	\$9.32	\$13.29	0.00	\$71.92
Outside Electrical - East						
CABLE TECHNICIAN (Power Zone) <i>OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104</i>	08/29/2011	\$27.11	\$6.70	\$1.50	0.00	\$35.31
CABLEMAN (Underground Ducts & Cables) <i>OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104</i>	08/29/2011	\$38.41	\$6.70	\$1.00	0.00	\$46.11
DRIVER / GROUNDMAN CDL <i>OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104</i>	08/29/2011	\$31.63	\$6.70	\$2.50	0.00	\$40.83
DRIVER / GROUNDMAN -Inexperienced (<2000 Hrs) <i>OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104</i>	08/29/2011	\$24.85	\$6.70	\$1.50	0.00	\$33.05
EQUIPMENT OPERATOR (Class A CDL) <i>OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104</i>	08/29/2011	\$38.41	\$6.70	\$5.00	0.00	\$50.11
EQUIPMENT OPERATOR (Class B CDL) <i>OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104</i>	08/29/2011	\$33.89	\$6.70	\$2.75	0.00	\$43.34

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Awarding Authority: City of Cambridge Purchasing Department
Contract Number: 5816 **City/Town:** CAMBRIDGE
Description of Work: Infrastructure Improvements - Includes, but is not limited to the construction of sewers & drains ranging in size from 10inch to 48inch in diameter;
Job Location: Western Avenue

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
GROUNDMAN <i>OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104</i>	08/29/2011	\$24.85	\$6.70	\$1.00	0.00	\$32.55
GROUNDMAN -Inexperienced (<2000 Hrs.) <i>OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104</i>	08/29/2011	\$20.34	\$6.70	\$0.75	0.00	\$27.79
JOURNEYMAN LINEMAN <i>OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104</i>	08/29/2011	\$45.19	\$6.70	\$7.86	0.00	\$59.75

Apprentice - LINEMAN (Outside Electrical) - East Local 104

Effective Date - 08/29/2011

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	60	\$27.11	\$6.70	2.11	\$0.00	\$35.92
2	65	\$29.37	\$6.70	2.36	\$0.00	\$38.43
3	70	\$31.63	\$6.70	2.86	\$0.00	\$41.19
4	75	\$33.89	\$6.70	3.36	\$0.00	\$43.95
5	80	\$36.15	\$6.70	3.86	\$0.00	\$46.71
6	85	\$38.41	\$6.70	4.36	\$0.00	\$49.47
7	90	\$40.67	\$6.70	5.36	\$0.00	\$52.73

Notes:

Apprentice to Journeyworker Ratio:1:2

TELEDATA CABLE SPLICER <i>OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104</i>	07/18/2011	\$25.94	\$4.18	\$2.78	0.00	\$32.90
	07/16/2012	\$26.33	\$4.18	\$2.79	0.00	\$33.30
TELEDATA LINEMAN/EQUIPMENT OPERATOR <i>OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104</i>	07/18/2011	\$24.42	\$4.18	\$2.73	0.00	\$31.33
	07/16/2012	\$24.78	\$4.18	\$2.74	0.00	\$31.70
TELEDATA WIREMAN/INSTALLER/TECHNICIAN <i>OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104</i>	07/18/2011	\$24.42	\$4.18	\$2.73	0.00	\$31.33
	07/16/2012	\$24.78	\$4.18	\$2.74	0.00	\$31.70

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Awarding Authority: City of Cambridge Purchasing Department
Contract Number: 5816 **City/Town:** CAMBRIDGE
Description of Work: Infrastructure Improvements - Includes, but is not limited to the construction of sewers & drains ranging in size from 10inch to 48inch in diameter;
Job Location: Western Avenue

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
TREE TRIMMER <i>OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104</i> This classification applies only to the trimming of branches on and around utility lines.	02/01/2009	\$16.59	\$2.42	\$0.00	0.00	\$19.01
TREE TRIMMER GROUNDMAN <i>OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104</i> This classification applies only to the trimming of branches on and around utility lines.	02/01/2009	\$14.64	\$2.42	\$0.00	0.00	\$17.06

Additional Apprentices 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) unless otherwise specified.

- * Ratios are expressed in allowable number of apprentices to journeymen or fraction thereof.
- ** 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.

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SECTION 00680

DIVISION OF LABOR AND STATEMENT OF COMPLIANCE

The Statement of Compliance and the Weekly Payroll Report Form that are required for work performed under this Contract are included on the following pages.

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MASSACHUSETTS WEEKLY CERTIFIED PAYROLL REPORT FORM



Company's Name:			Address:				Phone No.:			Payroll No.:								
Employer's Signature:			Title:				Contract No.:		Tax Payer ID No.:		Work Week Ending:							
Awarding Authority's Name:			Public Works Project Name:				Public Works Project Location:			Min. Wage Rate Sheet No.:								
General / Prime Contractor's Name:			Subcontractor's Name:				"Employer" Hourly Fringe Benefit Contributions											
Employee Name & Complete Address	Employee is OSHA 10 Certified (?)	Work Classification:	Appr. Rate (%)	Worked Hours							Project Hours (A) All Other Hours	Hourly Base Wage (B)	Health & Welfare Insurance (C')	ERISA Pension Plan (D)	Supp. Unemp. (E)	(B+C+D+E) Total Hourly Prev. Wage (F)	(A x F) Project Gross Wages (G) Total Gross Wages	Check No. (H)
				Su.	Mo.	Tu.	We.	Th.	Fr.	Sa.								

NOTE: Pursuant to MGL Ch. 149 s.27B, every contractor and subcontractor is required to submit a "true and accurate" copy of their weekly payroll records directly to the awarding authority. Failure to comply may result in the commencement of a criminal action or the issuance of a civil citation.

Date recieved by awarding authority / /
--

**WEEKLY PAYROLL RECORDS REPORT
& STATEMENT OF COMPLIANCE**

In accordance with Massachusetts General Law c. 149, §27B, a true and accurate record must be kept of all persons employed on the public works project for which the enclosed rates have been provided. A Payroll Form has been printed on the reverse of this page and includes all the information required to be kept by law. Every contractor or subcontractor is required to keep these records and preserve them for a period of three years from the date of completion of the contract.

In addition, every contractor and subcontractor is required to submit a copy of their weekly payroll records to the awarding authority. For every week in which an apprentice is employed, a photocopy of the apprentice's identification card must be attached to the payroll report. Once collected, the awarding authority is also required to preserve those records for three years.

In addition, each such contractor, subcontractor, or public body shall furnish to the awarding authority directly, within fifteen days after completion of its portion of the work a statement, executed by the contractor, subcontractor or public body who supervises the payment of wages, in the following form:

<p>STATEMENT OF COMPLIANCE</p> <p style="text-align: center;">_____, 20____</p> <p>I, _____, _____</p> <p style="text-align: center;">(Name of signatory party) (Title)</p> <p>do hereby state:</p> <p style="text-align: center;">That I pay or supervise the payment of the persons employed by</p> <p>_____ on the _____</p> <p style="text-align: center;">(Contractor, subcontractor or public body) (Building or project)</p> <p>and that all mechanics and apprentices, teamsters, chauffeurs and laborers employed on said project have been paid in accordance with wages determined under the provisions of sections twenty-six and twenty-seven of chapter one hundred and forty nine of the General Laws.</p> <p style="text-align: right;">Signature _____</p> <p style="text-align: right;">Title _____</p>
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SECTION 00800
GENERAL TERMS AND CONDITIONS OF THE CONTRACT
FOR CONSTRUCTION, RECONSTRUCTION, ALTERATION,
REMODELING, OR REPAIR OF ANY
CITY OF CAMBRIDGE PUBLIC WORK
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GENERAL TERMS AND CONDITIONS OF THE CONTRACT

FOR CONSTRUCTION, RECONSTRUCTION, INSTALLATION, DEMOLITION, MAINTENANCE, OR REPAIR OF ANY CITY OF CAMBRIDGE PUBLIC WORK

ARTICLE 1 DEFINITIONS

1.1 In General

1.1.1 **Well-known meanings.** When words or phrases, which have a well-known technical or construction industry or trade meaning, are used in the Contract Documents, such words or phrases shall be interpreted in accordance with that meaning, unless otherwise stated.

1.1.2 **Capitalization.** The words and terms defined in this Article are capitalized in these General Terms and Conditions of the Contract. Other capitalized words may refer to a specific document found in the Contract Documents.

1.1.3 **Persons.** Whenever the word person or persons is used, it includes, unless otherwise stated, entity or entities, respectively, including, but not limited to, corporations, partnerships, and joint ventures.

1.1.4 **Singular and Plural.** The following terms have the meanings indicated which are applicable to both the singular and the plural thereof.

1.2. Definitions

1.2.1 **Agreement-**The Agreement is the written document between the **City** and the **Contractor** which is titled: Agreement between the City of Cambridge and the Contractor, which is the executed portion of the Contract, and which forms a part of the Contract. The Agreement also includes all documents required to be attached thereto, including, but not limited to, the performance bond, the labor and materials or payment bonds, certificates of insurance, and all Modifications of the Agreement.

1.2.2 **Change Order-**A Change Order is a document which is signed by the **Contractor**, the **Engineer**, and the **City**; which is directed to the **Contractor**; which authorizes the **Contractor** to make an addition to, a deletion from or a revision in the Work, or an adjustment in the Contract Sum or in the Contract Time; and which is issued on or after the date of the Agreement between the **Contractor** and the **City**.

1.2.3 **City-** The **City** refers to the City of Cambridge, which is the owner of the Project and is the public awarding authority with whom the **Contractor** has entered into the Contract and for whom the Work is to be provided.

1.2.4 **Claim-**A Claim is a dispute, demand, or assertion by one of the parties arising out of or relating to the Contract for which such party is seeking relief.

1.2.5 **Contract-**The Contract consists of all the Contract Documents. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations, or agreements, either written or oral. The Contract may be amended or modified only by a Modification to the Contract signed by both parties.

1.2.6 **Contract Documents-**The Contract Documents consist of the Agreement; the notice of award of the Contract; the Notice to Proceed; the entire Project Manual; Change Orders; Work Change Directives; the **Contractor's** Bid and all accompanying documents accepted by the City; and the **Engineer's** written interpretations and clarifications issued on or after the issuance of the Notice to Proceed. Shop Drawing

submittals and reports or drawings utilized by the **Engineer** in preparing the Contract Documents are not Contract Documents.

1.2.7 **Contractor**-The **Contractor** is the person who is awarded the Contract for the Project herein pursuant to M.G.L. c. 39, §39M; and is identified in the Agreement as such. The term “**Contractor**” is intended to include the **Contractor** as well as its authorized representative(s).

1.2.8 **Contract Sum**-The Contract Sum is the total amount stated in the Agreement payable by the **City** to the **Contractor** for the completion of the Work in accordance with the Contract Documents.

1.2.9 **Contract Time**-Unless otherwise provided, the Contract Time is the number of days allotted in the Contract Documents or the dates stated in the Agreement, including authorized adjustments, for Substantial Completion.

1.2.10 **Coordination Drawings**-Coordination Drawings are those drawings which are prepared by the **Contractor** or a Subcontractor which show the exact alignment, physical locations, and configuration of the mechanical, electrical, and fire protection installations.

1.2.11 **Day**-The term “day” shall mean calendar day unless otherwise stated.

1.2.12 **Engineer**-The **Engineer** is the person lawfully licensed to practice engineering and has been selected by the **City** to administer the Contract. The term “**Engineer**,” while referred to in the singular, means the **Engineer** and/or the **Engineer's** representative.

1.2.13 **Field Order**-A Field Order is a written order issued by the **Engineer** which orders minor changes in the Work, but which does not involve a change in the Contract Sum or the Contract Time.

1.2.14. **Final Completion**-Final Completion is the point in time when the Engineer certifies that the Work has been fully completed in accordance with the Contract Documents. Final Completion shall be no later than thirty (30) days after Substantial Completion.

1.2.15 **General Requirements**-General Requirements refer to Sections of Division 1 of the Specifications.

1.2.16. **Modification**-A Modification is a written instrument which amends the Contract after execution of the Agreement.

1.2.17 **Notice to Proceed**-A Notice to Proceed is a written notice given by the **City**, or the **Engineer**, to the **Contractor** fixing the date on which the Contract Time will begin to run and on which the **Contractor** shall start to perform its obligations under the Contract Documents.

1.2.18 **Drawings**-The Drawings are the graphic and pictorial portions of the Contract Documents, wherever located and whenever issued, showing the design, location, dimensions, scope, extent, and character of the Work to be furnished and performed by the **Contractor** and which have been prepared or approved by the **Engineer**.

1.2.19 **Product Data**-Product Data are illustrations, standard schedules, performance charts, instructions, brochures, diagrams, and other information furnished by the General **Contractor** to illustrate materials or equipment for some portion of the Work. Product Data are not considered part of the Contract Documents.

1.2.20 **Project**-The Project is the total Work to be provided under the Contract Documents and may be the whole or a part as indicated elsewhere in the Contract Documents and may include construction by the

City or by separate contractors. The Project is the Work described in the invitation to bid (advertisement) and Specifications and illustrated by the Drawings, including any Modifications.

1.2.21. **Project Manual**-The Project Manual is the entire set of bidding documents which includes, but is not limited to, the invitation to bid (advertisement), the instructions to bidders, all of the forms, the wage rates, all City and state requirements, the General Terms and Conditions of the Contract, any supplementary conditions thereto, the Drawings, the Specifications, and all addenda.

1.2.22 **Proposed Change Order**-A Proposed Change Order is a Change Order that has been submitted by the **Contractor** to the **Engineer**, is under review, and has not been approved by the **City**.

1.2.23 **Samples**-Samples are 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. Samples are not considered part of the Contract Documents.

1.2.24 **Shop Drawings**-Shop Drawings are all drawings, diagrams, illustrations, schedules, and other information which are specifically prepared or assembled by or for the **Contractor** and submitted by the **Contractor** to illustrate some portion of the Work. Shop Drawings are not considered part of the Contract Documents.

1.2.25 **Site**-The Site is the location of the Project and of the Work.

1.2.26 **Specifications**-Specifications are those portions of the Contract Documents consisting of written technical descriptions of materials, equipment, construction systems, standards, and workmanship as applied to the Work and certain administrative details applicable thereto.

1.2.27 **Subcontractor**-A Subcontractor is a person, firm or corporation who contracts directly with the **Contractor**, unless otherwise stated.

1.2.28 **Submittals**-Submittals are those Shop Drawings, Product Data, Samples, or any other required document which are provided to the Engineer for review and approval.

1.2.29 **Substantial Completion**-Substantial Completion means that the Work has been completed and the Site or the facility is opened to public use, except for minor incomplete or unsatisfactory items that do not materially impair the usefulness of the Work. The **Engineer** shall decide what constitutes “minor,” “incomplete,” “unsatisfactory,” and “materially” and the **Engineer's** decision shall be final.

1.2.30 **Sub-subcontractor**-A Sub-subcontractor is a person who has contracted directly with a Subcontractor.

1.2.31 **Supplier**-A Supplier is a manufacturer, fabricator, distributor, material, person, or vendor having a direct contract with the Contractor or with any Subcontractor to furnish materials or equipment to be incorporated into the Work by the Contractor or any Subcontractor.

1.2.32 **Work**-Work refers to the services and the entire completed construction or the various separately identifiable parts thereof required by the Contract Documents, including all labor, materials, and equipment furnished, furnished and incorporated into the Project, or to be provided by the **Contractor** to fulfill the **Contractor's** obligations. The Work may constitute the whole or a part of the Project.

1.2.33 **Work Change Directive**-A Work Change Directive is a written directive to the **Contractor** ordering an addition to, a deletion from, or a revision to the Work issued on or after the date of the Agreement, signed by the City, and recommended by the Engineer.

ARTICLE 2 ABOUT THE CONTRACT DOCUMENTS

2.1 Priority/Conflict

2.1.1 Priority Among Contract Documents. In the event of conflict among the Contract Documents, the Contract Documents shall be construed according to the following priorities “except as may otherwise be specifically stated”:

Highest Priority:	Modifications
Second Priority:	Agreement
Third Priority:	Addenda-later date to take precedence
Fourth Priority:	Supplementary General Conditions
Fifth Priority:	General Conditions
Sixth Priority:	Drawings and Specifications

2.1.1.1 If there is a conflict between the Drawings and Specifications, the figured dimensions shall govern over the scaled dimensions. Detailed Drawings shall govern over the general Drawings. Larger scale Drawings shall take precedence over smaller scale Drawings. Drawings shall govern over Shop Drawings. Whenever there is a conflict concerning quality or quantity between or among notes, specifications, dimensions, details, or schedules in the Specifications or in the Drawings, or between the Specifications and the Drawings, or in all other instances not specifically noted above, the Contractor shall provide, unless otherwise directed by a Modification of the Contract, the better quality or greater quantity of Work at no increase in the Contract Sum or in the Contract Time.

2.1.1.2 Compliance with these priority conditions shall not justify any changes in the Work or any increase in the Contract Sum or Contract Time, unless any such compliance results in Work that may not be reasonably inferred from the Contract Documents as being required to produce the intended result as determined by the Engineer.

2.1.2 Review of the Contract Documents and Field Conditions and Discovery of Conflict, Error, Ambiguity, or Discrepancy. Before starting the Work, and during the progress thereof, the Contractor shall carefully study and compare the Contract Documents with each other and with the information furnished by the City pursuant to Article 3 and shall at once report to the Engineer any error, inconsistency, or omission the Contractor may discover. Any necessary change shall be ordered as provided in Article 11, subject to the requirements of any other provisions of the Contract Documents. The Contractor shall not proceed with the Work affected thereby (except in an emergency) until a Modification has been issued. If the Contractor proceeds with the Work having discovered such errors, inconsistencies, or omissions contrary to the provisions contained herein, or if by reasonable study of the Contract Documents the Contractor could have discovered such, the Contractor shall bear all costs arising therefrom. The Contractor shall be liable to the City for failure to report any conflict, error, ambiguity, or discrepancy, of which it knew or should have known.

2.1.3 Field Measurements. The Contractor shall take field measurements and verify field conditions and shall carefully compare such field measurements and conditions and other information known to the Contractor with the Contract Documents before commencing activities. Errors, inconsistencies, or omissions discovered shall be reported to the Engineer at once.

2.1.4 Statutory Provisions. The City and the Contractor recognize that other rights duties and obligations with respect to public construction contracts are provided for by statute, notwithstanding the fact that they may not be provided for in the Contract Documents. In case of conflict between the statutory

provisions and other provisions of the Contract Documents and the provisions of any applicable statute, the statutory provisions shall govern.

2.1.5 Voided or Unlawful Provisions. In the event any provision in the Contract is voided or deemed unlawful, such provision shall be deleted without affecting the remainder of the Contract.

2.2 Execution

2.2.1 Execution of the Agreement by the Contractor is a representation that the Contractor has visited the Site, become familiar with local conditions under which the Work is to be performed, and correlated personal observations with requirements of the Contract Documents.

2.3 Intent

2.3.1 Entire Agreement. The Contract Documents comprise the entire agreement between the City and the Contractor concerning the Work. The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary; what is required by one shall be as binding as if required by all. Performance by the Contractor shall be required only to the extent consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the intended results. All Work mentioned or indicated in the Contract Documents shall be performed by the Contractor as part of this Contract unless it is specifically indicated in the Contract Documents that such Work is to be done by others.

2.3.2 Statutory Provisions. Each and every provision of law, code, and regulation, 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.

2.3.3 Functionally Complete Project. It is the intent of the Contract Documents to describe a functionally complete Project. The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. Any Work, materials, or equipment that may be reasonably inferred from the Contract Documents or from prevailing custom or trade usage as being required to produce the intended result will be furnished and performed by the Contractor whether or not specifically called for in the Contract Documents.

2.3.4 Indications or Notations. All indications or notations which apply to one of a number of similar situations, materials, or processes shall be deemed to apply to all such situations, materials, or processes wherever they appear in the Work, except where a contrary result is clearly indicated by the Contract Documents.

2.3.5 Standards or Quality of Materials or Workmanship. Where no explicit quality or standards for materials or workmanship are established for Work, such Work is to be of good quality for the intended use and consistent with the quality of the surrounding Work and of the construction of the Project generally.

2.3.6 Manufactured Products. All manufactured articles, materials, and equipment shall be applied, installed, connected, erected, used, cleaned, and conditioned in accordance with the manufacturer's written or printed directions and instructions unless otherwise indicated in the Contract Documents.

2.3.9 Tests. When test boring or soil test information are included with the Contract Documents or otherwise made available to the Contractor and such test boring or soil test information was obtained by the City for use by the Engineer in the design of the Project or Work, the City does not hold out such

information to the Contractor as an accurate or approximate indication of subsurface conditions, and no claim for extra cost of extension of time resulting from a reliance by the Contractor on such information shall be allowed except as otherwise provided herein. Any such reports are not part of the Contract Documents.

2.3.10 Joining Work. Where the Work is to fit with existing conditions or work to be performed by others, the Contractor shall fully and completely join the Work with such conditions or work, unless otherwise specified.

2.4 Organization

2.4.1 Except as provided in M.G.L. c. 149, §44F, the organization of the Specifications into divisions, sections, and articles, and the arrangement of Drawings shall not control the Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be performed by any trade.

2.5 References

2.5.1 Where codes, manuals, specifications, standards, requirements and publications of public and private bodies are referred to in the Contract Documents whether specifically or by implication, references shall be understood to be to the latest revision prior to the date of receiving bids, except where otherwise indicated. Where statutes are referred to in the Contract Documents whether specifically or by implication, references shall be understood to be to the latest revision.

2.5.2 References herein to particular paragraphs or Articles are solely to facilitate finding additional information with regard to the specific matters and are not to be construed in any way as limiting the possible paragraphs and Articles in which such matters may be found elsewhere in this document.

2.6 Reuse of Engineer's Written Instruments

2.6.1 Neither the Contractor nor any Subcontractor or Supplier shall have or acquire any title to or ownership rights in any of the Drawings, Specifications, or other documents prepared by the Engineer and shall not reuse any of such Drawings, Specifications, or other documents without prior written consent of the City and the Engineer.

2.7 Written Material of the Contractor

2.7.1 All written material prepared or collected by the Contractor in the course of completing the Work shall be the exclusive property of the City and shall not be used by the Contractor for any purpose other than the purpose of this Contract.

2.8 Modifying Words

2.8.1 In the interest of simplicity, modifying words such as "all" and "any" may be omitted, but the fact that such words may be absent from one sentence and appear in another is not intended to affect the interpretation of either statement.

2.9 Use of Certain Words and Terms

2.9.1 Whenever in the Contract Documents the terms "as ordered," "as directed," "as required," "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 a requirement, direction, review, or judgment of the City or of the Engineer as to the Work, it is intended that such requirement, direction, review, or judgment 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). As used herein, "provided" shall be understood to mean "provided complete and in place"; that is, "furnished and installed, complete."

2.9.2 The use of any such term or adjective shall not be effective to change the duties and responsibilities of the City or the Engineer from those assigned in the Contract Documents or to assign any duty or authority to supervise or direct the furnishing or performance of the Work or any duty or authority to undertake responsibility contrary to the provisions of the Contract Documents.

2.9.3 When the words "Contractor," "Subcontractor," "Sub-subcontractor," and "Supplier" are used, they are intended to include their employees and agents, unless otherwise specified.

2.10 Modification of the Contract Documents

2.10.1 Major Modifications. Major Modifications may affect the Contract Sum or the Contract Time. The Contract Documents may be amended to provide for additions, deletions, and revisions in the Work or to modify the terms and conditions thereof in one or more of the following ways, all of which must contain a written endorsement by the City:

2.10.1.1 A formal written amendment;

2.10.1.2 A Change Order;

2.10.1.3 A Work Change Directive; or

2.10.1.4 The Engineer's written interpretation, clarification, or decision.

2.10.2 Minor Modifications. Minor modifications do not affect the Contract Sum or the Contract Time. The requirements of the Contract Documents may be supplemented and minor variations and deviations of the Work may be authorized in one or more of the following ways:

2.10.2.1 A Field Order; or

2.10.2.2 The Engineer's approval of a Shop Drawing or Sample.

ARTICLE 3 THE CITY

3.1 Signatory

3.1.1 All documents which require a signature or an endorsement by the City must be signed by the City Manager in order to be deemed ratified by the City.

3.2 Requirements to Provide Documents

3.2.1 To the extent they are available, the City shall furnish surveys describing physical characteristics, legal limitations, and utility locations for the site of the Project, and a legal description of the Site.

3.2.2 The City shall obtain and pay for necessary approvals, easements, assessments, and charges, which are customarily secured prior to the execution of the Contract.

3.2.3 The City shall furnish information or services required of the City hereunder with reasonable promptness after receipt from the Contractor of a written request for such information or services.

3.2.4 The City shall provide the Contractor, at no charge, such copies of the Project Manual as are reasonably necessary for the execution of the Work.

3.3 Clerk of the Works

3.3.1 The City may engage a Clerk of the Works for this Project, in which case the City shall, upon request of the Contractor, provide the Contractor with a written statement of the duties, responsibilities, and limitations of authority of such Clerk of the Works. Except as expressly set forth in such written statement, the Clerk of the Works shall have no authority to approve Work, to approve Change Orders, or to exercise any of the power and authority of the City or the Engineer. The Clerk of the Works shall observe the Contractor's operations and construction activities for compliance with the Drawings and Specifications. The Clerk of the Works shall have access to all areas of the Project at all times. The Contractor shall fully cooperate with the Clerk of the Works in the performance of the Clerk's duties.

3.4 City's Right to Perform Construction and to Award Separate Contracts.

3.4.1 The City reserves the right to perform construction or operations at the Site with its own forces or others. If the Contractor claims that a delay or additional cost is involved because of such action by the City, the Contractor shall make such Claim as provided elsewhere in the Contract Documents.

3.4.2 When the separate contracts are awarded for different portions of the Project or other construction or operations on the site, the term "Contractor" in the Contract Documents in each case shall mean the Contractor who executes each separate City-Contractor Agreement.

3.4.3 The City shall provide for coordination of the activities of the City's own forces and of each separate contractor with the Work of the Contractor, who shall cooperate with them. The Contractor shall afford each other person access to the Site and shall properly coordinate its Work with that of the persons performing other work. The Contractor shall participate with other separate contractors and the City in reviewing their construction schedules when directed to do so. The Contractor shall make any revisions to the construction schedules deemed necessary after a joint review and mutual agreement. The construction schedules shall then constitute the schedules to be used by the Contractor, separate contractors, and the City until subsequently revised.

3.5 Limitations on the City's Responsibilities

3.5.1 The City shall not supervise, direct, or have control or authority over, nor be responsible for the Contractor's means, methods, techniques, sequences, or procedures of construction or the safety precautions and programs incident thereto, or for any failure of the Contractor to comply with laws, codes and regulations applicable to the furnishing or performance of the Work. The City will not be responsible for the Contractor's failure to perform or furnish the Work in accordance with the Contract Documents. The

City is not responsible for the acts or omissions of the Contractor, any Subcontractor, Supplier, or anyone for whose acts the Contractor, any Subcontractor or Suppliers may be liable.

3.5.2 The City's authority to review any of the Contractor's progress schedules, or its decision to raise or not to raise any objections about such schedules shall not impose on the City any responsibility for the timing, planning, scheduling, or execution of the Work, nor in any way give rise to any duty or responsibility on the part of the City to exercise this authority for the benefit of the Contractor, any Subcontractor or Supplier or any other party.

3.5.3 The City's decision to raise or not to raise objections with regard to any aspects of the Contractor's insurance shall in no way give rise to any duty or responsibility on the part of the City to or for the benefit of the Contractor, any Subcontractor, any Supplier, or any other party.

3.6 Reservation of Rights

3.6.1 The City reserves the right to correct at any time any error in any progress payment that may have been made.

3.6.2 Should defective Work be discovered subsequent to final payment, the City reserves the right to make a claim and recover all costs and professional fees associated therewith, including the cost of removing and/or replacing the defective Work.

3.7 Waivers

3.7.1 All waivers by the City are valid only to the extent that they are signed by the City. Any such waivers pertain only to the specific matter contained in the waiver and not to any similar, subsequent matters.

ARTICLE 4 THE ENGINEER

4.1 City's Representative

4.1.1 The Engineer is the City's representative (1) during construction, (2) until final payment is due, and (3) with the City's concurrence, from time to time during the correction period described in Article 10. The Engineer will advise and consult with the City. The Engineer will have authority to act on behalf of the City only to the extent provided in the Contract Documents, unless otherwise modified by a written instrument in accordance with other provisions of the Contract.

4.1.2 The duties, responsibilities, and the limitations of authority of the Engineer as the City's representative during construction are set forth in the Contract Documents and shall not be extended without the written consent of the City and the Engineer.

4.2 Administration of the Contract

4.2.1 The Engineer will provide administration of the Contract as described in the Contract Documents, unless the City has engaged a construction manager.

4.3 Visits to the Site

4.3.1 The Engineer will visit the site at intervals appropriate to the stage of construction to become generally familiar with the progress and quality of the completed Work and to determine in general if the

Work is being performed in a manner indicating that the Work, when completed, will be in accordance with the Contract Documents. However, the Engineer will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. On the basis of on-site observations as an engineer, the Engineer will keep the City informed of progress of the Work in writing and will endeavor to guard the City against defects and deficiencies in the Work.

4.4 Communications Facilitating Contract Administration

4.4.1 Except as otherwise provided in the Contract Documents or when direct communications have been specially authorized, the City and the Contractor shall endeavor to communicate through the Engineer. Communications by and with the Engineer's consultants shall be through the Engineer. Communications by and with Subcontractors and Suppliers shall be through the Contractor. Communications by and with City employees and separate contractors shall be through the City.

4.4.2 When it deems it necessary or expedient, the City may communicate directly with the Contractor, any Subcontractors, Suppliers, or consultants.

4.5 Certification of Applications for Payment

4.5.1 Based on the Engineer's observations and evaluations of the Contractor's applications for payment, the Engineer will review and certify the amounts due the Contractor and will issue certificates for payment in such amounts.

4.6 Rejection of Work

4.6.1 The Engineer will have authority to reject or disapprove Work which (1) does not conform to the Contract Documents; (2) which the Engineer believes to be defective; and (3) the 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. Whenever the Engineer considers it necessary or advisable for implementation of the intent of the Contract Documents, the Engineer will have authority to require additional inspection or testing of the Work in accordance with Article 9, whether or not such Work is fabricated, installed, or completed. However, neither this authority of the Engineer nor a decision made in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Engineer to the Contractor, Subcontractors, Suppliers, or other persons performing portions of the Work.

4.7 Review of Submittals

4.7.1 The Engineer will review or take other appropriate action upon the Contractor's submittals such as Shop Drawings, Product Data, and Samples, but only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents and only to the extent which the Engineer believes desirable to protect the City's interest. The Engineer's action will be taken with reasonable promptness, while allowing sufficient time in the Engineer's professional judgment to permit adequate review, taking into account the time periods set forth in the latest schedule prepared by the Contractor and approved by the Engineer. Review of such submittals is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of the Contractor as required by the Contract Documents. The Engineer's review of the Contractor's submittals shall not relieve the Contractor of the obligations under Article 5. The Engineer's review shall not constitute approval of safety precautions or of any construction means, methods, techniques, sequences, or procedures. The Engineer's approval of a specific item shall not indicate approval of an assembly of which the item is a component. After the rejection of the second resubmittal of any one Submittal, the Contractor shall bear the cost of the review of each subsequent resubmittal.

4.8 Preparation of Change Orders and Work Change Directives

4.8.1 The Engineer will prepare Change Orders and Work Change Directives and may authorize minor Modifications in the Work as provided in Article 11.

4.9 Inspections

4.9.1 The Engineer will conduct inspections to determine the date or dates of Substantial Completion and the date of final completion; will receive and forward to the City for the City's review and records written warranties and related documents required by the Contract and assembled by the Contractor; and will issue a final certificate for payment upon the Contractor's compliance with all of the requirements of the Contract Documents.

4.10 Interpretations, Clarifications, and Decisions

4.10.1 The Engineer will interpret and decide matters concerning performance under and requirements of the Contract Documents on written request of either the City or the Contractor. The Engineer's response to such requests will be made with reasonable promptness and within the time set forth in the Agreement between the City and the Engineer. Any such written interpretations, clarifications, and decisions shall be binding on the Contractor.

4.10.2 Interpretations, clarifications, and decisions of the Engineer will be consistent with the intent of and reasonably inferable from the Contract Documents and will be in writing or in the form of drawings. The Engineer will not be liable to the Contractor, any Subcontractor, or Supplier for results of interpretations, clarifications, or decisions so rendered in good faith.

4.10.3 The Engineer may, as the Engineer judges desirable, issue additional drawings or instructions indicating in greater detail the construction or design of the various parts of the Work; such drawings or instructions may be effected by a Field Order or other notice to the Contractor, and provided such drawings or instructions are reasonably consistent with the previously existing Contract Documents, the Work shall be executed in accordance with such additional drawings or instructions without any additional cost or an extension of the Contract Time.

4.10.4 The Engineer's decisions on matters relating to aesthetic effect must be consistent with the City's and will be final.

4.11 Limitation on the Engineer's Responsibilities

4.11.1 Neither the Engineer's authority to act under the provisions of the Contract Documents nor any decision made by the Engineer in good faith to exercise or not to exercise such authority shall give rise to any duty or responsibility of the Engineer to the Contractor, any Subcontractor, any Supplier, any surety for any of them or any other person.

4.11.2 The Engineer will not have control over or charge of and will not be responsible for construction means, methods, techniques, sequences, or procedures, or for safety precautions and programs in connection with the Work, since these are solely the Contractor's responsibility as provided in Article 5. The Engineer will not be responsible for the Contractor's failure to carry out the Work in accordance with the Contract Documents. The Engineer will not have control over or charge of and will not be responsible for acts or omissions of the Contractor, Subcontractors, Suppliers, or of any other persons performing portions of the Work.

ARTICLE 5 THE CONTRACTOR

5.1 Relationship with the City

5.1.1 The Contractor is an independent contractor and not an employee of the City. The Contractor is engaged by virtue of the Contract to perform only those services contained therein. The Contractor is not authorized to contract on behalf of the City or to incur any liability on the part of the City.

5.1.2. The **City** (1) shall not enter into a contract with, and shall not approve as a subcontractor furnishing labor and materials for a part of any such work, a foreign corporation which has not filed with such awarding authority a certificate of the state secretary stating that such corporation has complied with sections three and five of chapter one hundred and eighty-one and the date of such compliance, and (2) shall report to the state secretary and to the department of corporations and taxation any foreign corporation performing work under such contract or subcontract, and any person, other than a corporation, performing work under such contract or subcontract, and residing or having a principal place of business outside the commonwealth. (*Reference: M.G.L. c. 30, §39L*)

5.2 Code of Conduct

5.2.1 Chapter 2.117 of the Cambridge Municipal Code, Code of Conduct for City Officials and Employees, establishes standards of conduct for officials and employees of the City. The Contractor is subject to certain provisions contained therein. The Contractor shall familiarize itself with the ordinance and act accordingly.

5.3 Quality Assurance

5.3.1 The Contractor shall be responsible for ensuring that it, all Subcontractors, Suppliers, and all persons employed to do the Work under the Contract Documents perform in a professional manner, provide a high quality of service and Work, and perform in accordance with the Contract Documents.

5.4 Supervision

5.4.1 Competence and Efficiency. The Contractor shall supervise, inspect, and direct the Work competently and efficiently, devoting such attention thereto and applying such skills, attention and expertise as may be necessary to perform the Work in accordance with the Contract Documents.

5.4.2 Construction Means, Methods, Techniques, Etc. The Contractor shall be solely responsible for and have control over construction means, methods, techniques, sequences, and procedures and for coordinating all portions of the Work under the Contract. Where the Contract Documents refer to particular construction means, methods, techniques, sequences, or procedures or indicate or imply that such are to be used in the Work, such mention is intended only to indicate that the operations of the Contractor shall be such as to produce at least the quality of Work implied by the operations described. The actual determination of whether or not the described operations may be safely and suitably employed on the Work shall be the responsibility of the Contractor, who shall notify the Engineer in writing, prior to implementation, of the actual means, methods, techniques, sequences, or procedures which will be employed on the Work, if these differ from those mentioned in the Contract Documents. All loss, damage, liability or cost of correcting defective work arising from the employment of any construction means, methods, techniques, sequences, or procedures shall be borne by the Contractor, notwithstanding that such construction means, methods, techniques, sequences, or procedures are referred to, indicated or implied by the Contract Documents, unless the Contractor has given timely notice to the City and the Engineer in writing that such means, methods, techniques, sequences, or procedures are not safe or suitable, and the City has then instructed the Contractor in writing to proceed at the City's risk.

5.4.3 Variance between the Contract Documents and Statutes, Ordinances, Codes, Rules, and Regulations. The Contractor shall promptly notify the Engineer and the City in writing of any variances between the Contract Documents and statutes, ordinances, codes, rules, and regulations. If the Contractor, without written notice to the Engineer and the City, performs Work knowing that it is contrary to statutes, ordinances, codes, rules, and regulations, the Contractor shall assume full responsibility for such Work and shall bear the costs associated therewith, i.e., replacement, repairs, removal, and fines.

5.4.4 Acts and Omissions. The Contractor shall be responsible to the City for the acts and omissions of all persons performing or supplying the Work. The Contractor shall be as fully responsible to the City for the acts and omissions of the subcontractors, and of persons either directly or indirectly employed by them, as for the acts and omissions of persons directly employed by the Contractor.

5.4.5 Inspections. The Contractor shall be responsible for inspection of portions of Work already performed under this Contract to determine whether such portions are in proper condition to receive subsequent Work.

5.5 Personnel

5.5.1 Suitability. The Contractor shall provide competent, properly licensed and/or certified, suitably qualified, and reliable personnel to perform the Work required by the Contract Documents. The Contractor shall enforce strict discipline and maintain good order at the site at all times. The Contractor shall not employ any Subcontractor, Supplier, or other person, whether initially or as a substitute, against whom the City may have reasonable objection. Acceptance of any Subcontractor or other person by the City shall not constitute a waiver of any right of the City to reject defective Work.

5.5.2 Sexual Harassment. The City has a policy against sexual harassment. The Contractor, Subcontractors, and all other persons responsible for any portion of the Work are subject to the City's policy. The Contractor shall be responsible for any acts of sexual harassment committed by any persons responsible for any portion of the Work. The Contractor shall take appropriate action against any such individuals. Notwithstanding any remedial action taken by the Contractor, the City reserves the right to enforce its policy.

5.5.3 Weapons and Illegal Drugs. No weapons or illegal drugs are permitted on the Site. It is the responsibility of the Contractor to ensure that no weapons or illegal drugs are brought to the Site.

5.5.4 Maximum Work Day and Work Week. (Reference: M.G.L. c. 149, §§30 and 34). No laborer, worker, mechanic, foreperson or inspector working within this Commonwealth in the employ of the Contractor, Subcontractor or other person doing or contracting to do the whole or part of the work contemplated by the Contract, shall be required or permitted to work more than eight (8) hours in any one day or more than forty-eight (48) hours in any one week, or more than six (6) days in any one week, except in cases of emergency.

5.5.5 Lodging. (Reference: M.G.L. c. 149, §25). Every employee under this Contract shall lodge, board and trade where and with whom he or she elects, and neither the Contractor nor its agents or employees shall, either directly or indirectly, require as a condition of the employment of any person that the employee shall lodge, board or trade at a particular place or with a particular person.

5.5.6 Wage Rates. (Reference: M.G.L. c. 149, §27). Mechanics and apprentices, teamsters, chauffeurs and laborers performing Work shall be paid no less than the minimum rate of wages included in the Project Manual and which are made part of the Contract. They shall continue to be the minimum rate of wages for said employees during the life of the Contract. The Contractor shall keep a legible copy of the wage rates

posted in a conspicuous place at the site during the life of the Contract. These rates of wages shall include payments by employers to health and welfare plans, pension plans and supplementary unemployment benefit plans as provided in M.G.L. c. 149, §26; and such payments shall be considered as payments to persons under M.G.L. c. 149, §27 performing work as therein provided. If the Contractor does not make payments to a health and welfare plan, a pension plan and a supplementary unemployment benefit plan, where such payments are included in the rates of wages, the Contractor shall pay the amount of said payments directly to each employee engaged in the Work. If the Contractor pays less than the rate of wages, including payments to health and welfare funds and pension funds, or the equivalent payments in wages to any person performing Work within the classifications as determined by the Commissioner of Labor and Industries, and if the Contractor takes or receives for its own use or the use of any other person, as a rebate, refund or gratuity, or in any other guise, any part or portion of the wages, including payments to health and welfare funds and pension funds, or the equivalent payment in wages, paid to such person for Work done or service rendered on the Project, the Contractor will be subject to the penalties set forth in M.G.L. c. 149, §27.

5.5.7 Payroll Records of Employees. (Reference: M.G.L. c. 149, §27B). The Contractor and all Subcontractors who are subject to M.G.L. c. 149, §§27 and 27A shall keep a true and accurate record of all mechanics and apprentices, teamsters, chauffeurs, and laborers performing Work showing the name, address and occupational classification of each such employee, the hours worked by and the wages paid to all such employees. The Contractor and the Subcontractors shall submit a copy of said record to the City on a weekly basis.

5.5.7.1 (Reference: M.G.L. c. 149, §27B). The Contractor and all Subcontractors who are subject to M.G.L. c. 149, §§27 and 27A shall preserve their payroll records for a period of three (3) years from the date of completion of the Contract.

5.5.7.2 (Reference: M.G.L. c. 149, §27B). The Contractor and all Subcontractors who are subject to M.G.L. c. 149, §§27 and 27A shall furnish to the Commissioner of Labor and Industries and the City within fifteen (15) days after completion of their portion of the Work a statement executed by the Contractor or Subcontractor or by any authorized officer or employee of the Contractor or Subcontractor who supervises the payment of wages in the form found in M.G.L. c.149, §27B.

5.6 Superintendence

5.6.1 Employment of a Superintendent. The Contractor shall employ a competent, properly licensed superintendent, reasonably acceptable to the City, and necessary assistants who shall be in attendance at the Site full time during the progress of the Work until the date of Substantial Completion and for such additional time thereafter as the Engineer or the City may determine to be necessary for the expeditious completion of the Work.

5.6.2 Removal/Replacement of a Superintendent. The Contractor shall remove the superintendent if requested to do so in writing by the City and shall promptly replace such superintendent with a competent person reasonably acceptable to the City. The superintendent shall represent the Contractor, and communications given to the superintendent shall be as binding as if given to the Contractor. The Contractor shall not replace the superintendent without written notice to the City and the Engineer.

5.6.3 Registered Professional Engineer or Registered Land Surveyor. The Contractor shall retain a competent Registered Professional Engineer or Registered Land Surveyor, acceptable to the Engineer, who shall establish the exterior lines and required elevations of all structures to be erected on the site and shall establish sufficient lines and grades for the construction of associated Work such as, but not limited to, roads, utilities, and site grading. The Engineer or Land Surveyor shall certify as to the actual location of the constructed facilities in relation to property lines, building lines, easements, and other restrictive boundaries. See also, DWPC Construction Grants Policy Memorandum No. CG-3.

5.6.4 Building Grades, Lines, Etc. The Contractor shall establish the building grades; lines; levels; column, wall and partition lines required by the various Subcontractors in laying out their Work.

5.6.5 Coordination and Supervision. The Contractor shall coordinate and supervise the Work performed by Subcontractors to the end that the Work is carried out without conflict between trades and so that no trade, at any time, causes delay to the general progress of the Work. The Contractor and all Subcontractors shall at all times afford each trade, any separate contractor, or the City, every reasonable opportunity for the installation of Work and the storage of materials.

5.6.6 Job Meetings. There shall be job meetings held on a weekly basis, or more often if required by the City. The Contractor shall arrange for and attend weekly job meetings with the Engineer and such other persons as the Engineer may from time to time wish to have present. The Contractor shall be represented by a principal, project manager, general superintendent or other authorized main office representative, as well as by the Contractor's own superintendent. An authorized representative of any Subcontractor or Sub-subcontractor shall attend such meetings if the representative's presence is requested by the Engineer. Such representatives shall be empowered to make binding commitments on all matters to be discussed at such meetings, including costs, payments, Change Orders, time schedules and workforce power. Any notices required under the Contract may be served on such representatives.

5.7 Materials, Labor, Equipment, Etc

5.7.1 Provision of. Unless otherwise provided in the Contract Documents, the Contractor shall furnish and assume full responsibility for all 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 furnishing, performance, testing, start-up, and completion of the Work. It is understood that except as otherwise specifically stated in the Contract Documents, the Contractor shall provide and pay for temporary construction of every nature, and all other services and facilities of every nature whatsoever necessary to protect, execute, complete, and deliver the work within the specified time.

5.7.2 Quality and Use of. All materials and equipment shall be of good quality and new, except as otherwise provided in the Contract Documents. If required by the Engineer, the Contractor shall furnish satisfactory evidence (including reports of required tests) as to the kind and quality of materials and equipment. All materials and equipment shall be applied, installed, connected, erected, used, cleaned, and conditioned in accordance with instructions of the applicable Supplier, except as otherwise provided in the Contract Documents.

5.7.3 Discrepancies or Defects. If the Contractor is unable to perform its Work because of discrepancies or defects in the work of the City's own forces or of a separate contractor, the Contractor shall immediately notify the Engineer and the City in writing of the conditions that render unable to so perform. Failure to notify the Engineer constitutes an acknowledgment and acceptance of the other work as being fit and proper for integration with the Contractor's Work except for latent or non-apparent defects and deficiencies in the other work.

5.8 Contractor's Management and Financial Statement Requirements (Reference: M.G.L. c. 30, §39R)

5.8.1 The words defined herein shall have the meaning stated below whenever they appear in this Paragraph:

5.8.1.1 "Contractor" means any person, corporation, partnership, joint venture, sole proprietorship, or other entity awarded a contract pursuant to M.G.L. c.30. §39M, inclusive.

5.8.1.2 “Contract” means any contract awarded or executed pursuant to M.G.L. c. 30, §39M, which is for an amount or estimate amount that exceed the dollar amount set forth in M.G.L. c. 30, §39R.

5.8.1.3 “Records” means books of original entry, accounts, checks, bank statements and all other banking documents, correspondence, memoranda, invoices, computer printouts, tapes, discs, papers and other documents or transcribed information of any type, whether expressed in ordinary or machine language.

5.8.1.4 “Independent Certified Public Account” means a person duly registered in good standing and entitled to practice as a certified public accountant under the laws of the place of his/her residence or principal office and who is in fact independent. In determining whether an accountant is independent with respect to a particular person, appropriate consideration should be given to all relationships between the accountant and that person or any affiliate thereof. Determination of an accountant’s independence shall not be confined to the relationships existing in connection with the filing of reports with the City.

5.8.1.5 “Audit,” when used in regard to financial statement, means an examination of records by an independent certified public accountant in accordance with generally accepted accounting principles and auditing standards for the purpose of expressing a certified opinion thereon, or, in the alternative, a qualified opinion or a declination to express an opinion for stated reasons.

5.8.1.6 “Accountant’s Report,” when used in regard to financial statements, means a document in which an independent certified accountant indicates the scope of the audit which s/he has made and sets forth his/her opinion regarding the financial statements taken as a whole with listing of noted exceptions and qualifications, or an assertion to the effect that an overall opinion cannot be expressed. When an overall opinion cannot be expressed the reason therefor shall be stated. An accountant’s report shall include as part thereof a signed statement by the responsible corporate officer attesting that management has fully disclosed all material facts to the independent certified public accountant, and that the audited financial statement is a true and complete statement of the financial condition of the contractor.

5.8.1.7 “Management,” when used herein, means the chief executive officers, partners, principals or other person or persons primarily responsible for the financial and operational policies and practices of the contractor.

5.8.1.8 Accounting terms, unless otherwise defined herein shall have a meaning in accordance with generally accepted accounting principles and auditing standards.

5.8.2 The contractor shall make, and keep for at least six (6) years after final payment, books, records, and accounts which in reasonable detail accurately and fairly reflect the transactions and dispositions of the contractor, and

5.8.3 Until the expiration of six (6) years after final payment, the office of inspector general, and the deputy commissioner of capital planning and operations shall have the right to examine any books, documents, papers or records of the contractor or of his/her subcontractors that directly pertain to, and involve transactions relating to, the contractor or his/her subcontractors, and

5.8.4 The contractor shall describe any change in the method of maintaining records or recording transactions which materially affect any statements filed with the City, including in his/her description the date of the change and reasons therefor, and shall accompany said description with a letter from the contractor’s independent certified public accountant approving or otherwise commenting on the changes, and

5.8.5 The contractor has filed a statement of management on internal accounting controls as set forth below prior to the execution of the contract, and

5.8.6 The contractor has filed prior to the execution of the contract and will continue to file annually, an audited financial statement for the most recent completed fiscal year as set forth below.

5.8.7 The contractor shall file with the City a statement of management as to whether the system of internal accounting controls of the contractor and its subsidiaries reasonably assures that:

5.8.7.1 Transactions are executed in accordance with management's general and specific authorization;

5.8.7.2 Transactions are recorded as necessary

5.8.7.2.1 To permit preparation of financial statements in conformity with generally accepted accounting principles, and

5.8.7.2.2 To maintain accountability for assets;

5.8.7.3 Access to assets is permitted only in accordance with management's general or specific authorization; and

5.8.7.4 The recorded accountability for assets is compared with the existing assets at reasonable intervals and appropriate action was taken with respect to any difference.

5.8.7.5 The contractor shall also file with the City a statement prepared and signed by an independent certified public accountant stating that s/he has examined the statement of management on internal accounting controls, and expressing an opinion as to:

5.8.7.5.1 Whether the representation of management in response to this paragraph and paragraphs 5.8.2 through 5.8.6 above are consistent with the result of management's evaluation of the system of internal accounting controls; and

5.8.7.5.2 Whether such representations of management are, in addition, reasonable with respect to transactions and assets in amounts which would be material when measured in relation to the applicant's financial statements.

5.8.8 The contractor shall annually file with the Commissioner of Capital Planning and Operations during the term of the contract a financial statement prepared by an independent certified public accountant on the basis of an audit by such accountant. The final statement filed shall include the date of final payment. All statements shall be accompanied by an accountant's report. Such statements shall be made available to the City upon request.

5.9 Taxes

The Contractor shall pay all sales, consumer, use, and other similar taxes for the Work or portions thereof which are provided by the Contractor which are legally enacted when bids are received, whether or not yet effective or merely scheduled to go into effect. However, the Contractor shall not pay, and the City shall not reimburse or pay the Contractor for, any sales taxes for building supplies or materials for which an exemption is provided in M.G.L. c. 64H, §6(f). The City's tax exemption number to be used by the Contractor in this regard is E046001383.

5.10 Permits, Licenses, and Fees COMPLIANCE WITH LAW

5.10.1 Unless otherwise provided, the Contractor shall obtain and pay the fees for all permits, licenses, and inspections which are necessary for the proper execution and completion of the Work and which are customarily secured after execution of the Contract and which are legally required. All fees for permits, licenses, and inspections required by any City department shall be waived.

5.11 Notices Required By Statutes, Ordinances, Codes, Rules, Regulations, and Orders of the City

5.11.1 The Contractor shall give notices required by statutes, ordinances, codes, rules, regulations, and orders of the City bearing on performance of the Work.

5.12 Additional Information from Engineer.

5.12.1 The Contractor shall perform the Work in accordance with the Contract Documents and submittals approved pursuant to Article 4.

5.12.2 The Contractor shall give the Engineer timely notice of any additional Drawings, Specifications, or instructions required to define the Work in greater detail, or to permit the proper progress of the Work.

5.12.3 The Contractor shall not proceed with any Work not clearly and consistently defined in detail in the Contract Documents, but shall request additional drawings or instructions from the Engineer as provided in the previous Paragraph. If the Contractor proceeds with such Work without obtaining further drawings, Specifications, or instructions, the Contractor shall correct Work incorrectly done at the Contractor's own expense.

5.13 "Or equal"

5.13.1 Requirements. (Reference: M.G.L. c. 30, §39M(b)). Where products or materials are specified or described by manufacturer name, trade name, or catalog reference, the words "or approved equal" shall be understood to follow. An item shall be considered equal to the item so named or described if, in the opinion of the Engineer:

5.13.1.1 It is at least equal in quality, durability, appearance, strength, and design;

5.13.1.2 It performs at least equally the function imposed by the general design for the Work;

5.13.1.3 It conforms substantially, even with deviations, to the detailed requirements for the items as indicated by the Specifications.

5.13.2 Net Savings. No proposed substitution will be permitted unless the Contractor certifies that the proposed substitution will yield a net savings to the City and will not extend the Contract Time.

5.13.3 Contractor's Expense. Any structural or mechanical changes made necessary to accommodate substituted equipment under this paragraph shall be at the expense of the Contractor or Subcontractor responsible for the Work item.

5.13.3.1 Any additional cost, or any loss or damage arising from the substitution of any material or any method for those originally specified shall be borne by the Contractor, notwithstanding approval or acceptance of such substitution by the City or the Engineer, unless such substitution was made at the written request or direction of the City or the Engineer.

5.13.3.2 All data to be provided by the Contractor in support of any proposed "or equal" or substitute item will be at the Contractor's expense.

5.13.4 Meeting Requirements. The Contractor shall be responsible for determining that all materials furnished for the Work meet all requirements of the Contract Documents. The Engineer may require the Contractor to produce reasonable evidence that a material meets such requirements, such as certified reports

of past tests by qualified testing laboratories, reports of studies by qualified experts, or other evidence which, in the opinion of the Engineer, would lead to a reasonable certainty that any material used, or proposed to be used, in the Work meets the requirements of the Contract Documents. All such data shall be furnished at the Contractor's expense. This provision shall not require the Contractor to pay for periodic testing of different batches of the same material, unless such testing is specifically required by the Contract Documents to be performed at the Contractor's expense.

5.13.5 Named Manufacturer's Product. In all cases in which a manufacturer's name, trade name, or other proprietary designation is used in connection with materials or articles to be furnished under this Contract, whether or not the phrase "or equal" is used after such name, the Contractor shall furnish the product of the name manufacturer(s) without substitution, unless a written request for a substitute has been submitted by the Contractor and approved in writing by the Engineer as provided in the following paragraph.

5.13.6 Deviations. If the Contractor proposes to use a material which while suitable for the intended use, deviates in any way from the detailed requirements of the Contract Documents, the Contractor shall inform the Engineer in writing of the nature of such deviations at the time the material is submitted for approval and shall request written approval of the deviation from the requirements of the Contract Documents.

5.13.7 Rejection of Deviations. In requesting approval of deviations or substitutions, the Contractor shall provide, upon request, evidence leading to a reasonable certainty that the proposed substitution or deviation will provide a quality of result at least equal to that otherwise attainable. If, in the opinion of the Engineer, the evidence presented by the Contractor does not provide a sufficient basis for such reasonable certainty, the Engineer may reject such substitution or deviation without further investigation.

5.13.8 Consistent Character and Quality of Design. The Contract Documents are intended to produce a building of consistent character and quality of design. All components of the building including visible items of mechanical and electrical equipment have been selected to have a coordinated design in relation to the overall appearance of the building. The Engineer shall judge the design and appearance of proposed substitutes on the basis of their suitability in relation to the overall design of the Project, as well as for their intrinsic merits. The Engineer will not approve as equal to materials specified proposed substitutes which, in the Engineer's opinion, would be out of character, obtrusive, or otherwise inconsistent with the character or quality of design of the Project. In order to permit coordinated design of color and finishes the Contractor shall, if required by the Engineer, furnish the substituted material in any color, finish, texture, or pattern which would have been available from the manufacturer originally specified, at no additional cost to the City.

5.13.9 Warranty. The warranties provided herein shall be in addition to and not in limitation of any other warranty required by the Contract Documents or otherwise prescribed by law.

5.13.10 Engineer's Approval. The Engineer will be the sole judge of acceptability. No "or equal" or substitute will be ordered, installed, or utilized without the Engineer's prior written acceptance which will be evidenced by either a Change Order or an approved Shop Drawing. The City may require the Contractor to furnish at the Contractor's expense a special performance guarantee or other surety with respect to any "or equal" or substitute. The Engineer will record the time required by the Engineer and its consultants in evaluating substitutes proposed or submitted by the Contractor and in making changes in the Contract Documents (or in the provisions of any other direct contract with the City for work on the Project) occasioned thereby. Whether or not the Engineer accepts a substitute item so proposed or submitted by the Contractor, the Contractor shall reimburse the City for the charges of the Engineer and its consultants for evaluating each such proposed substitute item.

5.14 Substitute Construction Methods or Procedures

5.14.1 If a specific means, method, technique, sequence, or procedure of construction is shown or indicated in and expressly required by the Contract Documents, the Contractor may furnish or utilize a substitute means, method, technique, sequence or procedure of construction acceptable to the Engineer. The Contractor shall submit sufficient information to allow the Engineer, in the Engineer's sole discretion, to determine whether the substitute proposed is equivalent to that expressly called for by the Contract Documents.

5.15 Contractor's Progress Schedule

5.15.1 Before Starting Construction. Within ten (10) days after the date of the Notice to Proceed, the Contractor shall submit to the Engineer for review:

5.15.1.1 A preliminary progress schedule indicating the times (number of days or dates) for starting and completing the various stages of the Work;

5.15.1.2 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;

5.15.1.3 A preliminary schedule of values for all of the Work which will include quantities and prices of items aggregating the Contract Sum and will subdivide the Work into component parts in sufficient detail to serve as the basis for progress payments during construction. Such prices will include and appropriate amount of overhead and profit applicable to each item of Work.

5.15.2 Review of Progress Schedule. At least ten (10) days prior to the commencement of construction, the Engineer, the Contractor, and any other appropriate persons will meet to review and discuss the acceptability to the Engineer of the progress schedule. The Contractor will have an additional ten (10) days to make corrections and adjustments and to complete and resubmit the schedule. No progress payment shall be made to the Contractor until the schedule is submitted to and acceptable to the Engineer as provided below.

5.15.3 Acceptability of Progress Schedule. The progress schedule will be acceptable to the Engineer if, according to the Engineer, it provides an orderly progression of the Work to completion within any specified time frame, but such acceptance will neither impose on the Engineer responsibility for the sequencing, scheduling, or progress of the Work nor interfere with or relieve the Contractor from the Contractor's full responsibility therefor. The Contractor's schedule of Submittals must be acceptable to the Engineer if it provides a workable arrangement for reviewing and processing the required Submittals. The Contractor's schedule of values must be acceptable to the Engineer as to form and substance.

5.15.4 Sepia and Copies. After the Engineer has approved the schedule, the Contractor shall submit to the Engineer one (1) sepia and four (4) copies bearing the Contractor's stamp of approval as a representation to the City that the Contractor has determined or verified all data on that progress schedule and that the Contractor, the Subcontractors and Suppliers have reviewed and coordinated the sequences in that progress schedule with the requirements of the Work.

5.15.5 Adjustment of Schedule. The Contractor shall adhere to the established progress schedule which may be adjusted from time to time as follows: the Contractor shall submit to the Engineer for acceptance proposed adjustments in the progress schedule that will not change the Contract Time. Such adjustments will conform generally to the progress schedule then in effect and will comply with any provisions of the requirements applicable thereto.

5.15.6 During Construction. The Contractor shall submit monthly progress schedules to the Engineer. The schedules shall stay current with the Contractor's approach to the Work remaining.

5.15.7 Schedule of Submittals. The Contractor shall prepare and keep current, for the Engineer's approval, a schedule of Submittals which is coordinated with the Contractor's construction schedule and allows the Engineer reasonable time to review Submittals.

5.16 Project Coordination

5.16.1 In General. The Contractor shall be responsible for the proper coordination of the Work of all of the trades.

5.16.2 Coordination with Subcontractors. The Contractor shall coordinate the work of each Subcontractor with the Work of every other Subcontractor whose Work affects the other.

5.16.3 Coordination with the City's Own Forces or Separate Contractors. The Contractor shall coordinate its operations with those of the City's own forces or separate contractors. The Contractor shall provide the City's own forces and separate contractors a reasonable opportunity for the handling, unloading and storage of their materials and equipment and execution of their work. The Contractor shall connect and coordinate its Work with theirs.

5.16.4 Coordination with Utility Companies. The Contractor shall coordinate its operations with all the appropriate utility companies to assure that the utilities required on the Project are available and functioning properly pursuant to the requirements of the Contract Documents.

5.17 Project Photographs

5.17.1 In General. The Contractor shall take, at its own expense, interior and exterior photographs at the site, from different vantages as directed by the Engineer or the City, before beginning any Work and thereafter on the first work day of each month until final completion of the Work, including final Site photos. The photographs shall be taken by a skilled commercial photographer. The number of photographs required shall be at the discretion of the City or the Engineer.

5.17.2 Prints and Negatives. Within fourteen (14) days after the photographs have been taken, the Contractor shall cause prints to be made and delivered to the City and the Engineer. All photographs shall be 8" x 10". Each print shall state the date of the photograph, the name of the Project, the description of the view and the name and address of the photographer. The City shall receive all the negatives and one glossy print. The Engineer shall receive one glossy print. Photographs shall be suitably mounted and with clear acetate cover with flap for binding. Binders shall be furnished in sufficient number to bind each set of photographs. Each photograph shall have a legible description or title indicating project name, Contractor's name, location of picture, date photograph taken, and sufficient description of subject.

5.17.3 Failure to Comply. Should the Contractor fail to adhere to any requirement set forth in the previous two paragraphs, the City may have the photographs taken at the Contractor's expense or receive a set-off against the Contractor's next application for payment.

5.18 Record Documents and Samples at the Site

5.18.1 The Contractor shall maintain in a safe place at the site one record copy of all Drawings, Specifications, Modifications, Change Orders, Work Change Directives, Field Orders and written interpretations and clarifications in good order and annotated to show all changes made during construction. These record documents together with all approved Samples and a counterpart of all approved Shop Drawings will be available to the Engineer for reference. Upon completion of the Work, these record documents, Samples and Shop Drawings will be delivered by the Contractor to the Engineer for the City.

5.19 Submittals

5.19.1 Purpose. The purpose of Submittals is to demonstrate for those portions of the Work for which Submittals are required the way the Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents.

5.19.2 Submittal Procedure. Within 7 days from the Notice to Proceed, the Contractor shall submit to the Engineer a completed Submittals schedule. The Contractor shall review, approve, and submit to the Engineer Submittals required by the Contract Documents with reasonable promptness and in such sequence as to cause no delay in the Work or in the activities of the City or of separate contractors. Submittals made by the Contractor which are not required by the Contract Documents may be returned without action. The schedules shall be updated and resubmitted each month. All Submittals will be identified as the Engineer may require and in the number 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 the Engineer the materials and equipment that the Contractor proposes to provide and to enable the Engineer to review the information for the limited purposes stated below.

5.19.3 The Contractor shall submit promptly to the Engineer five copies of shop or setting drawings prepared in accordance with a predetermined schedule. After examination of such drawings by the Engineer and the return thereof, the Contractor shall make such corrections to the drawings as have been indicated and shall furnish the Engineer with five corrected copies. Regardless of corrections made in or approval given to such drawings by the Engineer, the Contractor will nevertheless be responsible for the accuracy of such drawings and for its conformity to the Contract Drawings and Specifications, unless he notifies the Engineer in writing of any deviations at the time he furnished such drawings.

5.19.4 Shop drawings of all fabricated work shall be submitted to the Engineer for approval and no work shall be fabricated by the Contractor save at its own risk until approval has been given.

5.19.5 **Contractor's Representations.** By approving and providing Submittals, the **Contractor** thereby represents that the **Contractor** has determined and verified all dimensions, quantities, field dimensions, relations to existing Work, coordination with Work to be installed later, coordination with information on previously accepted Submittals and verification of compliance with all the requirements of the Contract Documents. The accuracy of all such information is the responsibility of the **Contractor**. In reviewing Submittals, the **Engineer** shall be entitled to rely upon the **Contractor's** representation that such information is correct and accurate

5.19.6 All shop drawings submitted must bear the stamp of approval of the Contractor as evidence that the drawings have been checked by the Contractor. Any drawings submitted without this stamp of approval will not be considered and will be returned to the Contractor for resubmission. If the shop drawings show variations from the requirements of the Contract Documents because of standard shop practice or other reason, the Contractor shall make specific mention of such variation in its letter of transmittal in order that if acceptable, suitable action may be taken for proper adjustment; otherwise, the Contractor will not be relieved of the responsibility for executing the work in accordance with the Contract Documents even though such shop drawings have been approved.

5.19.7 Where shop drawings submitted by the Contractor indicate a departure from the Contract which the Engineer deems to be a minor adjustment in its interest and not involving a change in the Contract price or extension of time, the Engineer may approve the drawings, but the approval will contain in substance the following:

5.19.7.1 The modification shown on the attached drawings is approved in the interest of the City to effect an improvement for the project, and is ordered with the understanding that it does not involve any change in the Contract price or time; that it is subject generally to all Contract stipulations and covenants; and that it is without prejudice to any and all rights of the City under the Contract and Bond or Bonds; and

5.19.7.2 The approval of shop drawings will be general, and shall not relieve the Contractor from the responsibility for adherence to the Contract, nor shall it relieve the Contractor of the responsibility for any error, which may exist.

5.19.8 The Contractor agrees to hold the Engineer and the City harmless, and defend them against damages or claims for damage arising out of injury to others or property of third persons which result from errors on shop, working or setting drawings, whether or not the same have been approved by the Engineer, and/or the City.

5.19.9 ADDITIONAL INSTRUCTIONS AND DETAIL DRAWINGS: The Contractor will be furnished additional instructions and detail drawings as necessary to carry out the work included in the Contract. The additional drawings and instructions thus supplied to the Contractor will be coordinated with the Contract Documents and will be so prepared that they can be reasonably interpreted as part thereof. The Contractor shall carry out the work in accordance with the additional detail drawings and instructions. The Contractor and the Owner will prepare jointly (a) a schedule fixing the dates at which special detail drawings will be required; such drawings, if any, to be furnished by the Owner in accordance with said schedule, and (b) a schedule fixing the respective dates for the submission of the work. Each such schedule shall be subject to change from time to time in accordance with the progress of the work.

5.19.10 Samples. The Contractor shall also submit Samples to the Engineer for review and approval in accordance with said accepted schedule of Submittals. Each Sample will be identified clearly as to material, Supplier, pertinent data such as catalog numbers and the use for which it is intended and otherwise as the Engineer may require to enable the Engineer to review the Submittal for the limited purposes stated below. The numbers of each Sample to be submitted will be as specified in the Specifications. Unless otherwise specified in the Specifications, three (3) specimens of each Sample shall be submitted.

5.19.10.1 The Samples shall be of sufficient size to permit proper evaluation of material. Where variations in color or other characteristics are to be expected, samples showing the minimum range of variation shall be submitted. Materials exceeding the range of variation of the approved Samples will not be approved on the Work.

5.19.10.2 All costs associated with delivery of Samples will be paid by the Contractor.

5.19.11 Contractor's Verifications. Before submitting each Submittal, the Contractor shall have determined and verified:

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

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

5.19.11.3 All information relative to the Contractor's sole responsibilities in respect of means, methods, techniques, sequences, and procedures of construction and safety precautions and programs incident thereto.

5.19.12 Contractor's Representations. By approving and providing Submittals, the Contractor thereby represents that the Contractor has determined and verified all dimensions, quantities, field dimensions, relations to existing Work, coordination with Work to be installed later, coordination with information on previously accepted Submittals and verification of compliance with all the requirements of the Contract Documents. The accuracy of all such information is the responsibility of the Contractor. In reviewing

Submittals, the Engineer shall be entitled to rely upon the Contractor's representation that such information is correct and accurate.

5.19.13 Coordination. The Contractor shall also have reviewed and coordinated each Submittal with other Submittals and with the requirements of the Work and the Contract Documents.

Stamp or Specific Written Indication. Each Submittal will bear a stamp or specific written indication that the Contractor has satisfied the Contractor's obligations under the Contract Documents with respect to the Contractor's review and approval of that Submittal.

5.19.14 Written Notice of Variations. At the time of each Submittal, the Contractor shall give the Engineer specific written notice of such variations, if any, that the Submittal may have from the requirements of the Contract Documents. Such notice is to be in a written communication separate from the Submittal. Moreover, the Contractor shall make a specific notation on each Submittal to the Engineer for review and approval of each such variation.

5.19.15 Review and Approval by the Engineer. The Contractor shall perform no portion of the Work requiring a Submittal until the respective Submittal has been approved by the Engineer. Such Work shall be in accordance with approved Submittals.

5.19.16 The Engineer will review and approve Submittals in accordance with the schedule of Submittals accepted by the Engineer as required above. The 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 in the Contract Documents. The Engineer's review and approval will not extend to means, method, technique, sequences, or procedures of construction (except where a particular means, method, technique, sequences or procedures 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.

5.19.17 Deviations. The Contractor shall not be relieved of responsibility for deviations from requirements of the Contract Documents by the Engineer's approval of Submittals unless the Contractor has specifically informed the Engineer in writing of such deviation at the time of Submittal and the Engineer has given written approval to the specific deviation. The Contractor shall not be relieved of responsibility for errors or omissions in Submittals by the Engineer's approval thereof.

5.19.18 Revisions. The Contractor shall make corrections required by the Engineer and shall return the required number of corrected copies of Submittals and submit as required new Submittals for review and approval. The Contractor shall direct specific attention, in writing or on resubmitted Submittals, to revisions other than those requested by the Engineer on previous Submittals. Unless such written notice has been given, the Engineer's approval of a resubmitted Submittal shall not constitute approval of any changes not requested on the prior Submittal.

5.19.19 Related Work. Where a Submittal is required by the Contract Documents or the schedule of Submittals accepted by the Engineer, any related Work performed prior to the Engineer's review and approval of the pertinent Submittal will be at the sole expense and responsibility of the Contractor.

5.19.20 Informational Submittals. Informational Submittals upon which the Engineer is not expected to take responsive action may be so identified in the Contract Documents.

5.19.21 Certification. When professional certification of performance criteria of materials, systems or equipment is required by the Contract Documents, the City shall be entitled to rely upon such certifications,

and neither the City nor the Engineer shall be expected to make any independent examination with respect thereto.

5.20 Continuing the Work

5.20.1 The Contractor shall carry on the Work and adhere to the progress schedule during all disputes or disagreements with the City. No Work shall be delayed or postponed pending resolution of any disputes or disagreements, except as otherwise provided herein or as the City and the Contractor may agree in writing.

5.20.2 Any work necessary to be performed after regular working hours on Saturdays, Sundays, or legal holidays, shall be performed by the Contractor without additional expense to the City.

5.21 Use of Site; Access to Work

5.21.1 The right of possession of the premises and the improvements made thereon by the Contractor shall remain at all times in the City. The Contractor's right to entry and use thereof arises solely from the permission granted by the City under the Contract Documents. The Contractor shall confine the Contractor's apparatus, the storage of materials, and the operations of the Contractor's workers to limits indicated by law, ordinance, the Contract Documents and permits and/or directions of the Engineer and shall not unreasonably encumber the premises with the Contractor's materials. The City shall not be liable to the Contractor, the Subcontractors, Suppliers, or anyone else with respect to the conditions of the premises, except for a condition caused directly and solely by the negligence of the City.

5.21.2 At all times, the City and the Engineer shall have access to the Work.

5.22 Protection of Persons and Property

5.22.1 In General. The Contractor shall be responsible for initiating, maintaining, and supervising all health and safety precautions and programs in connection with the performance of the Contract. The Contractor is responsible for the implementation of all Federal, State, and local health and safety requirements.

5.22.2 The Contractor shall take reasonable precautions for safety of, and shall provide reasonable protection to prevent damage, injury, or loss to:

5.22.2.1 Employees on the site and other persons who may be affected thereby;

5.22.2.2 The Work, materials, and equipment to be incorporated therein, whether in storage on or off the site, under the care, custody or control of the Contractor, Subcontractors, or Sub-subcontractors;

5.22.2.3 Other property at the site or adjacent or in close proximity thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures, and utilities not designated for removal, relocation, or replacement in the course of construction; and

5.22.2.4 Any other property of the City, whether or not forming part of the Work, located at the site or adjacent thereto in areas to which the Contractor has access.

5.22.3 Notices and Compliance. The Contractor shall give notices and comply in all other respects with applicable laws, ordinances, rules, regulations, codes, and lawful orders of public authorities bearing on the safety of persons or property or their protection from damage, injury, or loss. The Contractor shall notify owners of adjacent and nearby properties of underground facilities and 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.

5.22.4 **Erection and Maintenance of Safeguards.** The Contractor shall erect and maintain, as required by existing conditions and the terms of the Contract, reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards, promulgating safety regulations and notifying owners and users of adjacent and nearby sites and utilities.

5.22.5 **Hazardous Materials and Equipment.** When use or storage of explosives or other hazardous materials or equipment or unusual methods are necessary for execution of the Work, the Contractor shall exercise utmost care and carry on such activities under the supervision of properly qualified personnel.

5.22.6 **Damage to Property.** The Contractor shall promptly remedy damage and loss to property referred to above. If the damage or loss is due in whole or in part to the Contractor's failure to take the precautions required herein, the Contractor shall bear the cost, subject to any reimbursement to which the Contractor is entitled under property insurance required by the Contract Documents. The Contractor shall be fully and solely responsible for all Work and other operations carried out on adjacent properties. The insurance required under Article 8 shall cover such Work or operations, and the Contractor shall indemnify and defend the City, the Engineer, and the owners of such adjacent or nearby properties from and against all claims, suits, losses, or costs arising out of such Work or operations.

5.22.7 **Fire Protection Equipment and Services.** The Contractor shall provide and maintain in good operating condition suitable and adequate fire protection equipment and services and shall comply with all reasonable recommendations regarding fire protection made by the representatives of the fire insurance company carrying insurance on the Work or by the local fire chief or fire marshal. The area within the site limits shall be kept orderly and clean and all combustible rubbish shall be promptly removed from the site.

5.22.8 **Protection of Excavations, Trenches, Etc.** The Contractor shall at all times protect excavations, trenches, buildings and materials from rain water, ground water, backup or leakage of sewers, drains and other piping, and from water of any other origin and shall remove promptly any accumulation of water. The Contractor shall provide and operate all pumps, piping, and other equipment necessary to this end.

5.22.9 **Snow and Ice Removal.** The Contractor shall remove snow and ice which might result in damage or delay.

5.22.10 **Safety Representative.** The 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.

5.22.11 **Weather Protection.** (Reference: M.G.L. c. 149, §44F(1)). The Contractor shall install weather protection and furnish adequate heat in the protected area from November 1 through March 31. If in the opinion of the City any work or material shall have been damaged or injured by reason of failure on the part of the Contractor or any subcontractors so to protect their work, or otherwise damaged by the negligence of the Contractor, subcontractors, or their agents or servants, or is otherwise defective, such materials shall be removed and replaced at the expense of the Contractor.

5.22.12 **Security.** The Contractor shall provide, within the Contract Sum, a sufficient number of security personnel at the Site at all times when the Contractor's personnel are not present, from commencement of the Work until Substantial Completion to assure that the Site, the facility, and the Work, and all materials and equipment stored at the Site are fully and completely protected against loss or damage due to vandalism, theft, or malicious mischief. If the Contractor elects, in addition, to use guard dogs for this purpose, each dog shall at all times be accompanied by an adult handler. If the Contractor fails to comply with the requirements of this paragraph, then the City may provide appropriate security and charge the cost thereof to the Contractor. The City's provision of such security, or failure to do so, shall not relieve the Contractor of its responsibility to pay for loss or damage due to vandalism, theft, or malicious mischief at the Site.

5.22.13 Hazard Communication Programs. The Contractor shall be responsible for coordinating any exchange of material safety data sheets or other hazard communications information required to be made available to or exchanged between or among employers at the site in accordance with laws, codes and regulations.

5.22.14 Noise Pollution Control. The Contractor shall comply with all applicable provisions of Cambridge Municipal Code Chapter 8.16.

5.22.15 Reporting. The Contractor and all subcontractors shall immediately report all accidents, injuries, or health hazards to the City or its designated representatives in writing for information purposes only. This shall not relieve the Contractor or all subcontractors from mandatory reporting requirements, or any other requirements under the Occupational Safety and Health Act of 1970.

5.22.16 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 (Industrial Bulletin No. 12)." Contractors shall be familiar with the requirements of these regulations, and MUCTD and ADA safety requirements.

5.23 Cutting and Patching

5.23.1 In General. Unless otherwise provided in the Contract Documents, the Contractor shall be responsible for cutting, fitting, or patching required to complete the Work or to make its parts fit together properly, including the work of the City or of separate contractors.

5.23.2 Damage to Work of City or of Separate Contractor. The Contractor shall not damage or endanger a portion of the Work or fully or partially completed construction of the City or separate contractors by cutting, patching, or otherwise altering such construction, or by excavation. The Contractor shall not cut or otherwise alter such construction by the City or a separate contractor except with prior written consent of the City and of such separate contractor; such consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold from the City or a separate contractor the Contractor's consent to cutting or otherwise altering the Work.

5.23.3 Damage Caused by Contractor. Should the Contractor cause damage to the work or property of any separate contractor at the Site, or should any claim arising out of the Contractor's performance of Work at the Site be made by any separate contractor against the Contractor, the City, the Engineer, or any of the Engineer's consultants, the Contractor shall promptly attempt to settle with such other contractor by agreement, or to otherwise resolve the dispute by arbitration or at law. The Contractor shall, to the fullest extent permitted by laws and regulations, indemnify and hold harmless the City, the Engineer, and the Engineer's consultants from and against all claims, damages, losses and expenses (including, but not limited to, fees of engineers, Engineers, attorneys and other professionals, and court and arbitration or mediation costs) arising directly, indirectly or consequentially out of any action, legal or equitable, brought by any separate contractor against the City, the Engineer, or any of the Engineer's consultants, to the extent based on a claim arising out of the Contractor's performance of the Work. Should a separate contractor cause damage to the Work or property of the Contractor or should the performance of work by any separate contractor at the site give rise to any other claim, the Contractor shall not institute any action, legal or equitable, against the City, the Engineer, or any of the Engineer's consultants, or permit any action against any of them to be maintained and continued in its name or for its benefit in any court or before any arbiter which seeks to impose liability on or to recover damages from the City, the Engineer, or any of the Engineer's consultants, on account of any such damage or claim. If the Contractor is delayed at any time in performing or furnishing Work by any act or neglect of a separate contractor and the City and the Contractor

are unable to agree as to the extent of any adjustment in the Contract Time attributable thereto, the Contractor may make a claim for an extension of time in accordance with Article 16. An extension of the Contract Time shall be the Contractor's exclusive remedy with respect to the City, the Engineer, and the Engineer's consultants, for any delay, disruption, interference, or hindrance caused by any separate contractor.

5.24 Cleaning Up

5.24.1 During the progress of the Work, the Contractor shall keep the premises and surrounding area free from accumulation of waste materials and rubbish caused by operations under the Contract or other debris. At the completion of the Work, the Contractor shall remove from and about the Project all waste materials, rubbish, debris, the Contractor's tools, construction equipment, machinery and surplus materials. The Contractor shall leave the site clean and ready for use by the City at Substantial Completion of the Work. Immediately prior to the Engineer's inspection for Substantial Completion, the Contractor shall completely clean the premises. Concrete and ceramic surfaces shall be cleaned and washed. Resilient coverings shall be cleaned, waxed and buffed. Woodwork shall be dusted and cleaned. Sash, fixtures and equipment shall be thoroughly cleaned. Stains, spots, dust, marks and smears shall be removed from all surfaces. Hardware and all metal surfaces shall be cleaned and polished. Glass and plastic surfaces shall be thoroughly cleaned by professional window cleaners. All damaged, broken or scratched glass or plastic shall be replaced by the Contractor at the Contractor's expense. The Contractor shall restore to original condition all property not designated for alteration by the Contract Documents.

5.24.2 If the Contractor fails to clean up as provided herein, the City may do so and charge the cost thereof to the Contractor.

5.25 Royalties and Patents

5.25.1 The 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. To the fullest extent permitted by law, the Contractor shall indemnify and hold harmless the City and the Engineer from and against all claims, costs, losses, and damages arising out of or resulting from 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. The Contractor shall hold and save the Engineer, the City, and their officers, agents, servants, and employees harmless from liability of any nature or kind, including cost and expenses for or on account of any patented or un-patented invention, process, article, or appliance manufactured or used in the performance of the Contract, including its use by the City.

5.26 Contractor's Obligation to Perform

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

5.26.1.1 Observations by the Engineer;

5.26.1.2 Recommendation of any progress or final payment by the Engineer;

5.26.1.3 The issuance of a certificate of Substantial Completion or any payment by the City to the Contractor under the Contract Documents;

5.26.1.4 Use or occupancy of the Work, Project, or Site, or any part thereof, by the City;

5.26.1.5 Any acceptance by the City or any failure to do so;

5.26.1.6 Any review and approval of a Shop Drawing or Sample submittal or the issuance of a notice of acceptance by the Engineer;

5.26.1.7 Any inspection, test, or approval by others; or

5.26.1.8 Any correction of defective Work by the City.

5.27 Indemnification and Covenant Not To Sue

5.27.1 To the fullest extent permitted by law, the Contractor shall assume the defense of, indemnify and hold harmless the City, the Engineer, the Engineer's consultants and agents and employees of any of them from and against claims, damages, losses, and expenses, including, but not limited, to attorneys' fee, arising out of or resulting from 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 caused in whole or in part by alleged negligent 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 not be construed to negate, abridge, or reduce other rights or obligations of indemnity, which would otherwise exist as to a party or person described in this paragraph.

5.27.2 In claims against any person or entity indemnified under the foregoing paragraph by an employee of the Contractor, a Subcontractor, anyone directly or indirectly employed by them or anyone for whose acts they may be liable, the indemnification obligation under the foregoing paragraph shall not be limited by a limitation on the amount or type of damages, compensation or benefits payable by or for the Contractor or a Subcontractor under Workers' Compensation laws, disability benefit acts or other employee benefit acts.

5.27.3 The obligations of the Contractor in this Article shall not extend to the liability of the Engineer, the Engineer's consultants, and agents or employees of any of them arising out of (1) the preparation of maps, Drawings, opinions, reports, surveys, Change Orders, designs, or Specifications, or (2) directions or instructions given by the Engineer, the Engineer's consultants and agents or employees of any of them, provided such instructions or directions are the primary cause of the injury or damage.

5.27.4 The Contractor, or any successor, assign, or subrogate of the Contractor agrees not to bring any civil suit, action, or other proceeding in law, equity or arbitration against the Engineer, or the officers, employees, agents, or consultants of the Engineer, for the enforcement of any action which the Contractor may have arising out of or in any manner connected with the Work. The Contractor shall assure that this covenant not to sue is contained in all subcontracts and sub-subcontracts of every tier and shall assure its enforcement. The Engineer, its officers, employees, agents, and consultants are intended third-party beneficiaries of this covenant not to sue, and are entitled to enforce this covenant in law or equity.

5.28 Survival of Obligations

5.28.1 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 and termination or completion of the Contract.

5.29 Representations of Contractor

5.29.1 That the Contractor is financially solvent and that he is experienced and competent to perform the type of work or furnish the plant, material, supplies, or equipment to be performed or furnished by the Contractor; and

5.29.2 That the Contractor is familiar with all Federal, State, municipal, and department laws, O.S.H.A., safety, MUTCD, ADA, and confined space regulation, ordinances, orders, and other regulations which may in any way affect the work of those employed therein, including but not limited to any special acts relating to the work or to the project of which it is a part; and

5.29.3 That such temporary and permanent work required by the Contract Documents to be done by the Contractor can be satisfactorily constructed and used for the purpose for which it is intended, and that such construction will not injure any person or damage any property; and

5.29.4 That the Contractor has carefully examined the Drawings, Specifications, and Addendum (or Addenda) if any, and the site of the work, and that from the Contractor's own investigations is satisfied as to the nature and location of the work, the character, quality and quantity of surface and subsurface materials likely to be encountered, the character of equipment and other facilities needed for the performance of the work, the general and local conditions, and all other materials which may in any way affect the work or its performance; and

5.29.5 That the Contractor is aware of the hazards involved in the work and the danger to life and property both evident and inherent, and that the work shall be conducted in a careful and safe manner without injury to persons or property.

ARTICLE 6 SUBCONTRACTORS

6.1 Use of Subcontractors

6.1.1 The Contractor shall use the Subcontractors named in the Contractor's Bid.

6.1.2 The Contractor may utilize the services of specialty subcontractors on those parts of the work which, under normal contracting practices, are performed by specialty subcontractors.

6.2 Substitution of Subcontractors

6.2.1 The Contractor shall not substitute another Subcontractor therefor without notice to the City and the City's prior written consent of such substitution.

6.3 Names of Subcontractors

6.3.1 Upon execution of the Contract with the City, the Contractor shall provide in writing to the City, through the Engineer, the names, addresses, telephone numbers, and fax numbers of all persons proposed for each principal portion of the Work.

6.4 Objections to Subcontractors

6.4.1 The Contractor shall not use any Subcontractor against whom the City has a reasonable objection. The Contractor shall not be required to contract with any person or entity against whom it has a reasonable objection.

6.5 Form of the Subcontract

6.5.1 All Work performed by a Subcontractor shall be through an appropriate subcontract. The form of subcontract shall be submitted to the Purchasing Agent for her approval, which shall not be unreasonably withheld or delayed.

6.5.2 Appropriate provisions to be inserted in all subcontracts relative to the work to bind subcontractors to the Contractor by the terms of the Contract and General Conditions, and other Contract Documents insofar as applicable to the work of subcontractors, and to give the Contractor the same power as regards terminating any subcontract that the City may exercise over the Contractor under any provision of the Contract Documents.

6.5.3 Nothing contained in this Contract shall create any contractual relation between any subcontractor and the City.

6.6 Content of the Subcontract

6.6.1 In addition to all statutorily mandated provisions and provisions required elsewhere in the Contract Documents, each subcontract shall expressly provide that:

6.6.1.1 Each subcontract agreement for a portion of the Work is assigned by the Contractor to the City provided that:

6.6.1.1.1 The assignment is effective only after termination of the Contract by the City or the Contractor and only for those subcontract agreements which the City accepts by notifying the Subcontractor in writing; and

6.6.1.1.2 The assignment is subject to the prior rights of the surety, if any, obligated under bond relating to the Contract.

6.6.1.2 Each Subcontractor is bound by the requirements of the Contract Documents for the express benefit of the City.

6.6.1.3 Each Subcontractor shall assume toward the Contractor all the obligations which the Contractor assumes toward the City and the Engineer, unless otherwise provided by law.

ARTICLE 7 PERFORMANCE AND PAYMENT BONDS

7.1 Form of Bonds

7.1.1 The performance and labor and material or payment bonds shall be in the form required by the City, copies of which are included in the Project Manual. The City reserves the right to reject any bond which does not conform to the City's requirements.

7.2 Furnished by the Contractor

7.2.1 (Reference: M.G.L. c. 30, §39M(c), M.G.L. c. 149, §29). The Contractor shall furnish a performance bond and a labor and materials or payment bond, each with a surety company qualified to do business under the laws of the Commonwealth and satisfactory to the City and each in the sum of the Contract Sum, the premiums for which are to be paid by the Contractor and are included in the Contract

Sum. The bonds shall remain in effect until final payment is made. The sum of the performance bond shall increase each time the Contract Sum is increased as a result of a Change Order.

7.2.2 The Contractor shall furnish Surety Bonds (in SEXTUPLICATE) each in an amount equal to at least one hundred (100%) percent of the Contract price as security for the faithful performance of this Contract, and for the payment of all persons performing labor on the project under this Contract and furnishing materials, equipment, and all other incidentals in connection with this Contract. The Surety on such Bond shall be a duly authorized surety company satisfactory to the Owner, and the cost of same shall be paid by the Contractor. Before final acceptance, the Bonds must be approved by the City.

7.3 Submission to the City

7.3.1 The Contractor must submit the performance bond and labor and materials or payment bond to the City upon the Contractor's execution of the Agreement.

7.3.2 If at any time the City for justifiable cause shall be or become dissatisfied with the Surety or Sureties for the Performance and/or Payment Bonds, the Contractor shall within five (5) days after notice from the City to do so, substitute an acceptable bond (or bonds) in such form and sum, and signed by such other Surety or Sureties as may be satisfactory to the City. The premiums on such bond shall be paid by the Contractor. No further payments will be deemed due nor will be made until the new Surety or Sureties shall have furnished such an acceptable bond to the City.

ARTICLE 8 INSURANCE REQUIREMENTS

8.1 Worker's Compensation

8.1.1 (Reference: M.G.L. c. 149, §34A). Before commencing performance of the Contract, the Contractor shall provide by insurance for the payment of compensation and the furnishing of other benefits under M.G.L. c. 152 to all persons to be employed under the Contract, and the Contractor shall continue such insurance in full force and effect during the term of the Contract. Sufficient proof of compliance with this paragraph must be furnished at the time of execution of this Contract. Failure to provide and continue in force such insurance as aforesaid shall be deemed a material breach of the Contract and shall operate as an immediate termination thereof. No cancellation of such insurance, whether by the insurer or by the insured, shall be valid unless written notice thereof is given by the party proposing cancellation to the other party and to the City at least fifteen (15) days prior to the intended effective date thereof, which date shall be expressed in said notice.

8.2 Additional Insured

8.2.1 Each policy must list the City as an additional insured.

8.3 Insurance Rating

8.3.1 Any insurance carrier utilized to fulfill the insurance requirements of this Contract shall have a minimum A.M. Best rating of A-X.

8.4 Premiums

8.4.1 The Contractor must provide the required insurance at its own expense.

8.5 Notice of Occurrence

8.5.1 Notice of occurrence shall be given to the City Manager, City of Cambridge, City Hall, 795 Massachusetts Avenue, Cambridge, MA 02139 and, at the option of the Contractor, any other City official permitted by law to receive notice.

8.6 Waiver of Subrogation

8.6.1 The Contractor and all Subcontractors waive subrogation rights against the City for all losses.

8.7 Coverage Period

8.7.1 Each insurance policy must cover the entire contract period.

8.8 Policies and Limits

8.8.1 The insurance required shall include all major division of coverage and shall be on a comprehensive general basis including Premises and Operations (including X-C-U), City’s Protective (as a separate policy), Products and Completed Operations, and Owned, Non-owned, Leased, and Hired Motor Vehicles. Such insurance shall be written for not less than any limits of liability required by law or the following limits, whichever are greater:

Owner’s Protective Liability (as a separate policy)	
Each Occurrence	\$1 Million
Aggregate	\$2 Million
Commercial Liability	
General Aggregate - per project	\$2 Million
Products Completed Operations	
Aggregate – per project	\$1 Million
Personal Injury and Advertising Limit	\$1 Million
Each Occurrence	\$1 Million

This policy shall include contractual liability coverage insuring the contractor’s indemnity obligations under this Contract. The contractual and completed operations coverage shall be maintained on the City’s and Indemnitees’ behalf for a period of two (2) years after final completion and acceptance by City. If the Work includes work to be performed within 50 feet of a railroad, any exclusion for liability assumed under contract for work within 50 feet of a railroad shall be deleted.

This policy shall include City and any other party at interest requested by City as an additional insured with endorsements equivalent to ISO CG 20 10 for ongoing operations and to ISO CG 20 37 for completed operations. This policy shall be primary and non-contributory with respect to any other insurance available to an additional insured. The policy shall include endorsement equivalent to ISO CG 24 04, a Waiver of Subrogation in favor of City. The policy shall include endorsement CG 24 10, Coverage for injury to leased workers.

Railroad Protective Liability (if required by an abutter, permittee or other)

Each Occurrence	\$2 Million
Aggregate	\$6 Million

Automotive-for all owned, non-owned, hired and leased vehicles

Combined single limit	\$1 Million
or	
Bodily injury - each person	\$100,000
- each accident	\$1 Million
Property damage-each occurrence	\$1 Million

If hauling contaminants and/or pollutants, the policy shall include a CA 99 48 Broadened Pollution Endorsement. must adhere to Sections 29 and 30 of the Motor Carrier Act of 1980, which shall contain coverage Form MCS-90. The policy shall name City as an additional insured. The policy shall contain a Waiver of Subrogation in favor of City.

Builder’s Risk/Installation Floater (Value of the Contract)

The **Contractor** shall be required to purchase, maintain and furnish evidence satisfactory to the **City** property insurance generally described as Builders' Risk Insurance with an "all risk" type installation floater covering loss by fire and standard extended coverage in the completed value form in the amount of the total value of structures, materials, and equipment to be built and installed under the Contract on a replacement cost basis.

This provision, with respect to Builders' Risk Insurance, shall in no way relieve the **Contractor** of his obligation of completing the Work covered by the Contract.

Contractor Pollution Liability	
Combined single limit- per occurrence	\$1 Million
Annual aggregate	\$3 Million

8.9 Excess Liability Insurance

8.9.1 The Contractor may purchase and maintain excess liability insurance in the umbrella form in order to satisfy the limits of liability required for the insurance to be purchased and maintained in accordance with the requirements set forth above. Any such amounts must be in addition to the umbrella limits required, must list all underlying policies, and must list the City as an additional insured. Evidence of such excess liability shall be delivered to the City in the same form and manner as the required insurance policies.

8.10 Amendment of Insurance Requirements

8.10.1 The City reserves the right, at its sole discretion, to amend the insurance requirements contained herein.

8.11 Occurrence Basis

8.11.1 All insurance shall be written on an occurrence basis, unless the City approves in writing coverage on a claims-made basis. Coverages whether written on an occurrence or a claims-made basis shall be maintained without interruption from the date of commencement of the Work until the date of final payment and termination of any coverage required to be maintained after final payment.

8.12 Certificates of Insurance

8.12.1 Certificates of Insurance acceptable to the City and confirming the insurance coverage required herein are attached to the Contract. The City shall have no obligation to execute the Contract and may award the Contract to the next lowest responsible and responsive bidder, if such insurance certificates have not been provided to the City within five (5) business days after presentation of the Contract to the Contractor for execution.

8.13 Endorsements

8.13.1 The Contractor shall furnish to the City copies of any endorsements that are subsequently issued amending limits of coverage.

8.14 Property Insurance

8.14.1 The City does not intend to purchase property insurance covering the Project or the Work. The Contractor shall not be required to provide such insurance, but the Contractor may, if it so desires, procure property insurance which will protect the interests of the Contractor, Subcontractor and Sub-subcontractors

in the Work. The Contractor understands that such property insurance is solely the Contractor's responsibility, and the Contractor, its Subcontractors and Sub-subcontractors shall have no claim against the City on account of the City's failure to provide such property insurance. The Contractor shall promptly replace all damaged Work in which it or its Subcontractors and Sub-subcontractors have an insurable interest, and all Work which is stolen, vandalized, or damaged due to the Contractor's failure to protect the site as required by Article 5, at no additional cost to the City, whether or not the Contractor procures property insurance with respect to such Work as hereinabove provided.

ARTICLE 9 TESTS AND INSPECTIONS

9.1 Access

9.1.1 The City, the Engineer, and all other persons designated by the City shall have access to the Work at reasonable times for observing, inspecting, and testing. The Contractor shall provide them with proper and safe conditions for such access and advise them of the Contractor's site safety procedures and programs so that they may comply therewith as applicable.

9.2 Tests and Inspections

9.2.1 The Contractor shall give the 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.

9.2.2 Unless otherwise provided, the Contractor shall make arrangements for such tests, inspections, and approvals with an independent testing laboratory or entity acceptable to the City, or with the appropriate public authority and shall bear all related costs of tests, inspections, and approvals. If the 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, the Contractor shall assume full responsibility for arranging and obtaining such inspections, tests, or approvals, pay all costs in connection therewith and furnish the Engineer with the required certificates of inspection, testing, or approval.

9.2.3 The Contractor shall be responsible for arranging and obtaining and shall pay all costs in connection with any inspections, tests, or approvals required for the Engineer's acceptance of materials or equipment to be incorporated into the Work, or of materials, mix designs, or equipment submitted for approval prior to the Contractor's purchase thereof for incorporation into the Work.

9.2.4 If any Work that is to be inspected, tested, or approved is covered by the Contractor, Subcontractor, or Sub-subcontractor without the prior written consent of the Engineer, it must be uncovered for observation, inspection, testing, or approval, if requested by the Engineer. The Contractor must recover the Work at its own expense.

9.2.5 The Contractor shall not be relieved of obligations to perform the Work in accordance with the Contract Documents either by activities or duties of the Engineer in the Engineer's administration of the Contract or by tests, inspections, or approvals required or performed by persons other than the Contractor.

9.2.6 All materials and workmanship shall be subject to inspection, examination, and test by the City at any and all times during manufacture and/or construction, and at any and all places where such manufacture and/or construction are carried on to establish conformance with these Specifications and suitability for uses intended. The Contractor shall furnish promptly all reasonable facilities, labor and materials necessary to make tests so required safe and convenient; he shall also furnish evidence of conformance to any mill,

factory, or such other tests based on the Standards and Tentative Standards of the American Society for Testing and Materials, or other national standards as required by the City.

ARTICLE 10 UNCOVERING AND CORRECTING WORK

10.1 Uncovering Work

10.1.1 If a portion of the Work is covered contrary to the Engineer's request or to requirements specifically expressed in the Contract Documents, it must, if required in writing by the Engineer, be uncovered for the Engineer's observation and be replaced, both at the Contractor's expense and without change in the Contract Time.

10.1.2 If a portion of the Work has been covered which the Engineer has not specifically requested to observe prior to its being covered, the Engineer may request to see such Work, and it shall be uncovered by the Contractor. If it is found that such Work is in accordance with the Contract Documents, costs of uncovering and replacing shall, by appropriate Change Order, be charged to the City. If it is found that such Work is defective or not in accordance with the Contract Documents, the Contractor shall pay all claims, costs, losses, and damages caused by, arising out of or resulting from 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 the City shall be entitled to an appropriate decrease in the Contract Sum. The City may take such decrease by reducing the then current application for payment accordingly or subsequent applications, if necessary, until the decrease is paid in full.

10.2 Correcting Work

10.2.1 The Contractor shall promptly correct Work rejected by the Engineer or failing to conform to the requirements of the Contract Documents, whether observed before or after Substantial Completion and whether or not fabricated, installed, or completed. The Contractor shall bear all costs of correcting such rejected Work including additional testing and inspections and compensation for the Engineer's services and expenses made necessary thereby and any cost, loss, or damages to the City resulting from such failure or defect.

10.2.2 If, within one (1) year after the date of Substantial Completion of the Work or designated portion thereof, or after the date for commencement of warranties established in Article 15, or by terms of an applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of written notice from the City to do so, unless the City has previously given the Contractor a written acceptance of such condition. This period of one (1) year shall be extended with respect to portions of Work first performed after Substantial Completion by the period of time between Substantial Completion and the actual performance of the Work. This obligation to correct under this paragraph shall survive acceptance of the Work under the Contract and termination of the Contract. The City shall give such notice promptly after discovery of the condition.

10.2.3 The Contractor shall correct, remove, or replace portions of the Work which are not in accordance with the requirements of the Contract Documents and are neither corrected by the Contractor nor accepted by the City.

10.2.4 If the Contractor fails within a reasonable time to correct nonconforming Work, or to remove and replace rejected Work, or fails to perform the Work in accordance with the Contract Documents, the City may correct it in accordance with the provisions herein. If the Contractor does not proceed with correction, removal, or replacement of such nonconforming Work within seven (7) days from the date of written notice from the Engineer, the City may correct it and store any salvable materials or equipment at the Contractor's expense. If the Contractor does not pay costs of any such removal and storage within ten (10) days after written notice, the City may upon ten (10) additional days' written notice sell such materials and equipment

at auction or at private sale and shall account for the proceeds thereof, after deducting costs and damages that should have been borne by the Contractor, including compensation for the Engineer's services and expenses made necessary thereby. If such proceeds of sale do not cover all the costs which the Contractor should have borne, the Contract Sum shall be reduced by the deficiency. If payments then or thereafter due the Contractor are not sufficient to cover such amount, the Contractor shall pay the difference to the City.

10.2.5 The Contractor shall bear the cost of correcting destroyed or damaged construction, whether completed or partially completed, of the City or separate contractors caused by the Contractor's correction or removal of Work which is not in accordance with the requirements of the Contract Documents.

10.2.6 Nothing contained in this paragraph shall be construed to establish a period of limitation with respect to other obligations which the Contractor might have under the Contract Documents. Establishment of the time period of one (1) year as described in the above paragraph related only to the specific obligation of the Contractor to correct the Work and has no relationship to the time within which the obligation to comply with the Contract Documents may be sought to be enforced nor to the time within which proceedings may be commenced to establish the Contractor's liability with respect to the Contractor's obligations other than specifically to correct the Work.

10.2.7 All work and all materials, whether incorporated in the work or not, all processes of manufacture, and all methods of construction shall be at all times and places subject to the inspection of the Engineer who shall be the final judge of the quality and suitability of the work, materials, processes of manufacture, and methods of construction for the purposes for which they are used. Should they fail to meet the Engineer approval, they shall be forthwith reconstructed, made good, replaced and/or corrected, as the case may be, by the Contractor at the Contractor's expense. Rejected material shall immediately be removed from the site. If in the opinion of the Engineer it is undesirable to replace any defective or damaged materials, or to reconstruct or correct any portion of the work injured or not performed in accordance with the Contract Documents, the compensation to be paid to the Contractor hereunder shall be reduced by such amount as in the judgment of the Engineer shall be equitable.

10.3 Acceptance of Nonconforming Work

10.3.1 If, instead of requiring correction or removal and replacement of defective or nonconforming Work, the City prefers to accept Work which is not in accordance with the requirements of the Contract Documents, the City may do so instead of requiring its removal and correction, in which case the Contractor shall pay all claims, costs, losses, and damages attributable to the City's evaluation of and determination to accept such defective or nonconforming Work. The Contract Sum will be reduced as appropriate. Such adjustment shall be effected whether or not final payment has been made.

ARTICLE 11 CHANGES IN THE WORK

11.1 In General

11.1.1 The Contract Sum constitutes the total compensation (subject to authorized adjustments) payable to the Contractor for performing the Work. All duties, responsibilities and obligations assigned to or undertaken by the Contractor shall be at the Contractor's expense without any change in the Contract Sum.

11.1.2 Without invalidating the Contract and without notice to any surety, the City may, at any time or from time to time, order additions to, deletions from, or revisions in the Work. Such additions, deletions, or revisions will be authorized by a Change Order, a Modification or a Work Change Directive. Upon receipt of any such document, the 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).

11.1.3 The Contractor shall not be entitled to an increase in the Contract Sum or an extension of the Contract Time with respect to any Work performed that is not required by the Contract Documents as amended, modified, or supplemented, except as otherwise provided herein.

11.2 Change Orders

11.2.1 (Reference: M.G.L. c. 30, §39I). The Contractor shall perform all the Work required by this Contract in conformity with the Drawings and Specifications contained herein. No willful and substantial deviation from said Drawings and Specifications shall be made unless authorized in writing by the Engineer and the City in charge of the Work who is duly authorized by the City to approve such deviations. In order to avoid delays in the prosecution of the Work required by such Contract, such deviation from the Drawings or Specifications may be authorized by a written order of the City or the Engineer so authorized to approve such deviation. Within thirty (30) days thereafter, such written order shall be confirmed by a certificate of the City stating: (1) If such deviation involves any substitution or elimination of materials, fixtures or equipment, the reasons why such materials, fixtures, or equipment were included in the first instance and the reasons for substitution or elimination, and, if the deviation is of any other nature, the reasons for such deviation, giving justification therefor; (2) that the specified deviation does not materially injure the Project as a whole; (3) that either the work substituted for the Work specified is of the same cost and quality, or that an equitable adjustment has been agreed upon between the City and the Contractor and the amount in dollars of said adjustment; and (4) that the deviation is in the best interest of the City.

11.3 Work Change Directive

11.3.1 A Work Change Directive shall be used in the absence of total agreement on the terms of a Change Order.

11.3.2 Upon request of the City or the Engineer, the Contractor shall without cost to the City submit to the Engineer in such form as the Engineer may require, an accurate written estimate of the cost of any proposed extra work or change. The estimate shall indicate the quantity and unit cost of each item of materials, and the number of hours of work and hourly rate for each class of labor, as well as the description and amounts of all other costs chargeable under the terms of this Article. Unit labor costs for the installation of each item of materials shall be shown if required by the Engineer. If required by the Engineer, in order to establish the exact cost of new Work added or of previously required Work omitted, the Contractor shall obtain and furnish to the Engineer bona fide proposals from recognized Suppliers for furnishing any material included in such Work. Such estimates shall be furnished promptly so as to occasion no delay in the Work, and shall be furnished at the Contractor's expense.

11.3.3 The Contractor shall state in the estimate any extension of time required for the completion of the Work if the change or extra Work is ordered. The Contractor shall document, through a critical path analysis, or some other clearly delineated explanation, how the proposed change affects other aspects of the Work, and why it would require an extension of time. The Contractor shall promptly revise and resubmit such estimate if the Engineer determines that it is not in compliance with the requirements of this Article, or that it contains errors of fact or mathematical errors.

11.3.4 If the Work Change Directive provides for an adjustment to the Contract Sum, the adjustment shall be based on one of the following methods, as selected by the City, selection of which does not require the consent of the Contractor:

11.3.4.1 By unit prices stated in the Contract Documents or otherwise mutually agreed upon.

11.3.4.2 By Cost and Percentages estimated by the Contractor as provided herein and accepted by the City; the Contractor's estimate shall become a fixed price which shall not be changed by any variation in the actual cost of executing the Work covered by the change.

11.3.4.3 By actual Cost determined after the Work covered by the change is completed, plus Percentage.

11.3.4.4 By submission to arbitration or a court, which shall determine the fair value of the Work covered by the change.

11.3.5 As used in this paragraph, "Cost" shall mean the estimated or actual net increase or decrease in cost to the Contractor, Subcontractor, or Sub-subcontractor for performing the Work covered by the change, including actual payments for materials, equipment rentals, expendable items, wages, and associated benefits to the workers and to supervisors employed full time at the Site, insurance, bonds, and other provable direct costs, but not including any administrative, accounting or expediting costs, or other indirect or overhead costs, or any wages or benefits of supervisory personnel not assigned full time to the Site, or any amount for profit or fee to the Contractor, Subcontractor, or Sub-subcontractor.

11.3.6 "Percentage" shall mean an allowance to be added to or subtracted from the Cost in lieu of overhead and profit and of any other expense which is not included in the Cost of the Work covered by the change, as defined above. Percentage for a Sub-subcontractor shall be 8% of any net increase or decrease of Cost of any Work performed by the Sub-subcontractor's own forces plus 4% of any net increase or decrease in Cost of any Work performed for the Sub-subcontractor by lower tier Sub-subcontractors. Percentage for a Subcontractor shall be 12% of any net increase or decrease of Cost of any Work performed by the Subcontractor's own forces plus 4% of the Cost of Work performed by Sub-subcontractors. Percentage for the Contractor shall be 15% of any net increase or decrease of Cost of any Work performed by the Contractor's own forces plus 5% of any net increase or decrease in the Cost for all other Work covered by the change. When the Contractor is also performing Work as a Subcontractor or Sub-subcontractor, the Contractor shall only be entitled to a total of no more than 15% of any net increase or decrease of Cost of any Work.

11.3.7 When in the reasonable judgment of the Engineer a series of Work Change Directives or Change Orders effect a single change, Percentage shall be calculated on the cumulative net increase or decrease in Cost, if any.

11.3.8 If unit prices are stated in the Contract Documents or are subsequently agreed upon, and if quantities originally contemplated are so changed in a Proposed Change Order or Work Change Directive that the application of such unit prices to quantities of Work proposed will cause substantial inequity to the City or the Contractor, the applicable unit prices shall be equitably adjusted.

11.3.9 If the City elects to determine the Cost of the Work as provided in paragraph 11.3.4.1 using unit prices stated in the Contract Documents or subsequently agreed upon, the unit prices shall be subject to the prior paragraph. Notwithstanding the inclusion of unit prices in the Contract Documents, it shall be the City's option to require the Cost of any given change to be determined by one of the other methods stated in 11.3.4. If the City elected to determine the Cost of the change by unit prices and the nature of the work is such that its extent cannot readily be measured after the completion of such work or any subsequent Work, the Contractor shall keep daily records, available at all times to the Engineer for inspection, of the actual quantities of such Work put in place, and delivery receipts or other adequate evidence, acceptable to the Engineer, indicating the quantities of materials delivered to the Site for use in such unit price Work, and distinguishing such from other similar material delivered for use in Work included in the base Contract Sum. If so required by the Engineer, materials for use in unit price Work shall be stored apart from all other materials on the Project.

11.3.10 If the City elects to determine the Cost of the Work as provided in methods 11.3.4.3. or 11.3.4.4. or if the method of determining the Cost has not been established before the Work is begun, the Contractor shall keep detailed daily records of labor and material costs applicable to the Work.

11.3.11 Upon receipt of a Work Change Directive, the Contractor shall promptly proceed with the change in the Work involved and advise the Engineer in writing of the Contractor's agreement or disagreement with the method, if any, provided in the Work Change Directive for determining the proposed adjustment in the Contract Time.

11.3.12 A Work Change Directive signed by the Contractor indicates the agreement of the Contractor therewith, including adjustment in the Contract Sum and Contract Time or the method for determining them. Such agreement shall be effective immediately and shall be recorded as a Change Order.

11.3.13 If the Engineer and the Contractor do not agree with the adjustment in the Contract Time or the method for determining it, the adjustment or the method shall be referred to the Engineer for determination.

11.4 Minor Changes in the Work

11.4.1 The Engineer has the authority to order minor changes in the Work. "Minor changes" as used in this paragraph mean changes which are so insignificant as to not affect the Contract Sum or the Contract Time and which are not inconsistent with the intent of the Contract Documents. Any minor change shall be committed to a written order which shall be binding on both the City and the Contractor and which shall be promptly carried out by the Contractor.

11.5 Certificate of Appropriations

11.5.1 (Reference: M.G.L. c. 44, §31C). This Contract shall not be deemed to have been made until the City's auditor has certified thereon that an appropriation in the amount of this Contract is available therefor and that an officer or agent of the City has been authorized to execute said Contract and approve all requisitions and change orders. No order to the Contractor for a change in or addition to the Work, whether in the form of a drawing, plan, detail or any other written instruction, unless it is an order which the Contractor is willing to perform without any increase to the Contract price, shall be deemed to be given until the auditor has certified thereon that an appropriation in the amount of such order is available therefore; but such certificate shall not be construed as an admission by the City of its liability to pay for such work. The certificate of the auditor that an appropriation in the amount of this Contract or in the amount of such order is available shall bar any defense by the City on the grounds of insufficient appropriation.

ARTICLE 12 CHANGE IN THE CONTRACT TIME

12.1 Date of Commencement

12.1.1 The date of commencement of the Work is the date established in the Notice to Proceed. The date shall not be postponed by the failure to act of the Contractor or persons or entities for whom the Contractor is responsible.

12.2 Progress and Completion

12.2.1 Time is of the essence; all time limits stated in the Contract Documents are of the essence of the Contract. By executing the Agreement, the Contractor confirms that the Contract Time is a reasonable period for performing the Work.

12.2.2 The Contractor shall proceed expeditiously with adequate forces and shall achieve Substantial Completion within the Contract Time.

12.2.3 At least ten (10) working days before the first application for payment, the Contractor shall submit to the Engineer a progress schedule showing for each class of Work included in the schedule of values, the percentage of completion to be obtained and the total dollar value of Work to be completed as of the first of each month until Substantial Completion. All calculations shall be on the basis of Work in place, but may include, at the Engineer's discretion, the value of materials delivered but not in place.

12.2.4 The progress schedule shall be based on an orderly progression of the Work, allowing adequate time for each operation (including adequate time for submission and review of submittals), and leading to a reasonable certainty of Substantial Completion by the date established in the Agreement. The progress schedule will be reviewed by the Engineer for compliance with the requirements of this Article and will be accepted by the Engineer or returned to the Contractor for revision and resubmittal. Unless specifically required by law, no payment under this Contract shall be due until the progress schedule has been approved by the Engineer. The Engineer's review of the progress schedule shall not impose any duty on the Engineer or the City with respect to the timing, planning, scheduling, or execution of the Work. In particular, if the Contractor proposes a progress schedule indicating a date of Substantial Completion which is earlier than the Contract Time, the Contractor shall not be entitled to additional payment or compensation of any kind if, for any reason, the full Contract Time is required to achieve Substantial Completion of the Work.

12.2.5 If in any Application for Payment, the total value of the completed Work in place, as certified by the Engineer, is less than 90% of the total value of the Work in place estimated in the progress schedule, the City may, at the City's option, require the Contractor to accelerate the progress of the Work without cost to the City by increasing the workforce or hours of Work or by other reasonable means approved by the Engineer.

12.2.6 If each of three successive applications, as certified by the Engineer, indicate that the actual Work completed is less than 90% of the values estimated in the progress schedule to be completed by the respective dates, the City may at the City's option, treat the Contractor's delinquency as a default justifying the action permitted under Article 18.

12.2.7 If the Engineer has determined that the Contractor should be permitted to extend the time for completion as provided below, the calendar dates in the progress schedule shall be adjusted accordingly to retain their same relationship to the adjusted date of Substantial Completion, and the dollar value of the Work to be completed as of the first of each month shall be adjusted pro rata.

12.2.8 If the Contractor fails to submit any application for payment in any month, the Engineer shall, for the purpose of this evaluation of progress, certify separately to the actual value of the Work in place completed as of the first of the month to the best of the Engineer's knowledge.

12.2.9 Nothing herein shall limit the City's right to liquidated or other damages for delays by the Contractor or to any other remedy which the City may be entitled or may possess under other provisions of the Contract Documents or by law.

12.3 Delays and Extensions of Time

12.3.1 If the Contractor is delayed at any time in the progress of the Work by an act or neglect of the City or the Engineer, or of an employee of either, or of a separate contractor employed by the City, or by changes ordered in the Work, or by labor disputes, fire, unusual delay in deliveries, unavoidable casualties, or other causes (except weather) beyond the Contractor's control, or by delay authorized by the City, or by other causes which the Engineer determines may justify delay, then the Contract Time shall be extended by Change Order or Work Change Directive for such reasonable time as the Engineer may determine.

12.3.2 Claims relating to time shall be made in accordance with applicable provisions of Article 16.

12.3.3 No claim for extension of time shall be allowed on account of failure of the Engineer to furnish Drawings, Specifications or instructions or to return Shop Drawings or Samples until fifteen (15) days after receipt by the Engineer by registered or certified mail of written demand for such instructions, Drawings, Specifications, or Samples, and then not unless such claim is reasonable.

12.3.4 No extensions of time shall be granted because of seasonal or abnormal variations in temperature, humidity or precipitation, which conditions shall be wholly at the risk of the Contractor, whether occurring within the time originally scheduled for completion or within the period of any extension granted. There shall be no increase in the Contract Sum on account of any additional costs of operations or conditions resulting therefrom.

12.3.5 The Contractor hereby agrees that the Contractor shall have no claim for damages of any kind against the City or the Engineer on account of any delay in the commencement of the Work and/or any hindrance, delay, or suspension of any portion of the Work, whether such delay is caused by the City, the Engineer, or otherwise, except as and to the extent expressly provided under M.G.L. c. 30, §39O, in the case of written orders by the City. 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 this Article.

12.3.6 (Reference: M.G.L. c. 30, §39O). (a) The City may order the Contractor in writing to suspend, delay, or interrupt all or any part of the Work for such period of time as it may determine to be appropriate for the convenience of the City, provided however that if there is a suspension, delay, or interruption for fifteen (15) days or more due to a failure of the City to act within the time specified in this Contract, the City shall make an adjustment in the Contract prices for any increase in the cost of performance of this Contract but shall not include any profit to the Contractor on such increase; and provided further, that the City shall not make adjustment in the Contract Price under this provision for any suspension, delay, interruption, or failure to act to the extent that such is due to any cause for which this Contract provides for an equitable adjustment of the Contract price under any other Contract provisions.

(b) The Contractor must submit the amount of a claim under provision (a) to the City in writing as soon as practicable after the end of the suspension, delay, interruption, or failure to act and, in any event, not later than the date of final payment under this Contract and, except for costs due to a suspension order, the City shall not approve any costs in the claim incurred more than twenty (20) days before the Contractor notified the City in writing of the act or a failure to act involved in the Claim.

In the event a suspension, delay, interruption, or failure to act of the City increases the cost of performance to any Subcontractor, that Subcontractor shall have the same rights against the Contractor for payment for an increase in the cost of its performance as provisions (a) and (b) give the Contractor against the City, but nothing in provisions (a) and (b) shall in any way change, modify, or alter any other rights which the Contractor or the Subcontractor may have against each other.

12.4 Liquidated Damages

12.4.1 If the Contractor shall fail to achieve Substantial Completion or Final Completion within the Contract Times, it shall be liable to pay the City the daily amount specified in the Agreement, not as a

penalty, but as a fixed and agreed upon damages for breach of contract. The said amount is fixed and agreed upon because of the difficulty of ascertaining the City's actual damages. It is mutually understood that the said amount is a reasonable approximation or estimate thereof as of the date of the Agreement. The City may elect to withhold said amount from periodic or final payments due to the Contractor, in addition to retainage and other backcharges.

12.5 Changes in the Contract Time

12.5.1 How. The Contract Time may only be changed by a Change Order or a Modification. Any claim for an adjustment of the Contract Time shall be based on a written notice delivered to the party making the claim to the other party and to the Engineer promptly (but in no event later than seven (7) days) after the occurrence of the event giving rise to the claim and stating the general nature of the claim. Notice of the extent of the claim with supporting data shall be delivered within thirty (30) days after such occurrence and shall be accompanied by the claimant's written statement that the adjustment claimed is the entire adjustment to which the claimant has reason to believe it is entitled as a result of the occurrence of said event. All claims for adjustment in the Contract Time shall be determined by the Engineer in accordance with Article 16. No claim for an adjustment in the Contract Time will be valid if not submitted in accordance with the requirements of this paragraph.

12.5.2 Early Completion. The Contract Time shall not be changed due to a delay in the Contractor's early completion date.

ARTICLE 13 PAYMENTS

13.1 Schedule of Values

13.1.1 The Contractor shall submit to the Engineer a schedule of values as specified in paragraph 5.15 which shall subdivide the Work into its component parts and shall include quantities, direct craft labor worker hours, labor cost and material/equipment cost. Labor cost shall include an appropriate amount of construction equipment costs, supplemental costs, administrative expenses, contingencies, and profit. The Contractor shall prepare the schedule of values in such form and supported by such data to substantiate its accuracy as the Engineer may require and shall be revised if later found by the Engineer to be inaccurate. This schedule, unless objected to by the Engineer, shall be used as a basis for reviewing the Contractor's applications for payment.

13.2 Content and Submission of Applications for Payment

13.2.1 At least ten (10) days before the date established for each progress payment, the Contractor shall submit to the Engineer six (6) copies of an itemized application for payment for Work completed in accordance with the schedule of values. Such application shall be in a form or format established or approved by the Engineer and shall be supported by documentation substantiating the Contractor's right to payment.

13.2.2 When Work Change Directives have set forth an adjustment to the Contract Sum but have not yet been included in Change Orders, the value established by the City may be included in the application.

13.2.3 Applications covering Work of Subcontractors or Suppliers shall not include requests for payments of amounts the Contractor does not intend to pay to a Subcontractor or Supplier because of a dispute or other reason. The Contractor shall not be paid for any Work performed by a Subcontractor unless and until the City receives for that Subcontractor a certificate of insurance which conforms to the requirements of the Contract Documents.

13.2.4 Unless otherwise provided in the Contract Documents, payments shall be made on account of materials and equipment delivered and suitably stored at the Site for subsequent incorporation in the Work. If approved in advance by the City, payment may similarly be made for materials and equipment suitably stored off the Site at a location agreed upon in writing. Payment for materials and equipment stored on or off the Site shall be conditioned upon the application for payment being accompanied by a bill of sale, an invoice, or other documentation warranting that the City has received the materials and equipment free and clear of all liens, claims, security interests, or encumbrances, hereinafter collectively referred to as "liens," and evidence that the materials and equipment are covered by appropriate insurance and other arrangements to protect the City's interest therein.

13.2.5 Each application for payment or periodic estimate requesting payment shall be accompanied by, at the City's option, a certificate from each Subcontractor stating that the Subcontractor has been paid all amounts due the Subcontractor on the basis of the previous periodic payment to the Contractor, or else stating the amount not so paid and the reason for the discrepancy. In the event of any such discrepancy, the Contractor shall furnish the Contractor's own written explanation to the City through the Engineer. Such waiver or certificate shall be in a form acceptable to the City.

13.3 False Applications for Payment

13.3.1 (Reference: M.G.L. c. 93, §9B). Any person who shall make or cause to be made, or present or cause to be presented, for payment or approval, to or by any employee, department, or agency, any claim upon or against any department or agency, knowing such claim to be false, fictitious or fraudulent, or who, for the purpose of obtaining or aiding to obtain the payment or approval of such claim, makes, uses, or causes to be made or used, any false bill, receipt, voucher, toll, account, claim, certificate, affidavit, or deposition knowing the same to contain any fraudulent or fictitious statement or entry, shall forfeit and pay to the City the sum of two thousand dollars (\$2,000.00) and, in addition, double the amount of damages which the City may have sustained by reason of the doing or committing of such act, together with the costs of the action.

13.4 Review of Applications for Payment

13.4.1 The Engineer shall review each application for payment and will reject any application that (1) is not accompanied by the required documentation or (2) contains errors, mathematical or otherwise.

13.4.2 Within five (5) business days after receipt of an application for payment, the Engineer will either (1) return the application to the Contractor with a written explanation as to why it was rejected or (2) issue to the City a certificate for payment, with a copy to the Contractor, for such amount as the Engineer determines is properly due. In the event an application is returned to the Contractor, the date of receipt of the application shall be the date of receipt of the corrected application.

13.4.3 The Engineer or the City may make changes to any application submitted by the Contractor.

13.4.4 By recommending any payment, the Engineer will not thereby be deemed to have represented that: (1) exhaustive or continuous on-site inspections have been made to check the quality or the quantity of the Work beyond the responsibilities specifically assigned to the Engineer in the Contract Documents or (2) that there may not be other matters or issues between the parties that might entitle the Contractor to be paid additionally by the City or entitle the City to withhold payment to the Contractor. The Engineer's approval of the application for payment and the accompanying documentation shall indicate that to the best of the Engineer's knowledge, information, and belief, the Work has progressed to the point indicated by the Contractor, and that the quality of the Work is in accordance with the Contract Documents, subject to an evaluation of the Work as a functioning whole prior to or upon Substantial Completion, the results of any

subsequent tests specified in the Contract Documents, final determination of quantities and classifications for unit price work and any other qualifications so stated.

13.4.5 The Engineer's recommendation of any payment shall not mean that the Engineer is responsible for the Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of the Contractor to comply with laws and regulations applicable to the furnishing or performance of Work, or for any failure of the Contractor to perform or furnish Work in accordance with the Contract Documents.

13.4.6 No certificate given or payment made shall be evidence of the performance of this Contract, either wholly or in part and no payment, whether made upon the final certificate or otherwise, shall be construed as an acceptance of defective work or materials.

13.5 Decisions to Withhold Certification

13.5.1 The Engineer may refuse to recommend the whole or any part of any payment if, in the Engineer's opinion, it would be incorrect to make the representations to the City referred to above.

13.5.2 If the Contractor and the Engineer cannot agree on a revised amount, the Engineer will promptly approve a certificate for payment for the amount for which the Engineer is able to make such representations to the City. The Engineer may also decide not to certify payment or, because of subsequently discovered evidence or subsequent observations, may nullify the whole or a part of a certificate for payment previously issued, to such extent as may be necessary in the Engineer's opinion to protect the City from loss because of:

13.5.2.1 Defective Work not remedied;

13.5.2.2 Third party claims filed or reasonable evidence indicating probable filing of such claims;

13.5.2.3 Failure of the Contractor to make payments properly to Subcontractors or for labor, materials or equipment;

13.5.2.4 Reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;

13.5.2.5 Damage to the City or another contractor;

13.5.2.6 Reasonable evidence that the Work will not be completed within the Contract Time, and that retainage currently held by the City would not be adequate to cover actual or liquidated damage for the anticipated delay;

13.5.2.7 Persistent failure to carry out the Work in accordance with the Contract Documents; or

13.5.2.8 Failure the Contractor to comply with mandatory requirements for maintaining record drawings. The Contractor shall check record drawings each month. Written confirmation that the record drawings are current will be required by the Engineer before approval of the Contractor's monthly payment requisition.

13.5.3 When the above reasons for withholding certification are removed, certification will be made for amounts previously withheld.

13.6 Progress Payments

13.6.1 After the Engineer has issued a certificate for payment, the City shall make payment in the manner and within the time provided in the Contract Documents.

13.6.2 (Reference: M.G.L. c. 30, §39G). The City shall pay the amount due pursuant to any periodic, Substantial Completion or final estimate within thirty-five (35) days after receipt of written acceptance for such estimate from the Contractor. In the case of periodic payments, the City may deduct from its payment a retention based on its estimate of the fair value of its claims against the Contractor, a retention for direct payments to Subcontractors based on demands for same in accordance with M.G.L. c. 30, §39F and a retention to secure satisfactory performance of the contractual work, not exceeding five percent (5%) of the approved amount of any periodic payment, and the same right to retention shall apply to bonded Subcontractors entitled to direct payment under M.G.L. c. 30, §39F provided, that a five percent (5%) value of all items that are planted in the ground shall be deducted from the periodic payments until final acceptance.

13.6.3 No periodic, Substantial Completion or final estimate or acceptance or payment thereof shall bar the Contractor from reserving all rights to dispute the quantity and amount of, or the failure of the City to approve a quantity and amount of, all or part of any Work item or extra Work item.

13.7 Final Payment

13.7.1 After final inspection and after the Contractor has completed all the required corrections to the satisfaction of the Engineer and the City and 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, and all other documents called for in the Contract Documents, as well as any surplus materials requested by the City, the Contractor may make an application for final payment as provided below.

13.7.2 (Reference: M.G.L. c. 30, §39G). Within thirty (30) days after receipt by the City of a notice from the Contractor stating that all of the Work required by the Contract has been completed, the City shall prepare and forthwith send to the Contractor for acceptance a final estimate for the quantity and price of the Work done and all retainage on the Work less all payments made to date, unless the City's inspection shows that Work required by the Contract remains incomplete or unsatisfactory, or that documentation required by the Contract has not been completed.

13.7.3 The making and acceptance of final payment will constitute a waiver of all claims by the Contractor against the City other than those previously made in writing and still unsettled.

13.8 Payments to Subcontractors

13.8.1 Neither the City nor the Engineer shall have an obligation to pay or see to the payment of money to a Subcontractor, Sub-subcontractor, or Supplier except as may otherwise be required by law.

13.8.2 (Reference: M.G.L. c. 30, §39F) (1)(a) Forthwith after the Contractor receives payment on account of a periodic estimate, the Contractor shall pay to each Subcontractor the amount paid for the labor performed and the materials furnished by that Subcontractor, less any amount specified in any court proceedings barring such payment and also less any amount claimed due from the Subcontractor by the Contractor.

(b) Not later than the sixty-fifth day after each Subcontractor substantially completes its Work in accordance with the Drawings and Specifications, the entire balance due under the subcontract, less amounts retained by the City as the estimated cost of completing the incomplete and unsatisfactory items of Work, shall be due the Subcontractor; and the City shall pay that amount to the Contractor. The Contractor shall forthwith pay to the Subcontractor the full amount received from the City less any amount specified in any court proceeding barring such payment and also less any amount claimed due from the Subcontractor by the Contractor.

(c) Each payment made by the City to the Contractor pursuant to paragraphs (a) and (b) of M.G.L. c. 30, §39F(1), for the labor performed and the materials furnished by a Subcontractor shall be made to the Contractor for the account of that Subcontractor; and the City shall take reasonable steps to compel the Contractor to make each such payment to each such Subcontractor. If the City has received a demand for direct payment from a Subcontractor for any amount which has already been included in a payment to the Contractor or which is to be include in a payment to the Contractor for payment to the Subcontractor as provided in paragraphs (a) and (b) of M.G.L. c. 30, §39F(1), the City shall act upon the demand as provided in M.G.L. c. 30, §39F.

(d) If, within seventy (70) days after the Subcontractor has substantially completed the subcontract Work, the Subcontractor has not received from the Contractor the balance due under the subcontract including any amount due for extra labor and materials furnished to the Contractor, less any amount retained by the City as the estimated cost of completing the incomplete and unsatisfactory items of Work, the Subcontractor may demand direct payment of that balance from the City. The demand shall be by a sworn statement delivered

to or sent by certified mail to the City, and a copy shall be delivered to or sent by certified mail to the Contractor at the same time. The demand shall contain a detailed breakdown of the balance due under the subcontract and also a statement of the status of completion of the subcontract Work. [The demand letter shall indicate the certified mail number assigned by the postal service or the date of delivery to the Contractor.] 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 (10) days after the Subcontractor has delivered or so mailed the demand to the City and delivered or so mailed a copy to the Contractor, the Contractor may reply to the demand. The reply shall be by a sworn statement delivered to or sent by certified mail to the City, 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 Contractor and of the amount due for each claim made by the Contractor against the Subcontractor.

(e) Within fifteen (15) days after receipt of the demand by the City, but in no event prior to the seventieth day after substantial completion of the subcontract Work, the City shall make direct payment to the Subcontractor of the balance due under the subcontract, including any amount due for extra labor and materials furnished to the Contractor, less any amount (i) retained by the City 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 Contractor in the sworn reply; provided that the City 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 by the previous paragraph. The City shall make further direct payments to the Subcontractor forthwith after the removal of the basis for deductions from direct payments made as provided in parts (i) and (ii) of this paragraph.

(f) The City shall forthwith deposit the amount deducted from a direct payment as provided in part (iii) of the previous paragraph in an interest-bearing joint account in the names of the Contractor and the Subcontractor in a bank in Massachusetts selected by the City or agreed upon by the Contractor and the Subcontractor and shall notify the Contractor and the Subcontractor of the date of the deposit and the bank receiving the deposit. The bank shall pay the amount in the account, including accrued interest, as provided in an agreement between the 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 the previous paragraph shall be made out of amounts payable to the Contractor at the time of receipt of a demand for direct payment from a Subcontractor and out of amounts which later become payable to the Contractor and in the order of receipt of such demands from Subcontractors. All direct payments shall discharge the obligation of the City to the Contractor to the extent of such payment.

(h) The City shall deduct from payments to a Contractor amounts which, together with the deposits in interest-bearing accounts pursuant to paragraph (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 Contractor.

(2) Any assignment by a Subcontractor of the rights under this section to a surety company furnishing a bond under the provisions of M.G.L. c. 149, §29 shall be invalid. The assignment and subrogation rights of the surety to amounts included in a demand for direct payment which are in the possession of the City or which are on deposit pursuant to paragraph (g) shall be subordinate to the rights of all Subcontractors who are entitled to be paid under this section and who have not been paid in full.

(3) A Contractor or a Subcontractor shall enforce a claim to any portion of the amount of a demand for direct payment deposited as provided in herein by a petition in equity in the superior court against the other and the bank shall not be a necessary party. A Subcontractor shall enforce a claim for direct payment or a right to require a deposit as provided in paragraph (f) by a petition in equity in the superior court against the City and the Contractor shall not be a necessary party. Upon motion of any party the court shall advance for speedy trial any petition filed as provided in this paragraph. M.G.L. c. 231, §§59 and 59B shall apply to such petitions. The court shall enter an interlocutory decree upon which execution shall issue for any part of a claim found due pursuant to §§59 and 59B and, upon motion of any party, shall advance for speedy trial the petition to collect the remainder of the claim. Any party aggrieved by such interlocutory decree shall have the right to appeal therefrom as from a final decree. The court shall not consolidate for trial the petition of any Subcontractor with the petition of one or more Subcontractors or the same general contract unless the court finds that a substantial portion of the evidence of the same events during the course of construction (other than the fact that the claims sought to be consolidated arise under the same general contract) is applicable to the petitions sought to be consolidated and that such consolidation will prevent unnecessary duplication of evidence. A decree in any such proceeding shall not include interest on the disputed amount deposited in excess of the interest earned for the period of any such deposit. No person except a Subcontractor filing a demand for direct payment for which no funds due the Contractor are available for direct payment shall have a right to file a petition in court of equity against the City claiming a demand for direct payment is premature, and such Subcontractor must file the petition before the City has made a direct payment to the Subcontractor and has made a deposit of the disputed portion as provided in part (iii) of paragraph (e) and in paragraph (f).

(4) In any petition to collect any claim for which a Subcontractor has filed a demand for direct payment the court shall, upon motion of the Contractor, reduce by the amount of any deposit of a disputed amount by the City as provided in part (iii) of paragraph (e) and in paragraph (f) any amount held under a trustee writ or pursuant to a restraining order or injunction.

ARTICLE 14 SUBSTANTIAL COMPLETION

14.1 Substantial Completion

14.1.1 Upon Substantial Completion of the Work, the Contractor shall present in writing to the City its certification that the Work has been substantially completed and include in its certification (1) a list of items to be completed or corrected, (2) all special warranties required by the Contract Documents, endorsed by the Contractor and in a form reasonably acceptable to the Engineer and (3) the permits and certificates referred to in 13.7.1., or elsewhere. The failure to include any item on the list mentioned in the preceding sentence does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents. When the Engineer on the basis of an inspection determines that the Work or designated portion thereof is substantially complete and the other conditions have been met, the Engineer will then prepare a certificate of Substantial Completion which shall establish the date of Substantial Completion, shall state the responsibilities of the City and the Contractor for security, maintenance, heat, utilities, damage to the Work, and insurance, and shall fix the time within which the Contractor shall complete the items listed therein. The certificate of Substantial Completion shall be submitted to the City and the Contractor for their written acceptance of the responsibilities assigned to them in such certificate.

14.1.2 Within twenty-one (21) days after receipt of the certification from the Contractor, the City shall present to the Contractor either a written declaration that the Work has been substantially completed or an itemized list of incomplete or unsatisfactory work items required by the Contract sufficient to demonstrate that the Work has not been substantially completed. The City may include with such list a notice setting forth a reasonable time within which the Contractor must achieve Substantial Completion of the Work. If the City fails to respond, by presentation of a written declaration or itemized list as aforesaid, to the

Contractor's certification within the twenty-one (21) day period, the Contractor's certification shall take effect as the City's declaration that the Work has been substantially completed.

14.2 Partial Use or Occupancy of the Premises

14.2.1 The City may occupy or use any completed or partially completed portion of the Work at any stage. Such partial occupancy or use may begin whether or not the portion is substantially complete, provided that the respective responsibilities of the City and the Contractor with respect to payments, retainage, if any, security, maintenance, heat, utilities, damage to the Work, insurance, correction of the Work, and warranties shall be established by agreement of the City and the Contractor or, absent such agreement, shall be determined by the Engineer subject to the right of either party to contest such determination as provided in Article 16.

14.2.2 Immediately prior to such partial occupancy or use, the City, the Contractor and the Engineer shall jointly inspect the area to be occupied or portion of the Work to be used in order to determine and record the condition of the Work.

14.2.3 Unless otherwise agreed upon, partial occupancy or use of a portion or portions of the Work shall not constitute acceptance of Work not complying with the requirements of the Contract Documents.

14.2.4 (Reference: M.G.L. c. 30, §39G). Within sixty-five (65) days after the effective date of a declaration of Substantial Completion, the City shall prepare and send to the Contractor for acceptance a Substantial Completion estimate for the quantity and price of the Work done and all but one percent (1%) retainage on that Work, including the quantity, price and all but one percent (1%) retainage for the undisputed part of each item and extra work item in dispute, but excluding the disputed part thereof, less the estimated cost of completing all incomplete and unsatisfactory items and less the total periodic payments made to date for the Work. The City shall also deduct from the Substantial Completion estimate an amount equal to the sum of all demands for direct payment filed by Subcontractors and not yet paid to Subcontractors or deposited in joint accounts pursuant to M.G.L. c. 30, §39F.

14.2.5 (Reference: M.G.L. c. 30, §39G). If the City fails to prepare and send to the Contractor any Substantial Completion estimate required by the provisions herein on or before the date specified, the City shall pay to the Contractor interest on the amount which would have been due to the Contractor pursuant to such Substantial Completion estimate at the rate of three (3) percentage points above the rediscount rate then charged by the Federal Reserve Bank of Boston from such date to the date on which the City sends that Substantial Completion estimate to the Contractor for acceptance or to the date of payment therefor, whichever occurs first. The City shall include the amount of such interest in the Substantial Completion estimate.

14.2.6 (Reference: M.G.L. c. 30, §39G). Within fifteen (15) days after the effective date of the declaration of Substantial Completion, the City shall send to the Contractor by certified mail, return receipt requested, a complete list of all incomplete or unsatisfactory items, and unless delayed by causes beyond its control, the Contractor shall complete all such items within forty-five (45) days after the receipt of such list or before the date for final payment and acceptance, whichever is later. If the Contractor fails to complete such Work within such time, the City may, subsequent to seven (7) days' written notice to the Contractor by certified mail, return receipt requested, terminate the Contract and complete the incomplete or unsatisfactory items and charge the cost of same to the Contractor.

14.3 Final Inspection

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

ARTICLE 15 GUARANTEES AND WARRANTIES

15.1 In General

15.1.1 All guarantees and warranties specifically called for by the Specifications shall expressly run to the benefit of the City.

15.2 Warranties

15.2.1 Warranties required by the Contract Documents shall commence on the date of Substantial Completion of the Work or designated portion thereof, unless otherwise provided in the certificate of Substantial Completion.

15.2.2 The Contractor warrants that the materials and equipment furnished under the Contract will be new and of recent manufacture unless otherwise specified, and that all Work will be of good quality, free from faults and defects, and in conformance with 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, modifications not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear under normal usage. If required by the Engineer, the Contractor shall furnish satisfactory evidence as to the kind and quality of material and equipment.

15.2.3 The Contractor warrants that title to all Work covered by an application for payment will pass to the City either by incorporation in the construction or upon the receipt of payment by the Contractor, whichever occurs first, free and clear of all liens. The Contractor further agrees that the submission of any application for payment shall conclusively be deemed to waive all liens with respect to said Work to which the Contractor may then be entitled, provided that such waiver of the lien rights shall not waive the Contractor's right to payment for such Work.

15.2.4 The 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 the City no later than the time of payment free and clear of all liens.

15.2.5 No materials or supplies for the Work shall be purchased by the Contractor or Subcontractor subject to any chattel mortgage or under a conditional sale contract or other agreement by which an interest is retained by the seller. The Contractor warrants that it has good title to all materials and supplies used by it in the Work, free from all liens, claims and encumbrances.

15.2.6 The Contractor shall indemnify and hold the City harmless from all claims growing out of the lawful demands of Subcontractors, laborers, workers, mechanics, material, persons, and furnishers of machinery and parts thereof, equipment, power tools, and all supplies, including commissary, incurred in the furtherance of the performance of this Contract. The Contractor shall at the City's request, furnish satisfactory evidence that all obligations of the nature herein above designated have been paid, discharged, or waived. If the Contractor fails to do so, then the City may, after having served written notice on the Contractor either pay unpaid bills, of which the City has written notice, direct, or withhold from the Contractor's unpaid compensation a sum of money deemed reasonably sufficient to pay any and all such lawful claims until satisfactory evidence is furnished that all liabilities have been fully discharged whereupon payment to the Contractor shall be resumed, in accordance with the terms of this Contract, but in no event shall the provisions of this sentence be construed to impose any obligations on the City to either the Contractor or its surety. In paying any unpaid bills of the Contractor, the City shall be deemed the agent

of the Contractor and any payment so made by the City shall be considered as payment made under the Contract by the City to the Contractor and the City shall not be liable to the Contractor for any such payment made in good faith.

15.3 Extended Warranties and Guarantees

15.3.1 Any defective Work that is either corrected or replaced will be warranted and guaranteed for a period of one (1) year from the date of such correction or replacement.

ARTICLE 16 CLAIMS

16.1 In General

16.1.1 Written Notice. A Claim must be made by written notice to the other party.

16.1.2 Content of Notice. The notice must include all written supporting data.

16.1.3 Burden of Proof. The party making the Claim must substantiate the Claim.

16.2 Time Limits on Claims

16.2.1 Unless otherwise provided, all Claims must be made within twenty-one (21) days after the occurrence of the event giving rise to such Claim or within twenty-one (21) days after the claimant first recognizes the condition giving rise to the Claim, whichever is later. Any change or addition to a previously made Claim shall be made by a written notice within the twenty-one-day period in order to be valid.

16.3 Continuing Contract Performance

16.3.1 Pending final resolution of a Claim including arbitration, unless otherwise agreed in writing, the Contractor shall proceed diligently with performance of the Contract and the City shall continue to make payments in accordance with the Contract Documents.

16.4 Types of Claims

16.4.1 Claims for Differing Subsurface or Latent Physical Conditions. (Reference: M.G.L. c. 30, §39N). If, during the progress of the Work, the Contractor or the City discovers that the actual subsurface or latent physical conditions encountered at the Site differ substantially or materially from those shown on the Drawings or indicated in the Contract Documents, either the Contractor or the City may request an equitable adjustment in the Contract Sum of the Contract applying to Work affected by the differing Site conditions. A request for such an adjustment shall be in writing and shall be delivered by the party making such claim to the other party as soon as possible after such conditions are discovered. Upon receipt of such a claim from a Contractor, or upon its own initiative, the City shall make an investigation of such physical conditions, and if they differ substantially or materially from those shown on the Drawings or indicated in the Contract Documents or from those ordinarily encountered and generally recognized as inherent in Work of the character provided for in the Drawings and Contract Documents and are of such a nature as to cause an increase or decrease in the cost of performance of the Work or a change in the construction methods required for the performance of the Work which results in an increase or decrease in the cost of the Work, the City shall make an equitable adjustment in the Contract Sum and the Contract shall be modified in writing accordingly.

16.4.2 Claims for Additional Cost. If the Contractor claims that any acts or omissions of the City or the Engineer, including any instructions or orders, whether oral, written, by drawings, or otherwise, involve extra cost or time, and the Contractor has not received a written acknowledgment by the City or the Engineer that extra payment will be made or time extended on account thereof, the Contractor shall promptly so notify the Engineer in writing of such Claim and shall proceed with the Work relating to such Claim and all rights of both parties with respect to such Claim shall be deemed to have been reserved. No Claim by the Contractor on account of such acts, omissions, instructions, or orders shall be valid unless the Contractor has so notified the Engineer before proceeding.

16.4.2.1 Under no circumstances shall a Claim be made for additional cost where adverse weather conditions are the basis for the Claim.

16.4.3 Claims for Additional Time. If the Contractor wishes to make a Claim for an increase in the Contract Time, written notice as provided herein shall be given. The Contractor shall have the burden of demonstrating the effect of the claimed delay on the Contract Time and shall furnish the Engineer with such documentation relating thereto as the Engineer may reasonably require. Under no circumstances shall the Contractor make a Claim for an increase in the Contract Time due to a change in the Contractor's early completion date. If the increase in the Contract Time extends beyond the Contract Time established by the City, only the time that so extends beyond the Contract Time shall be reviewed and considered. In the case of a continuing delay, only one Claim is necessary.

16.4.3.1 Under no circumstances shall a Claim be made for additional time where adverse weather conditions are the basis for the Claim.

16.4.4 Claims for Injury to Person or Damage to Property. Should either party to the Contract suffer injury to person or damage to property because of any error, omission, or act of the other party or of any of the other party's employees or agents or others for whose acts the other party is legally liable, a Claim will be made in writing to the other party within twenty-one (21) days of the occurrence of the act giving rise to the injury or damage.

16.5 Review of Claims

16.5.1 Initial Referral. All Claims, the bases of which arise prior to final payment or the earlier termination of the Contract, shall be referred initially to the Engineer for action as provided herein.

16.5.2 Time Period and Action. The Engineer shall review Claims and shall do one of the following within fourteen (14) days of receipt of the Claim:

16.5.2.1 Defer any action with respect to all or any part of a Claim for the purpose of requesting and receiving additional information from either party;

16.5.2.2 Decline in writing to render a decision for any reason which it deems appropriate (including, but not limited to, the fact that the Claim involves allegations of fault on the part of the Engineer); or

16.5.2.3 Render a decision on all or a part of the Claim.

16.5.3 If the Engineer requests additional information, the Engineer shall take action with respect to the Claim no later than fourteen (14) days after receipt of the additional information. The Engineer shall notify the parties in writing of its disposition of such Claim. If the Engineer renders a decision or declines to render a decision, either party may proceed in accordance with paragraph 16.7.

16.6 Decisions

16.6.1 Decisions by the City or the Engineer. (Reference: M.G.L. c. 30, §39P). In every case in which this Contract requires the City, any official, or its Engineer to make a decision on interpretation of the Specifications, approval of equipment, material or any other approval, or progress of the Work, the decision shall be made promptly and, in any event, no later than fourteen (14) days after the written submission for decision; but if such decision requires extended investigation and study, the City, the official, or the Engineer shall, within fourteen (14) days after the receipt of the submission, give the party making the submission written notice of the reasons why the decision cannot be made within the thirty-day period and the date by which the decision will be made.

16.6.2 When Decision of the Engineer is Final and Binding. The decision of the Engineer shall be final and binding on the parties, unless a party files suit or a demand for arbitration within thirty (30) days after the date of the decision.

16.6.3 When Decision of the Engineer is Not Final and Binding. (Reference: M.G.L. c. 30, §39J). Notwithstanding any contrary provision of this Contract, no decision by the City or by the Engineer on a dispute, whether of fact or of law, arising under said Contract shall be final or conclusive if such decision is made in bad faith, fraudulently, capriciously, arbitrarily, is unsupported by substantial evidence, or is based upon error of law.

16.6.4 Resolved Claims. If a Claim is resolved, the Engineer shall obtain or prepare the appropriate documentation and provide the City and the Contractor with a copy of same.

16.7 Arbitration

16.7.1 Controversies and Claims Subject to Arbitration. Any controversy of Claim arising out of or related to the Contract, or the breach thereof, shall be settled by arbitration 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, except controversies of Claims relating to aesthetic effect, subject to the provisions of paragraph 16.7.7. In any such arbitration in which the amount stated in the demand is \$100,000 or less, the American Arbitration Association shall appoint a single arbitrator in accordance with such Rules, who shall be a lawyer. In any such arbitration in which the amount stated in the demand is in excess of \$100,000, the demand shall include the name of an arbitrator appointed by the claimant. The respondent shall appoint a second arbitrator and shall notify the claimant in writing of such appointment within thirty (30) days of receipt of the demand, failing which the matter shall be decided by the arbitrator named in the claimant's demand. Within thirty (30) days after the claimant's receipt of notice of the appointment of the second arbitrator, the two arbitrators shall appoint a neutral arbitrator and shall notify the parties in writing of such appointment, failing which either party may apply to the American Arbitration Association to appoint such neutral arbitrator. If such neutral arbitrator is appointed by the American Arbitration Association, he or she shall be a lawyer.

16.7.2 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, provided however that the arbitration panel shall have all of 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:

16.7.2.1 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.

16.7.2.2 After the neutral arbitrator has been appointed, neither party may engage in ex parte communication with any arbitrator.

16.7.3 When Arbitration May Be Demanded. Demand for arbitration of any Claim, the basis of which arises prior to final payment or the earlier termination of the Contract may not be made before the earlier of (1) the date on which the Engineer has rendered a written decision on the Claim or has notified the parties in writing that such decision will not be rendered or (2) forty-five (45) days following receipt by the Engineer of a written request for a decision sent by registered or certified mail to both the Engineer and the other party to this Contract.

16.7.3.1 In no event shall a demand for arbitration 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.

16.7.4 Limitation on Consolidation or Joinder. No arbitration arising out of or relating to the Contract Documents shall include, by consolidation or joinder or in any other manner, the Engineer, the Engineer's employees or consultants, except by written consent containing specific reference to the Contract and signed by the Engineer, the City, the Contractor, and any other person or entity sought to be joined. No arbitration shall include, by consolidation or joinder or in any other manner, parties other than the City, the Contractor, a separate contractor, and other persons substantially involved in a common question of fact or law whose presence is required if complete relief is to be accorded in arbitration. No person or entity other than the City, the Contractor, or a separate contractor shall be included as an original third party or additional third party to an arbitration whose interest or responsibility is insubstantial. Consent to arbitration involving an additional person or entity shall not constitute consent to arbitration of a dispute not described therein or with a person or entity so named or described herein. The foregoing agreement to arbitrate and other agreements to arbitrate with an additional person or entity duly consented to by parties to the Contract shall be specifically enforceable under applicable law in any court having jurisdiction thereof.

16.7.5 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.

16.7.6 Award Final. The award rendered by the arbitrator or arbitrators shall be final, and judgment may be entered upon it in accordance with applicable law in any court having jurisdiction thereof.

16.7.7 The City's Reservation of Rights. Notwithstanding any provision contained in this Article 16 or elsewhere in the Contract Documents, the City reserves the following rights in connection with Claims between the City and the Contractor, which rights may be exercised by the City unilaterally, in the City's sole discretion, and without the consent of the Contractor:

16.7.7.1 The right to institute legal action against the Contractor in any court of competent jurisdiction in lieu of demanding arbitration, in which case the dispute or disputes which are the subject of such action shall be decided by such court, and not by arbitration;

16.7.7.2 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;

16.7.7.3 The right to require the Contractor to join as a party in any arbitration between the City and the Engineer relating to the Project, in which case the Contractor agrees to be bound by the decision of the arbitrator or arbitrators in such arbitration.

16.7.8 In case the City elects to proceed in accordance with 16.7.7.1. or 16.7.7.2. above, the word “litigation” shall be deemed to replace the word “arbitration” wherever the latter word appears in the Contract Documents.

ARTICLE 17 EMERGENCIES

17.1 In an emergency affecting the health and safety of persons or property, the Contractor shall act to prevent threatened damage, injury, or loss.

17.2 In emergencies affecting the health, safety, or protection of persons, the Work or property at the Site or adjacent thereto, the Contractor, without special instruction or authorization from the City or the Engineer, is obligated to act to prevent threatened damage, injury, or loss. The Contractor shall give the Engineer prompt written notice if the Contractor believes that any significant changes in the Work or variations from the Contract Documents have been caused thereby. If the Engineer determines that a change in the Contract Documents is required because of the action taken by the Contractor in response to such an emergency, a Work Change Directive or Change Order will be issued to document the consequences of such action.

ARTICLE 18 TERMINATION OR SUSPENSION OF THE CONTRACT

18.1 Suspension by the City

18.1.1 At any time and without cause, the City may suspend the Work or any portion thereof for a period of not more than ninety (90) days by notice in writing to the Contractor and the Engineer which will fix the date on which Work will be resumed. The Contractor shall resume Work on the date so fixed. The Contractor shall be allowed an adjustment in the Contract Sum or an extension of the Contract Time, or both, directly attributable to any such suspension if the Contractor makes an approved Claim therefor.

18.1.2 If the Work is defective, if the Contractor fails to provide a sufficient number of skilled workers or suitable materials or equipment, or if the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a seven-day period after receipt of written notice from the City to begin and prosecute correction of such default or neglect with diligence and promptness, the City may correct such deficiencies, without prejudice to other remedies the City may have. In such case, an appropriate Work Change Directive shall be issued deducting from payments then or thereafter due to the Contractor the cost of correcting such deficiencies including compensation for the Engineer's additional services and expenses made necessary by such default, neglect, or failure and any and all direct, indirect, or consequential costs associated with the order to stop the Work. If such payments then or thereafter due the Contractor are not sufficient to cover such amounts, the Contractor shall immediately pay the difference to the City. The Contractor shall remain responsible for maintaining progress and shall not be entitled to any increase in the Contract Time or the Contract Sum.

18.2 Termination by the Contractor

18.2.1 If, through no act or fault of the Contractor, a Subcontractor, or a Sub-subcontractor, the Work is suspended for a period of more than ninety (90) days by the City, or under an order of court or other public authority, or the Engineer fails to act on any application for payment within thirty (30) days after it is submitted in proper form and content or the City fails for thirty (30) days to pay the Contractor any sum finally determined to be due, then the Contractor may terminate the Contract upon seven (7) days' written notice to the City, provided that the City does not remedy such suspension or failure within that time.

18.3 Termination by the City

18.3.1 If the Contractor is adjudged a bankrupt, or if the Contractor makes a general assignment for the benefit of the Contractor's creditors, or if a receiver is appointed on account of the Contractor's insolvency, or if the Contractor persistently or repeatedly refuses or fails, except in cases for which extension of time is

provided, to supply enough properly skilled workers or proper materials, or if the Contractor fails to make prompt payment to Subcontractors or for materials or labor, or persistently disregards laws, ordinances, rules, regulations, or orders of any public authority having jurisdiction or disregards an instruction, order, or decision of the Engineer, or otherwise is guilty of substantial violation of any provision of the Contract, then the Contractor shall be in default, and the City may, without prejudice to any other right or remedy and upon written notice to the Contractor, take possession of all materials, tools, appliances, equipment, construction equipment and machinery and vehicles, offices and other facilities on the Project Site, and all materials intended for the Work, wherever stored, and, seven (7) days after such notice, may terminate the employment of the Contractor, accept assignment of any or all subcontracts pursuant to Paragraph 6.6.1.1 and finish the Work by whatever method the City may deem expedient. The City shall be entitled to collect from the Contractor all direct, indirect, and consequential damages suffered by the City on account of the Contractor's default, including without limitation additional services and expenses of the Engineer made necessary thereby. The City shall be entitled to hold all amounts due to the Contractor at the date of termination until all of the City's damages have been established, and to apply such amounts to such damages.

18.3.2 (Reference: Cambridge Municipal Code Chapter 2.117, Section 2.117.110C). In the event the Contractor or any of its agents or employees violates any provision of Cambridge Municipal Code Chapter 2.117 which is applicable to City contractors in connection with the awarding, administration, or performance of the Contract, the City may terminate the Contract.

ARTICLE 19 AMERICANS WITH DISABILITIES ACT (42 U.S. 12131)

19.1 On July 26, 1994, the Americans with Disabilities Act ("the Act") became effective for employers of fifteen or more employees.

19.2 The Act protects against discrimination on the basis of "disability," which is defined as a physical or mental impairment that substantially limits at least one "major life activity;" or discrimination against an individual who has a record of such impairment; or discrimination against an individual being regarded - even if inaccurately - as having such impairment. The Act also expressly prohibits job discrimination that is based on any individual's relationship or association with a disabled person.

19.3 If the Contractor is subject to the Act, it must comply with its provisions.

ARTICLE 20 WRITTEN NOTICE TO THE PARTIES

20.1 In General

20.1.1 All written communications from the Engineer to the Contractor shall be copied to the City. All written communications from the Contractor to the Engineer shall be copied to the City. All written communications from the Contractor to the City shall be copied to the Engineer.

20.2 Addresses

20.2.1 To the City. Written notice to the City shall be sent or hand-delivered to:

City Manager
City of Cambridge
Massachusetts Avenue
Cambridge, MA 02139

20.2.2 To the Contractor. Both the address given on the bid form upon which the Agreement is founded and the Contractor's office at or near the Site of the Work are hereby designated as places to either of which notices, letters, and other communications to the Contractor shall be certified, mailed, or delivered. Delivery of any notice, letter, or other communication to the Contractor at or depositing same in a postpaid wrapper directed to either place shall be deemed sufficient service thereof upon the Contractor. Written notice shall be deemed to have been duly served on the Contractor if it is sent or hand-delivered to any member or officer of the Contractor. The date of said service shall be the date of such delivery or mailing. The address may be changed at any time by an instrument in writing, executed and acknowledged by the Contractor and delivered to the City and to the Engineer. Nothing herein contained shall be deemed to preclude or render inoperative the service of any notice, letter, or other communication upon the Contractor personally. Moreover, any notice, letter, or other communication required under the Contract may be served on the Contractor's representative at job meetings. The Contractor shall provide the City with its change of address seven (7) days prior to its effective date.

20.2.3 To the Engineer. Written notice to the Engineer shall be sent or hand-delivered to the address appearing on the Project Manual. Written notice shall be deemed to have been duly served on the Engineer if it is sent or hand-delivered to any member or officer of the Engineer.

ARTICLE 21 MISCELLANEOUS PROVISIONS

21.1 Governing Law

21.1.1 This Contract shall be governed by the laws of the Commonwealth of Massachusetts.

21.2 Venue

21.2.1 Venue for any court action or proceeding shall be Middlesex County in the Commonwealth of Massachusetts only. The Contractor, all Subcontractors, and Suppliers waive any and all jurisdictional and venue defenses.

21.3 Successors and Assigns

21.3.1 The Contractor shall not assign, in whole or in part, its rights and obligations under the Contract Documents without prior written consent of the City. An assignment without the prior written consent of the City shall not relieve the Contractor of its obligations thereunder.

21.3.2 The City and the Contractor respectively bind themselves, their partners, successors, assigns, and legal representatives to the other party hereto and to partners, successors, assigns, and legal representatives of such other party in respect to covenants, agreements, and obligations contained in the Contract Documents.

21.4 Statutory Limitation Period

21.4.1 It is expressly agreed that the obligations of the Contractor hereunder arise out of contractual duties, and that the failure of the Contractor to comply with the requirements of the Contract Documents shall constitute a breach of contract, not a tort, for the purpose of applicable statutes of limitations and repose. Any cause of action which the City may have on account of such failure shall be deemed to accrue only when the City has obtained actual knowledge of such failure, not before.

21.5 Rights and Remedies

21.5.1 Duties and obligations imposed by the Contract Documents and rights and remedies available thereunder shall be in addition to and not a limitation of duties, obligations, rights, and remedies otherwise imposed or available by law.

21.5.2 No action or failure to act by the City, the Engineer, or the Contractor shall constitute a waiver of a right or duty afforded them under the Contract, nor shall such action or failure to act constitute approval of or acquiescence in a breach thereunder, except as may be specifically agreed in writing.

THIS IS THE END OF THE GENERAL TERMS AND CONDITIONS

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SECTION 00825
SUPPLEMENTAL GENERAL CONDITIONS

FOR CONSTRUCTION, RECONSTRUCTION, ALTERATION
REMODELING, OR REPAIR OF ANY
CITY OF CAMBRIDGE PUBLIC WORK

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ARTICLE 1 - PROTECTION OF LIVES, HEALTH AND PROPERTY

1.1 The Contractor will be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the work. The Contractor shall take all necessary precautions for the safety of and will provide the necessary protection to prevent damage, injury, or loss to:

1.2 All employees on the work and other persons who may be affected thereby;

1.3 All the work and all materials or equipment to be incorporated therein, whether in storage on or off the site; and

1.4 Other existing property at the site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, and utilities not designated for removal, relocation, or replacement in the course of construction.

1.5 Notwithstanding any other provisions of this contract, the Contractor shall at Contractor's expense promptly restore to its prior condition all property (regardless of by whom owned or where located) damaged as a result of Contractor's operations.

1.6 The Contractor shall comply with all applicable laws, ordinances, rules, regulations, and orders of any public body having jurisdiction for the safety of persons or property or to protect them from damage, injury, or loss. The Contractor shall erect and maintain as required by the conditions and progress of the work, all necessary safeguards for safety and protection, and in addition the Contractor shall comply with all applicable recommendations of the Manual of Accident Prevention in Construction of the Associated General Contractors of America, Inc. The Contractor shall notify owners of adjacent utilities when prosecution of the work may affect them. All damage, injury, or loss to any property referred to in section 1.4 or 1.5 above, caused directly or indirectly, in whole or in part by the Contractor and subcontractor, or anyone directly or indirectly employed by any of them; or anyone for whose acts any of them may be liable will be remedied by the Contractor; except damage or loss attributable to the fault of drawings or specifications, or to the acts or omissions of the Engineer, the Owner, or the Engineer, or anyone employed by either of them; or anyone for whose acts either of them may be liable and not attributable directly or indirectly in whole or in part to the fault or negligence of the Contractor.

1.7 The Contractor shall designate a responsible member of its organization at the site whose duty shall be the prevention of accidents. This person shall be the Contractor's superintendent, unless otherwise designated in writing by the Contractor to the Owner.

1.8 The Contractor and all subcontractors shall immediately report all accidents, injuries, or health hazards to the Owner or its designated representatives in writing for information purposes only. This shall not relieve the Contractor or all subcontractors from mandatory reporting requirements, or any other requirements under the Occupational Safety and Health Act of 1970.

1.9 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 Workforce Development, Division of Industrial Safety "Rules and Regulations for the Prevention of Accidents in Construction Operations (Industrial Bulletin No. 12)." Contractors shall be familiar with the requirements of these regulations, and MUCTD and ADA safety requirements.

ARTICLE 2 - ACCESS TO THE WORK

2.1 The Owner and agents and employees of the Owner may at all times enter upon the work and areas occupied by the Contractor, and the Contractor shall provide safe and proper facilities for such entrance and for the inspection of the work.

2.2 The Contractor shall at all times provide proper facilities for access and inspection by representatives of the Commonwealth of Massachusetts to all work under this project wherever it is in preparation or progress.

ARTICLE 3 - CONTRACTOR TO LAY OUT CONTRACTOR'S OWN WORK

3.1 The Owner will establish such general reference points for all detailed layout, staking, and grade control as in its judgment will enable the Contractor to proceed with the work. The Contractor at its own expense shall provide all materials and equipment and such qualified helpers, including a registered engineer and/or land surveyor, as the Owner may require for utilizing the general reference points, and also, protect and preserve all stakes, benches, and other markers used to identify the reference points and be responsible for the accuracy of all lines, grades, and measurements. See also, DWPC Construction Grants Policy Memorandum No. CG-3.

ARTICLE 4 - PROJECT MEETINGS

4.1 First Progress Meeting: Prior to the commencement of Work at the site, the first progress meeting will be held at a mutually agreed time at the Owner's office which shall be attended by the Contractor's Project Manager, its superintendent and CQC Manager, and its Subcontractors as the Contractor deems appropriate. Other attendees will be:

- Resident Project Representative.
- Representatives of Owner.
- Governmental representatives as appropriate.
- Others as requested by Contractor or Owner.

4.2 The Contractor shall bring to the meeting the submittals specified in the GENERAL CONDITIONS, SUPPLEMENTAL GENERAL CONDITIONS AND THE SPECIAL CONDITIONS and Section 01300.

4.4 The purpose of the meeting is to designate responsible personnel and establish a Working relationship. Matters requiring coordination will be discussed and procedures for handling such matters established. The complete agenda will be furnished to the Contractor prior to the meeting date. However, the Contractor should be prepared to discuss all of the items listed below.

- Contractor's tentative schedules.
- Transmittal, review, and distribution of Contractor's submittals.
- Processing applications for payment.
- Maintaining record documents.
- Critical Work sequencing.
- Field decisions and Change Orders.
- Use of project site, office and storage areas, security, housekeeping, and Owner's needs.
- Major equipment deliveries and priorities.
- Contractor's assignments for safety and first aid.

4.5 The Owner will preside at the meeting and will arrange for keeping and distributing the minutes to all persons in attendance.

4.6 The Contractor and its Subcontractors should plan on the meeting taking no less than one full Working day.

4.7 Weekly Progress Meetings: See Article 5.6.6 of the GENERAL CONDITIONS.

ARTICLE 5 - PROJECT SIGN DETAILS

5.1 The Contractor shall furnish and erect a sign at the project site at the location directed. The Contractor shall maintain the sign, including repainting, in a satisfactory condition for the life of this Contract. Upon completion of the project and when directed, the sign shall become the property of the Contractor and shall be satisfactorily removed and disposed of by the Contractor off the site. The costs of furnishing, erecting, and maintaining the project sign shall be considered to be included in the prices stipulated for the various items of work as listed in the Bid; no direct payment will be made for this work. The sign shall meet the following criteria:

¾" thick exterior high density overlay plywood

Sign shall be 8 feet wide by 4 feet high, mounted at least 4 feet above the ground

Sign shall be multi-colored and with font style and font size as directed by the Owner

Sign shall include graphic logo for the City of Cambridge, DPW's "The Works" logo, the Engineers, and the Contractor.

The lettering on the sign shall be provided as indicated and to additional requirements as directed.

ARTICLE 6 - SUBSURFACE DATA

6.1 Subsurface soil and rock information and investigations have been obtained, made, and plotted for use by the Owner for the purpose of design of the project. The subsurface soils and rock data shown on the Drawings and in the Specifications are based on the geotechnical and environmental reports prepared for the work proposed. These reports, which are included in Appendices A and B, are for the general information of bidders and the Contractor and the attention of Bidders and Contractors is directed to the fact that by reason of methods commonly used for obtaining and expressing such boring data, these information and data may be limited and subject to error or misunderstanding. The terms used to describe soils, rock, groundwater, and such other conditions are subject to local usage, and to the interpretation of the person obtaining and making the records. The borings have been made with reasonable care, substantially at the locations indicated and to the depths shown. Groundwater levels shown in the reports in Appendices A and B are those reported by the driller to be existing at the particular boring location at the time subsurface investigations were made, and do not necessarily represent permanent groundwater levels; it shall be the responsibility of the Contractor to determine for itself annual and seasonal variations in groundwater levels which may affect the Contractor's work. Each bidder is expected to examine the site and the compiled record of investigations and information and then, based upon those inspections, interpretations, and such other investigations as the bidder may desire, decide the character of material to be encountered and excavated, the suitability of the materials that are to be used for backfilling and such other purposes, groundwater conditions, difficulties, or obstacles likely to be encountered, and other conditions affecting the work. No warranty, either expressed or implied by the Owner, Engineer, or their agents, is made as to the accuracy of the subsurface information and data shown on the Drawings, and the Engineer, the Owner, together with their agents, will not assume responsibility for any consequences delays, expense, or losses which may occur or have occurred in the event that such indications shall be found to be incomplete, incorrect, or misleading; nor shall such variations or inaccuracies in the indications of subsurface information and data constitute grounds for revision in contract price or the time of completion.

ARTICLE 7 - ADDITIONAL DEFINITIONS

- 7.1 Earth – Earth, whenever used as a name of material excavated or to be excavated, shall mean all kinds of material except rock.
- 7.2 Loam – “Loam”, “Soil”, or “Top Soil” shall mean the material composing the surface layer of ground containing varying amounts of organic matter.
- 7.3 Rock – Rock, whenever used as a name of material excavated or to be excavated, shall mean the sound bedrock properly removed by blasting, wedging or barring, also such boulders as exceed one cubic yard in volume removed or to be removed from the excavation.
- 7.4 Ton – Ton shall mean 2,000 pounds.

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SECTION 00825A
SPECIAL CONDITIONS

FOR CONSTRUCTION, RECONSTRUCTION, INSTALLATION,
DEMOLITION, MAINTENACE OR REPAIR OF ANY
CITY OF CAMBRIDGE PUBLIC WORK

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of Urban Forestry - Tree Protection During Construction
Attachment II – General Laws of Massachusetts – Part I – Title XIV
Public Ways and Works – Chapter 82 – Section 40
Attachment III – Ordinance Number 1329 (Dumpster Licenses)

SPECIAL CONDITIONS

ARTICLE 1 - SCOPE OF THE WORK: The Contractor shall furnish all plant, labor, materials, supplies, equipment and other facilities and things necessary or proper for, or incidental to, the work contemplated by this Contract as required by and in strict accordance with the Drawings, Specifications and Addendum (or Addenda), and/or required by, and in strict accordance with, such changes as are ordered and approved pursuant to this Contract, and the Contractor shall perform all other obligations imposed on the Contractor by this Contract. The Contractor shall be responsible for all materials delivered and work performed until completion and final acceptance. Upon completion of this Contract, the work shall be delivered complete and undamaged.

ARTICLE 2 - SPECIAL CONSIDERATIONS AND NOTICES:

- a. The Contractor shall be responsible for the control of flows in the existing sewers and drains affected by the work under this Contract. The use of stop logs, bagging, sand bags, or any other suitable method approved by the Owner may be used to interrupt flows within the work areas, provided pumping is used to maintain sewerage and drainage flows and water levels in the incoming sewer and drainage systems during construction operations. Pumped sewage and drainage shall be discharged into other sewers and drains, respectively, as approved by the Owner. The Contractor shall submit for review his proposed methods of flow controls.
- b. The Contractor shall supply the Owner, prior to the start of construction operations, with a telephone number and location of a place where he may be contacted at any time during the performance of this contract.
- c. All flows within the existing sewers shall be maintained. Existing combined sewers may flow at full capacity during storms. All plugs or similar devices used to block sewers or storm drains shall be removed at the end of each work day unless otherwise directed by the Owner due to special conditions. All plugs or similar devices to block sewers and storm drains shall be recorded as to location and time installed, and shall be recorded as to location and time removed. This accounting shall be enforced in order to avoid the potential for sewage or stormwater back-ups due to blocked pipelines. Copies of the recorded information shall be provided to the Engineer on a daily basis.
- d. All damaged areas outside the Contract work limits shall be restored to its original condition at the expense of the Contractor.
- e. Removal of portions of the existing manholes and existing storm catch basins may be required to permit construction operations. Portions of manholes and catch basins removed shall be replaced in conformance with the catch basin or manhole details contained in the Contract Drawings or shall consist of the same design as the structure removed unless otherwise specified by the Contract Documents or by the Engineer.
- f. The Contractor shall take all necessary precautions during the performance of the work to prevent causing a surcharge in the existing sewers and drains.
- g. The Contractor's attention is directed to Articles 9, 10 and 40 of these Special Conditions and Specification Section 01570, Maintenance of Traffic of the Technical Specifications.
- h. The Contractor shall contact Mr. David Lefcourt, City Arborist, at the City of Cambridge Urban Forestry Division at telephone number 617-349-6433 immediately upon notification to proceed by the City. All construction operations shall be coordinated with the Urban Forestry Division to avoid damage to existing trees. Any permitted pruning of the trees shall be accomplished with a representative of the Urban Forestry Division present at the construction site. The Contractor will need to comply with the City of

Cambridge Department of Public Works Division of Urban Forestry, Tree Protection During Construction policy attached at the end of these Special Conditions.

i. The Contractor shall be made aware of the following Cambridge events scheduled for the 2012, 2013, and 2014 calendar years and beyond which may affect the Contractor's work. This partial list is provided for information purposes only and is subject to change:

Head of the Charles Regatta – October 2012 and 2013
MIT Spring Term Final Examination Period – May 2012, 2013, and 2014
MIT graduation – June 2012, 2013, and 2014
Harvard Spring Term Final Examination Period – May 2012, 2013, 2014
Harvard graduation – June 2012, 2013, and 2014

Contractor shall be prepared to stop work due to weather conditions, parades, and other City and local school functions at the request of either City. The stoppage will result in no payment to the Contractor until the work is resumed when notified by the City.

ARTICLE 3 - WORK TO BE ACCOMPLISHED IN ACCORDANCE WITH THE DRAWINGS AND SPECIFICATIONS: The work during its progress and at its completion, shall conform to the lines and grades shown on the drawings and to the directions given by the Owner from time to time, subject to such modifications or additions as the Owner shall determine to be necessary during the execution of the work; and in no case will any work be paid for in excess of such requirements. The work shall also be accomplished in accordance with the data in these Specifications.

ARTICLE 4 - CONTRACTOR TO CHECK DIMENSIONS AND SCHEDULES: The Contractor shall be responsible for checking all dimensions and quantities shown on the drawings or schedules given to him by the Owner, and shall notify the Owner of all errors therein which he may discover by examining and checking the same. The Contractor shall not take advantage of any error or omission in these Specifications, Drawings or schedules. The Owner will furnish all instructions should such error or omission be discovered, and the Contractor shall carry out such instructions as if originally specified.

ARTICLE 5 - FIRST AID TO INJURED: The Contractor shall keep in its field office ready for immediate use, all articles necessary for giving first aid to injured employees. The Contractor shall also provide arrangements for the immediate removal and hospital treatment of any employee injured on the work who may require the same.

ARTICLE 6 - PROTECTION AGAINST HIGH WATER AND STORM:

a. The Contractor shall take all precautions to prevent damage to the work or equipment by flooding, high winds, high waters or by storms, including hurricanes. The Owner may prohibit the carrying out of any work at any time when in its judgement, high winds, high waters or storm conditions are unfavorable or not suitable, or at any time, regardless of the weather, when proper precautions are not being taken to safeguard previously constructed work or work in progress.

b. In case of damage caused by the failure of the Contractor to take adequate precautions, the Contractor shall repair or replace equipment damaged and shall make such repairs or rebuild such parts of the damaged work, as the Owner may require, at no additional expense to the Owner.

ARTICLE 7 - SEQUENCE OF WORK: The Contractor shall be required to prosecute the work in accordance with a schedule prepared by the Contractor and approved by the Owner prior to commencement of the work and in accordance with the additional requirements specified herein, and approved by the Owner. The development of the schedule, the cost loading of the schedule, monthly payment requisitions and project status reporting requirements of the Contract shall employ computerized Critical Path Method (CPM) scheduling. The CPM schedule and all reports should be prepared with "Primavera P3, Version

2.0B software in accordance with Specification Section 01311. This schedule shall state the methods and shall forecast the times for doing each portion of the work. Before beginning any portion of the work, the Contractor shall give the Owner advance notice and ample time for making the necessary preparations. Construction sequencing information provided in the Contract Documents are for information purposes in order to aid the Contractor in the sequencing of the work.

ARTICLE 8 - COMPETENT HELP TO BE EMPLOYED: The Contractor shall employ only experienced forepersons, craftspersons and other workers competent in the work in which they are to be engaged.

ARTICLE 9 - STREETS AND SIDEWALKS TO BE KEPT OPEN:
(See also SC Article 40 and Section 01570 of the Technical Specifications)

a. The Contractor shall at all times keep the streets and sidewalks in which the Contractor may be at work open for pedestrian and vehicular traffic and for vehicles maintaining public services. The Contractor shall bridge or construct plank crossings over the trenches at street crossings, roads or private ways. No sidewalk shall be obstructed where it is possible to avoid it. See Article 17b for restrictions on plank or steel plate crossings in the event of snow.

b. Having obtained approval from the Owner to close a street to traffic, the Contractor shall notify the Fire Chief and the Chief of Police of Boston and Cambridge; then provide a system of detour signs, approved by the Owner.

ARTICLE 10 - LIGHTS, BARRIERS, WATCHMEN, AND INDEMNITY:

a. The Contractor shall put up and maintain such barriers, barricades, fencing, lighting and warning lights, danger warning signals and signs that will prevent accidents during the construction work and protect the work and insure the safety of personnel and the public at all times and places; the Contractor shall indemnify and protect the Owner and the Engineer in every respect from any injury or damage whatsoever caused by any act or neglect of the Contractor or its subcontractors or their servants or agents.

b. All construction warning and traffic control signs, barricades, lights, and pedestrian safety controls shall be in compliance with the Massachusetts Highway Department (MHD), Standard Specifications for Highways and Bridges, Section 850 (Traffic Controls for Construction and Maintenance Operations), latest edition; the Massachusetts Manual on Uniform Traffic Control Devices (MUTCD), Part IV, latest edition; American Disabilities Act (ADA); regulations set forth by the City of Cambridge Department of Public Works, and Section 01570 of the Technical Specifications.

Reflective sheeting for barricades and signs shall conform to Subsection M9.30.2 (Encapsulated Lens Reflective Sheeting) of the Standard Specifications for Highways and Bridges.

c. In addition to the above, when and as necessary or when required by the Owner, the Contractor shall post signs and employ watchmen at the site for excluding unauthorized persons from the work at all times, for which the Contractor will not be paid additional compensation.

d. All detours required for pedestrian and vehicular traffic shall be in conformance with regulations set forth by the City of Cambridge Department of Public Works (DPW) and MUTCD requirements (see also Article 40). It shall be the Contractor's responsibility to contact and make all necessary arrangements for detours with the Department of Public Works prior to the beginning of construction operations.

e. The Contractor shall be responsible for excluding at all times from lands within easement areas, or other state or municipally owned areas, all persons not directly connected with the work or authorized by the Owner to be in the work areas.

ARTICLE 11 - WORK OUTSIDE REGULAR HOURS: Night work or work on Saturdays, Sundays, or legal holidays, requiring the presence of an engineer or inspector, will not be permissible except in case of emergency or unless otherwise indicated in Technical Specifications, and only upon the approval of the Owner. Should it be desired or required by the Owner to operate an organization for continuous night work or for emergency night work, the lighting, safety and other facilities which are deemed necessary by the Owner for performing such night work shall be provided by the Contractor. For night work, work on Saturdays, Sundays or legal holidays, if any be performed, the Contractor will receive no extra payment, but compensation shall be considered as having been included in the prices stipulated for the appropriate items of work as listed in the Bid. See Section 01010 of the Technical Specifications for work hour restrictions. See notes on plans for additional restrictions.

ARTICLE 12 - PUBLIC TRANSPORTATION INTERFERENCE: Whenever it may be necessary to interfere with any public transportation systems notice shall be given to the corporation owning the same, and reasonable time shall be given to said corporation to arrange the schedule for operation of same, as may be necessary.

ARTICLE 13 - WORK IN COLD WEATHER:

a. The Owner will determine when conditions are unfavorable for work and may order the work or any portion of it suspended whenever, in his opinion, if the conditions are not such as to insure first class work. In general, work shall be prosecuted throughout the year and the Contractor will be expected to keep work going, and employment of labor as continuous as possible.

b. All methods and materials used in the performance, and for the protection of, the work in cold weather shall be subject to the approval of the Owner. The Contractor shall take necessary precautions to protect the work from damage and for removing ice and frost from materials, including heating the water, sand and coarse aggregate, and for protecting the newly laid masonry. The Contractor will be responsible for snow plowing within the areas of work delineated by the Contract Documents. The Contractor will receive no extra payment for any labor, apparatus, tools or materials necessary to comply with the above requirements, but compensation shall be considered to be included in the prices stipulated for the appropriate items of work as listed in the Bid. Contractor will provide contact phone number to Owner and Engineer for party responsible for snow removal.

c. See Article 17b for restrictions on plank or steel plate crossings in the event of snow.

ARTICLE 14 - TUNNELING : Tunneling will not be permitted without the consent of the Owner.

ARTICLE 15 - RESERVED MATERIALS: Materials found on the work suitable for any special use in the project shall be reserved for that purpose. When approved by the Owner, the Contractor may use in the various parts of the work, without charge therefore, any suitable materials taken from the excavations.

ARTICLE 16 - DISPOSAL OF MATERIALS, ACCESS TO HYDRANTS AND GATES, AND MATERIALS TRIMMED-UP FOR CONVENIENCE OF PUBLIC TRAVEL OR ADJOINING TENANTS: The materials from trenches and other excavations and those used in the construction of the work shall be deposited in such a manner that they will not endanger the work and that free access may be had at any time to all hydrants and gates in the vicinity of the work. The materials shall be kept trimmed-up in such a manner as to be of as little inconvenience as possible to the public travel or the adjoining tenants. All suitable excavated materials not utilized as refill or backfill at the site of excavation or other locations on the project shall be removed and legally disposed of by the Contractor at no additional expense to the Owner. All unsuitable excavated material including rock shall be removed and legally disposed of by the Contractor at no additional expense to the Owner.

ARTICLE 17 - LENGTH OF TRENCH TO BE OPENED AND MAINTAINING PREMISES FREE FROM OBSTRUCTIONS:

a. The length of trench opened at any time, from point where ground is being broken to completed backfill and also the amount of space in streets or public and private lands occupied by equipment, trench and supplies, shall not exceed the length or space considered reasonably necessary and expedient by the Owner. In determining the length of open trench or spaces for equipment, materials, supplies and other necessities, the Owner will consider the nature of the lands or streets where work is being done, types and methods of construction and equipment being used, inconvenience to the public or to private parties, possible dangers and other proper matters. All work must be constructed with a minimum of inconvenience and danger to the public and all other parties concerned.

b. Whenever any trench obstructs pedestrian and vehicular traffic in or to any public way, private driveway or property entrance, or on private property, the Contractor shall take such means as may be necessary to maintain pedestrian and vehicular traffic and access in accordance with Article 10. Until such time as the work may have attained sufficient strength to support backfill, or if for any other reason it is not expedient to backfill the trench immediately, the Contractor shall construct and maintain suitable plank or steel plate crossings and bridges, as approved by the Owner, to carry essential traffic in or to the street, driveway or property in question as specified or directed. Plank or steel plate crossings will not be allowed to be used to cover open trenches or excavations in the event of snow. In this event, the trench or excavation must be backfilled immediately and temporary pavement installed.

c. Suitable signs, lights, and such items required to direct traffic shall be furnished and maintained by the Contractor in accordance with Article 10.

d. The Contractor must keep streets and premises free from unnecessary obstructions, debris and all other materials. The Owner may, at any time, order all equipment, materials, surplus from excavations, debris and all other materials lying outside that length of working space promptly removed, and should the Contractor fail to remove such material within 24 hours after notice to remove the same, the Owner may cause any part or all of such materials to be removed by such persons as it may employ, at the Contractor's expense, and may deduct the costs thereof from payments which may be or may become due to the Contractor under the Contract. In special cases, where public safety urgently demands it, the Owner may cause such materials to be removed without prior notice.

e. Storage of materials on the public way is not allowed except where placed temporarily to be used immediately in the work.

f. The Contractor shall provide storage areas off the site of the work, as required, and shall include the cost of same in the prices stipulated for the appropriate items of work as listed in the Bid.

ARTICLE 18 - INTERFERENCE WITH EXISTING STRUCTURES:

a. Whenever it may be necessary to cross or interfere with existing culverts, drains, sewers, cable television, water pipes or fixtures, guardrails, fences, gas pipes, electrical, or telephone cables or conduits, or fixtures or other structures needing special care, public or private, due notice shall be given to the owner of the aforementioned utility, and the work shall be done according to the Owner's directions. Whenever required, all objects shall be strengthened to meet any additional stress that the work herein specified may impose upon it, and any damage caused shall be thoroughly repaired. If so directed by the Owner, the locations of any existing work shall be changed to meet the requirements of the sewerage system or appurtenances or the sewerage system may be relocated, if necessary, to leave all in good working order. The entire work shall be the responsibility of the Contractor and the work shall be performed at no additional expense to the Owner.

b. The Contractor shall be responsible for any damage to all known mains or utilities encountered during the progress of the work and shall repair and be responsible for correcting all damages to such existing utilities and structures at no additional expense to the Owner. The Contractor shall contact the proper utility or authority to correct or make any changes due to utility or other obstructions during the work of construction of the sewerage and drainage systems, but the entire responsibility and expense shall be with the Contractor.

c. All items required to be removed and replaced due to construction and all existing items damaged by the Contractor shall be replaced or repaired by the Contractor to the complete satisfaction of the property owners and/or the Owner at no additional expense to the Owner, unless otherwise specified.

ARTICLE 19 - FENCING, TURF, TOPSOIL, AND OTHER REPLACED ITEMS: Where construction is through cultivated or sodded lands, the Contractor shall save the turf and topsoil separately and replace the same after the trench is filled, leaving the land as nearly as possible in its original condition. Trees, fences, walls, grassed and landscaped areas, walks, and play and recreational areas, and such other items must be restored or repaired to the satisfaction of the Owner, if damaged by work under this Contract, at no additional expense to the Owner.

ARTICLE 20 - MATERIALS: All materials furnished and used in the completed work shall be new, of best quality workmanship and design, and recognized as standard in good sewer construction practices. Whenever a Specification number or reference is given, the subsequent amendments shall be included. The standards set forth in the selection of materials and supplies are intended to conform with those standards adopted by the Owner. Preference in manufacturer shall be given to adopted standards and the Contractor shall further familiarize himself with the requirements of the Owner when the occasion or choice of materials or supplies so demand.

ARTICLE 21 - DEFECTIVE MATERIALS, INSPECTION AND TESTING OF MATERIALS FURNISHED, SAMPLES AND ORDERING LISTS:

a. No materials shall be laid or used which are known, or may be found, to be in any way defective. Notice shall be given to the Owner of any defective or imperfect material. Defective or unfit material found to have been laid shall be removed and replaced by the Contractor with sound and unobjectionable material without additional expense to the Owner.

b. All materials furnished by the Contractor are subject to thorough inspections and tests by the Owner.

c. The Contractor shall submit samples as required by the Owner of the various materials used in the Contract for testing purposes.

d. All ordering lists shall be submitted by the Contractor to the Owner for approval and shall be approved before the ordering of the materials.

ARTICLE 22 - CONTRACTOR'S OFFICE: The Contractor shall maintain during the performance of this Contract, an office at the site of the work at which the Contractor or its authorized agent shall be present at all times while the work is in progress. The Contractor shall be responsible for equipping its office at the work with all office facilities which may be required. Instructions from the Owner left at this office shall be considered as delivered to the Contractor. Copies of the Contract, Drawings, and Specifications shall be kept at said office ready for use at any time. The obtaining of a suitable site for the location of the office shall be the responsibility of the Contractor; however, the location and site shall be subject to approval of the Owner; all costs in connection with the obtaining and use of a suitable office site shall be the responsibility of the Contractor.

ARTICLE 23 - SANITARY REGULATIONS:

- a. Adequate sanitary conveniences for use of workers on the premises, properly secluded from public observation, shall be provided and maintained by the Contractor in accordance with requirements of local and State health authorities and in such manner and at such points as shall be approved, and their use shall be strictly enforced. Sanitary waste shall be treated and disposed of in a manner satisfactory to and as directed by the Owner and the local and State health authorities; under no circumstances shall sanitary wastes be allowed to flow on the surface of the ground.
- b. The Contractor shall rigorously prohibit the committing of nuisances by persons connected with the work upon the lanes or right-of-way of the Owner, about the work, or upon adjacent public or private property.
- c. The cost of the sanitary conveniences and maintenance of same will not be paid for separately, but compensation will be considered to be included in the prices stipulated for the appropriate items of work as listed in the Bid.

ARTICLE 24 - SPIRITUOUS LIQUORS: The Contractor shall neither permit nor suffer the introduction or use of spirituous liquors upon the work embraced in this Contract.

ARTICLE 25 - FINISHING AND CLEANING UP: In completing the backfilling of the trenches, the Contractor shall replace all surface material to the satisfaction of the Owner, and shall then immediately remove all surplus material, and all tools and other property belonging to him, leaving the entire street or surroundings free and clean and in good order at no additional expense to the Owner. The backfilling and removing of surplus materials shall follow closely upon the completion of the work. The Contractor shall exercise special care in keeping right-of-way and private and public lands, upon which work is to be performed, clean and free of debris at all times and to remove tools and other property belonging to the Contractor when they are not being used.

ARTICLE 26 - CLEAN-UP AT CONTRACTOR'S EXPENSE: In case the Contractor shall fail or neglect, after backfilling, to promptly remove all surplus materials, tools and other incidentals, or promptly do the required repaving when ordered, the Owner may after 24 hours notice, cause the work to be done, and the cost thereof shall be deducted from any monies then or thereafter due the Contractor.

ARTICLE 27 - RIGHTS OF ACCESS: Nothing herein contained or shown on the Drawings shall be construed as giving the Contractor exclusive occupancy of the work areas involved. The Owner or any other contractor employed by the Contractor, the various utilities companies, contractor or subcontractor employed by the Federal, State or local governmental agencies or other utility firms or agencies involved in the general project or upon public rights-of-way, may enter upon or cross the areas of work or occupy portions of it as directed or permitted. When the territory of one contract is the convenient means of access to the other, each contractor shall arrange its work in such manner as to permit such access to the other and prevent unnecessary delay to the work as a whole.

ARTICLE 28 - EXISTING UTILITIES OR CONNECTIONS:

- a. The location of existing underground pipes, cables, conduits and structures as shown has been collected from the best available sources and the Owner together with its agents does not imply or guarantee the data and information in connection with underground pipes, cables, conduits, structures and such other parts as to their completeness nor their locations as indicated. The Contractor shall contact utility owners and request marking location of all their lines in the work areas. The Contractor shall assume that there are existing water, gas, and other utility connections to each and every building enroute, whether they appear on the Drawings or not. Any expense and/or delay occasioned by these utilities and structures or damage

thereto, including those not shown, shall be the responsibility of the Contractor at no additional expense to the Owner. See General Notes on Contract Drawings.

b. Before proceeding with construction operations at any location, the Contractor shall make such supplemental investigations, including test pits, as it deems necessary and approved by the Owner to uncover and determine the exact location of utilities, structures, or other conditions, and the Contractor shall have no claims for damages due to encountering subsurface structures, utilities, or other conditions. The Contractor shall also have no claims for damages due to encountering subsurface structures, utilities or other conditions which are made known to the Contractor prior to construction operations.

ARTICLE 29 - COMPLETENESS OF WORK: In addition to the specified or described portions of work, all other work and all other materials, equipment and labor of whatever description which are necessary or required to complete the work, or for carrying out the full intent of the Drawings and Specifications, as interpreted by the Owner, shall be provided by the Contractor, and payment therefore shall be considered as having been included in the prices stipulated for the appropriate items of work as listed in the Bid.

ARTICLE 30 - PLANK CROSSINGS: As required or directed by the Owner, the Contractor shall install in selected locations suitable plank, steel plate or timber crossings substantially built and reinforced to sustain vehicular traffic across trench or other excavations. Crossings shall be constructed with wide and usable approaches for use by the traveling public, private property owners, or emergency equipment. No separate payment will be made for this work but the cost shall be included in the price the Bid. (See Article 17).

ARTICLE 31 - CLEANING FINISHED WORK: After the work is completed, the sewers, drains, manholes, catchbasins, and other structures shall be carefully cleaned free of dirt, broken masonry, mortar, construction and other debris and left in first class condition ready for use. All temporary or excess material shall be legally disposed of and the work left broom-clean to the satisfaction of the Owner.

ARTICLE 32 - DUST CONTROL: The Contractor shall exercise every precaution and means to prevent and control dust arising out of all construction operations from becoming a nuisance to abutting property owners or surrounding neighborhoods. Pavements adjoining the excavation or pipe trenches shall be kept broomed off and washed clean. The Contractor will be responsible for street sweeping within the areas of work delineated by the Contract Documents. Earth stockpiles along trenches when permitted, stockpiles, and surfaces of refilled trenches shall be kept moist at all times, as directed. No extra payment will be made for providing the dust control conforming to the requirements specified above, but compensation therefore shall be considered to be included in the prices stipulated for the appropriate items of work as listed in the Bid.

ARTICLE 33 - CARE OF THE WORK: The Contractor shall be responsible for all damages to persons or property that occur as a result of the Contractor's fault or negligence in connection with the prosecution of the work and shall be responsible for the proper care and protection of all material delivered and work performed until completion and final acceptance, whether or not the same has been covered by partial payments made by the Owner.

ARTICLE 34 - INDEMNIFICATION:

a. To the fullest extent permitted by law, the Contractor shall indemnify and hold harmless the Owner, the Engineer and their agents and employees from and against all claims, damages, losses and expenses, including but not limited to attorney's fees, arising out of or resulting from the performance of the work, provided that any such claim, damage, loss or expense (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 the Contractor, any Subcontractor, anyone directly or indirectly employed by any of them or anyone for whose

acts any of them may be liable, regardless of whether or not it is caused in part by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge, or otherwise reduce any other right or obligation of indemnity which would otherwise exist as to any party or person described in this Article 34.

b. In any and all claims against the Owner, the Engineer or any of their agents or employees by any employee of the Contractor, any Subcontractor, anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable, the indemnification obligation under this Article 34 shall not be limited in any way by any limitation on the amount or type of damages, compensation or benefits payable by or for the Contractor or any Subcontractor under workers' or workmen's compensation acts, disability benefit acts or other employee benefit acts.

ARTICLE 35 - CONSTRUCTION SCHEDULE: In addition to other requirements specified, the Contractor shall confer with the Owner for the purpose of drafting a construction schedule satisfactory to the Owner which is to include all the work of this Contract. The Contractor shall perform the work of this Contract to conform to the construction schedule as approved by the Owner, except that the Owner reserves the right to amend and alter the construction schedule as approved at any time in a manner which it deems to be in the best interest of the Owner so to do. The development of the schedule, the cost loading of the schedule, monthly payment requisitions and project status reporting requirements of the Contract shall employ computerized Critical Path Method (CPM) scheduling. The CPM schedule and all reports should be prepared with "Primavera P3, Version 2.0B software in accordance with Specification Section 01311. The Contractor shall arrange its work under this Contract to conform with the construction schedule as it may be revised from time to time by the Owner at no additional expense to the Owner. The Contractor shall notify the Owner immediately of any circumstances which affect the performance of the work in accordance with the current construction schedule.

ARTICLE 36 - WORK BY OTHERS: The Owner reserves the right to do any other work which may connect with or become a part of, or be adjacent to the work embraced by this Contract at any time by contract work or otherwise. The Contractor shall not interfere with or obstruct in any way the work of such other persons as the Owner may employ, and shall execute its own work in such manner as to aid the executing of work by others as may be required. No backfilling of trenches or excavations will be permitted until such work by the Owner is completed.

ARTICLE 37 - FIRE PREVENTION AND PROTECTION:

a. All State and municipal rules and regulations with respect to fire prevention, fire-resistant construction, and fire protection shall be strictly adhered to, and all work and facilities necessary therefore shall be provided and maintained by the Contractor in an approved manner at no expense to the Owner.

b. All fire protection equipment such as water tanks, hoses, pumps, extinguishers, and other materials and apparatus, shall be provided for the protection of the contract work, temporary work and adjacent property. Trained personnel experienced in the operation of all fire protection equipment and apparatus shall be available on the sites whenever work is in progress and at such other times as may be necessary for the safety of the public and the work at no expense to the Owner.

ARTICLE 38 - RECORD DRAWINGS:

a. The Contractor shall maintain to the satisfaction of the Engineer at the site a set of Drawings on which shall be recorded accurately as the work progresses, the actual "as built" locations and dimensions of all his work, indicating thereon all variations from the Contract Drawings. This record of "as built" conditions shall include the work of all subcontractors, and any discrepancies found in the course of the work between actual locations of existing utility lines and structures and the locations shown on the Drawings, details at test pits and all excavations that reveal existing detail, connections to existing structures and lines and their construction and conditions, buildings, services, vacant lots, etc., and shall be

available at all times for inspection by the Engineer. Progress sets of "as built" drawings shall be reviewed at construction progress meetings.

b. The Contractor shall submit monthly progress red line Record Drawing updates with each Pay Application. Progress Record Drawing red lines shall show daily progress of all construction and the information required as indicated above. Pay Applications which do not have a set of Progress Record Drawing red lines attached will not be processed until which time as the Progress Record Drawing red lines have been received by the Owner and Engineer and have been approved for completeness.

c. Prior to final acceptance of the work, all recorded data as gathered above shall be submitted to the Owner by the Contractor. The final record drawings will be prepared by the Owner with the information provided by the Contractor as specified above.

d. The survey data shall be obtained by Global Positioning Survey (GPS) and certified by a certified by a Professional Land Surveyor registered in Massachusetts.

e. No separate payment will be made for this work, but compensation therefor shall be considered as having been included in the prices stipulated for the appropriate items of work as listed in the Bid.

ARTICLE 39 - CONSTRUCTION STAGING: Construction staging areas will be limited to only those areas approved by the Owner.

ARTICLE 40 - STREETS TO BE KEPT OPEN-ADDITIONAL REQUIREMENTS: Minimum requirements for keeping streets within the project areas open shall be as follows:

The Contractor shall submit for approval by the Owner, proposed traffic management and pedestrian safety plans in conformance with the requirements set forth in Section 01570 of the technical specifications. Construction will not be allowed to proceed until approval of the Contractor's proposed traffic control and pedestrian safety plans unless otherwise directed by the Owner. The Contractor shall secure and pay for all permits, fees, and bonds in connection with his operations. All streets shall be open to traffic and abutters at all times during construction of this contract. Requests by the Contractor to close or to provide one-way traffic flow in a street shall be submitted by the Contractor to the Owner a minimum of five (5) working days in advance of the Contractor's proposed construction operations affecting the street. The request for approval shall include the contractor's proposed traffic control plan and schedule. Submission of incomplete or deficient planning and schedules shall result in denial of the request. Delays or costs incurred by Contractor for failure to comply with the requirements set forth herein will be borne by the Contractor at no cost to the City. The Contractor shall furnish, provide, erect, and maintain all signs, necessary barricades, suitable and sufficient red lights, lights, reflectorized signs or signals and danger signals in accordance with Article 10 of the Special Conditions, and Section 01570 of the Technical Specifications. The Contractor shall arrange for sufficient number of police and watchpersons and take all necessary precautions for the protection of the work, control of traffic and safety of the public.

ARTICLE 41 - WORK WITHIN THE LIMITS OF PRIVATE PROPERTY:

a. Particular attention is hereby directed to the fact that some of the work included under this Contract will be done within the limits of properties that are state-owned and privately-owned. The Owner has, or will, secure the necessary limited temporary or permanent easements for construction purposes. The Contractor will be permitted to use the areas of the Owner's easements subject to all conditions and requirements applicable to the use of said easements, including restoration of grassed and landscaped areas, fences, etc., which are disturbed. The Contractor shall be responsible for determining at all times all conditions and requirements as they may affect the Contractor's operations and the work of this Contract and shall conduct its operations and activities in the performance of the work under this Contract in accordance with all such conditions and requirements and such additional requirements as may be required by the Owner. All other means and rights of ingress and egress to the work areas and all other areas required for work space, in

addition to the said Owner's easements, shall be the entire responsibility of the Contractor. All costs in connection therewith shall be considered to be included in the prices stipulated for the appropriate items of work as listed in the bid. The Contractor shall neither use nor occupy public or private lands outside the limits of the Owner's easements and rights-of-way unless permits in writing have first been obtained by the Contractor from the owners of the public and/or private land and copies of such permits filed with the Owner. The Contractor shall be responsible for cooperating with state and private property owners and for the coordination and prosecution of the work of this Contract. Any abuse to lands of state or private owners shall be immediately corrected by the Contractor at its expense to the complete satisfaction of the owners, and such precautionary or preventive measures as required by the Owner shall be taken or made to prevent further additional nuisances, interference or inconvenience to the abutting owners.

b. It shall be the Contractor's full responsibility to familiarize itself with the limitations imposed on the work of construction within the various properties of state or private ownership and rights-of-way by the existing occupancy or use. To this end, the Contractor shall be required to make every effort to fully and satisfactorily protect trees, shrubs, lawns, gardens, fences, walks, driveways, yards or structures; protect all work by the erection or placing of safety guards or barriers, lights and such other incidentals; and where required, the Contractor shall construct temporary plank crossings, steel plates or timbers to permit full use of private facilities at all times at no additional expense to the Owner. All other applicable provisions for control of work within the areas of public travel set forth elsewhere herein shall also apply to work within the limits of private ownership.

c. The Contractor shall cooperate with state and private property owners and shall also contact the Owner for additional information regarding the requested (or required) length of time needed as a notice to be given to the state and private property owners before the Contractor enters the state or privately owned property in order to start the construction work. In some cases, a certain time to start the work and a certain limited length of time may be permitted by the state and private property owners for any required shutdowns or construction operations so the work of the Contractor will not interfere with the private operations of the state or private property owners.

d. Before proceeding with construction operations, the Contractor shall provide suitable and substantial gates or other approved forms of wire gap in every existing fence within the limits of the Owner's easements and through which the Contractor intends to move or pass equipment and materials. It shall be the responsibility of the Contractor to determine with the owner of each fence all requirements, in addition to those specified above, relating to the construction of gates or other forms of wire gap; conditions to be observed in their use and for the rebuilding of fences. It shall be the responsibility of the Contractor to comply with all requirements as specified herein and as determined with the owners of the fences. Any damage to fences as a result of the Contractor's operations shall be made good by the Contractor in a manner satisfactory to the Owner.

e. No separate payment will be made for the requirements specified under "WORK WITHIN THE LIMITS OF PRIVATE PROPERTY," and all costs in connection therewith shall be included in the price of the Bid.

ARTICLE 42 - DISTURBANCE OF BOUNDS: The Contractor shall replace all bounds disturbed by his operation at his own expense. The bounds shall be reset by a land surveyor registered in the Commonwealth of Massachusetts.

ARTICLE 43 - ARCHAEOLOGICAL FINDS DURING CONSTRUCTION AND RELATED ACTIVITIES: During the life of this Contract the Contractor is herewith required to immediately notify the following organizations in the event that any articles such as "fire cracked stones," "stone flaking material," or any other such related items of historical significance are discovered.

a. City Engineer

- b. State Archaeologist of Massachusetts
- c. Resident Engineer or Inspector

ARTICLE 44 - NOT USED

ARTICLE 45 - PROSECUTION OF THE WORK-SUPPLEMENTAL REQUIREMENTS: The Contractor shall establish liaison with other contractors working in adjacent areas under other construction programs to assure that their work is closely coordinated with his work to prevent any delay in the overall program.

ARTICLE 46 - EQUIPMENT RESTRICTIONS: The sizes of equipment to be used for the construction will be restricted in certain areas, where larger equipment could cause damage to sidewalks and curbs on narrow streets, or to trees adjacent to the work and tree limbs overhanging the work. The Contractor shall submit the sizes of equipment he proposes to use on each street to the Owner for approval.

ARTICLE 47 - CONTRACTOR RECORDS: The Contractor shall comply with all applicable provisions of M.G.L., Chapter 30, Section 39R relative to Contractor's Records. The Contractor shall make, and keep for at least six years after final payment, books, records, and accounts which in reasonable detail accurately and fairly reflect the transactions and dispositions of the Contract. A complete copy of Section 39R shall be available for review at Engineer's office.

ARTICLE 48 - CONTRACT DRAWINGS: The work shall conform to the Contract Drawings, titled Endicott Street Area Drainage Improvements Project – Contract No. 1, all of which form a part of these specifications.

ARTICLE 49 - PIPE TESTING: All sewer pipe shall be tested in accordance with the Contract documents and sound engineering practice. If, after 60 days following submission of a monthly payment estimate for pipe items, the pipe for which payment is requested has not been successfully tested, the owner may withhold up to 10% of the amount requested for such pipe items until the pipe has been so tested. However, in the case of a major (pipe diameter 24 inches or greater) interceptor pipe installation, sums retained by the owner pursuant to this policy memorandum shall not exceed two per centum (2%) of the costs of such pipe items.

ARTICLE 50 - EXCAVATIONS IN PUBLIC WAYS: See Notice Requirements relative to excavations in public ways (Chapter 353 of the Acts of 1983) inserted at the end of these Special Conditions.

ARTICLE 51 - LEAKAGE TESTS:

a. The sewers and appurtenant structures connected thereto shall be made as nearly watertight as practicable. Where practical, as determined by the Owner, leakage tests will be performed for the new sewers and sewer manholes. Leakage into or from the sewers and structures will be determined by infiltration tests, exfiltration tests, or Low Pressure Air Acceptance tests as specified herein and as directed. The maximum allowable amount of infiltration into the sewers or exfiltration from the sewers, as determined respectively by the infiltration or exfiltration tests, including manholes, shall be at a rate of not greater than 125 gallons per inch of pipe diameter per mile of pipes per 24 hours, and there shall be no gushing or spurting streams of water into or from the sewers or manholes. The phrase "per mile of pipes" shall refer to the total length of sewers measured through manholes. Where the groundwater level can be maintained at a height of not less than one foot above the top of the pipe for the full length of the section of sewer pipe being tested for leakage, the leakage into the sewers and manholes shall be determined as specified under "Infiltration Tests." When the ground water cannot be maintained at a level of not less than one foot above the top of the pipe for the full length of the section of sewer being tested, the leakage from the sewers and manholes shall be determined as specified under "Exfiltration Tests."

b. Infiltration Tests. The tests shall be conducted at such times as the groundwater level is at a height of not less than one foot above the top of the pipe for the full length of the section of sewer being tested. The groundwater leakage into the pipes will be measured by the Owner at such point or points as he may direct. The Contractor shall construct such weirs or other means of measurement as shall be required and shall do such pumping as shall be necessary to enable the tests to be satisfactorily made.

c. Exfiltration Tests. Where exfiltration tests are required, the section of the sewer to be tested shall be subjected to an internal pressure. The lower end of the section of sewer to be tested shall be closed and the entire section of the sewer, including manholes, shall be filled with clean water so as to obtain a minimum head of 2 feet above the top of the pipes; the length of the section of sewer pipeline being tested shall be such that with the head of water 2 feet above the top of pipe at the upper end of the section of pipeline being tested, the pipeline being tested will not exceed 8 feet. The rate of leakage from each section of the sewers being tested will be determined by the Owner by measuring the amount of water required to maintain the minimum head of 2 feet above the top of the pipes for the full length of each section of the sewers being tested.

d. Low Pressure Air Acceptance Test. The Contract may perform the leakage tests using the low pressure air test where approved by the Owner. This test shall conform to Uni-Bell Plastic Pipe Association recommended practice, UNI-6, latest revision, for all PVC pipes and to the additional requirements listed herein.

1. The pipeline shall be considered acceptable if the time interval for the 1.0 psi pressure drop is not less than the holding time as calculated in accordance with UNI-6, latest revision.

e. Testing as described above cannot readily be performed on many sewers due to the presence of existing building service connections which could offset test results or surcharge during testing, resulting in basement flooding. Testing of such sewers will be limited, as determined by the Owner, to physical inspection of the pipe sections from adjacent manholes or closed circuit television inspection. Any defective pipe, joints, or other construction shall be replaced or repaired by the Contractor at no additional expense to the Owner.

f. The Contractor shall do all the work, provide all necessary weirs, gauges, or such other measuring devices as required, do all pumping and furnish all labor, equipment and materials necessary for the proper performance of leakage tests at no additional expense to the Owner. Leakage tests shall not be performed in Owner's absence.

g. Should the leakage test on any section of the sewers, including manholes, show a rate of leakage into or from the sewers exceeding the maximum allowable rate specified herein, the Contractor shall locate and repair or replace defective joints or pipe and work in a manner satisfactory to the Owner, and retest at no additional expense to the Owner until the rate of leakage from each section or joint of the sewers being tested does not exceed the rate specified herein.

h. When hydrants are used with the consent of the City, the Cambridge Water System shall be protected with backflow prevention devices per Massachusetts Department of Environmental Protection (DEP) Regulation 310 CMR 22.22 and the Cambridge Water Department Cross Connection Control Program. This includes, but is not limited to, street sweepers, sewer flushing and paving equipment, and hookups for any purpose.

ARTICLE 52 - TEST REPORTS, CERTIFICATES OF COMPLIANCE AND SHIPPING LISTS:

In addition to other requirements specified herein, the Contractor shall furnish to the Owner the materials, manufacturers notarized test reports and methods of tests to show compliance of materials furnished with all specification requirements, and manufacturer's notarized certificates of compliance stating that all materials

to be furnished under these Specifications conform with all specification requirements; each shipment of materials shall be accompanied with the manufacturer's notarized certificate of conformance and a shipping list itemizing the amounts of each item shipped. All testing of all materials furnished under these Specifications shall be provided by the Contractor at no additional expense to the Owner.

ARTICLE 53 -SERVICES OF MANUFACTURER'S REPRESENTATIVES: The Contractor shall furnish, at no additional expense to the Owner, the services of materials and manufacturer's representatives for such lengths of time as may be necessary to properly instruct the Contractor's personnel and the Owner in the proper handling and installation of the material in accordance with the manufacturer's printed recommendation.

ARTICLE 54 - NOT USED

ARTICLE 55 - 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 (Chapter 454 C.M.R. 10.00 et seq.)". Contractors shall be familiar with the requirements of these regulations and the safety requirements of the MUTCD and ADA.

ARTICLE 56 - SPECIAL PROVISIONS The Owner reserves the right to assess special penalties if the Contractor's actions during construction result in the following situations:

- a. Closing of a traffic lane or lanes not previously permitted nor approved by the Owner or Engineer in writing prior to the commencement of work
- b. Working during hours not stipulated by permit nor approved by the Owner or Engineer in writing prior to the commencement of work.
- c. Damage to Public Shade Trees: See "City of Cambridge Department of Public Works, Division of Urban Forestry Tree Protection During Construction" which is included in ATTACHMENT-I of Section-00825A Special Conditions.

Penalties shall be assessed on a per occurrence basis at \$1000 per occurrence and shall be deducted from the progress payments due to the Contractor.

ARTICLE 57 - STATE GOVERNMENT PROVISIONS:

- a. State Government Provisions included herein, have been selected from those to which specific references have been made elsewhere in the Contract Documents. Each and every other provisions of law of clause required by law to be inserted in this Contract shall be deemed to be also inserted herein in accordance with paragraph GC-2.3.2 of the General Conditions.
- b. The OWNER and CONTRACTOR also agree that the provisions of Mass General Law Chapter 82 Section 40, which are included in ATTACHMENT II of SECTION 00825A apply to the work to be performed under this Contract and that these provisions supersede any conflicting provisions of this Contract.
- c. The OWNER and CONTRACTOR also agree that the provisions of Mass General Law Chapter 149 Sections 27 and 27B relating to Minimum Wage Rates 40 apply to the work to be performed under this Contract and that these provisions supersede any conflicting provisions of this Contract. Copies of minimum wage rates established for labor categories employed on this Contract are included in SECTION 00670. A copy of the required payroll reports to be submitted to the OWNER on a weekly basis is included in SECTION 00680.

ARTICLE 58 - HOMEOWNER MEETINGS: The CONTRACTOR is required to attend at least two City meetings and twelve neighborhood meetings held during working hours, at night, or on week-ends for the purpose of informing the residents about the schedule and project and answering questions. The on-site superintendent and project manager must both attend these meetings.

ARTICLE 59 – PERMITS: The CONTRACTOR shall refer to the Technical Specifications Section 01060 for a list of all permits and regulatory requirements.

END OF SECTION 00825A - SPECIAL CONDITIONS

(ATTACHMENTS I, II, AND III TO SECTION 00825A FOLLOW)

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Attachment I

City of Cambridge Department of Public Works Division of Urban Forestry Tree Protection During Construction

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CITY OF CAMBRIDGE DEPARTMENT OF PUBLIC WORKS DIVISION OF
URBAN FORESTRY

TREE PROTECTION DURING CONSTRUCTION

Public trees are protected by Massachusetts State Law Chapter 87. Section 12 states that a fine of up to five hundred dollars per incident of damage to public shade trees can be levied. Each branch broken or improperly pruned, each improper wounding of the trunks of trees and each root improperly pruned shall constitute an infraction.

During all construction projects, the utmost care shall be taken by the contractor to avoid unauthorized, unnecessary or improper wounding of public or private shade trees. Prior to construction, the contractor shall provide a tree protection plan and work schedule. A Massachusetts or International Certified Arborist shall be sub-contracted by the contractor to provide a protection plan and perform specified work. *All plans and schedules shall be subject to review and approval by the City Tree Warden.* Infraction of Massachusetts State Law Chapter 87 or failure to provide protection plan and work schedule will result in fines or the immediate cancellation of the contract.

Pre-construction tree protection measures shall include the following:

1. Wrapping the trunks of trees of a diameter at breast height (dbh) of 6" or greater with a durable material such as two by four lumber sufficient to protect tree trunks from mechanical damage. Removal of protective wrapping shall be done by the contractor after construction is complete.
2. The proper pruning (raise pruning) of low branches to a height no greater than fourteen feet above the roadway and eight feet above the sidewalk. This includes trees endangered by traffic re-routing as the result of construction operations.
3. Traffic control plans shall be designed in such a way as to direct traffic away from tree trunks and branches.
4. Tunneling shall be the preferred method of excavation adjacent to tree roots to avoid root pruning. If root pruning is unavoidable, certified personnel shall execute the operation with sufficiently sharpened hand tools and in such a fashion as to have minimum negative impact on tree health and safety.
5. Trucks and heavy equipment shall not pass over or park on roots of public shade trees. A protection zone shall be established by erecting a ridged fence outside the perimeter of the dripline of the tree. For occasional or one time access over roots, ½" plywood overlapped may be used. Permeable materials such as gravel or wood chips shall be placed over root systems of trees which are not covered by hardscape and over which trucks and heavy equipment must travel during

construction operations, when such travel is unavoidable, to prevent soil compaction and root damage. Material shall be replaced as needed.

6. All tree protection measures and operations shall be subject to review, approval or change by the City Tree Warden.

Attachment II

General Laws of Massachusetts – Part I – Title XIV Public Ways and Works – Chapter 82 – Section 40

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GENERAL LAWS OF MASSACHUSETTS

PART I.

TITLE XIV. PUBLIC WAYS AND WORKS

CHAPTER 82. THE LAYING OUT, ALTERATION, RELOCATION AND DISCONTINUANCE OF PUBLIC WAYS, AND SPECIFIC REPAIRS THEREON

FILING OF PETITIONS

Chapter 82: Section 40 Definitions

Section 40. The following words, as used in this section and sections 40A to 40E, inclusive, shall have the following meanings:

""Company", natural gas pipeline company, petroleum or petroleum products pipeline company, public utility company, cable television company, and municipal utility company or department that supply gas, electricity, telephone, communication or cable television services or private water companies within the city or town where such excavation is to be made.

""Description of excavation location", such description shall include the name of the city or town, street, way, or route number where appropriate, the name of the streets at the nearest intersection to the excavation, the number of the buildings closest to the excavation or any other description, including landmarks, utility pole numbers or other information which will accurately define the location of the excavation.

""Emergency", a condition in which the safety of the public is in imminent danger, such as a threat to life or health or where immediate correction is required to maintain or restore essential public utility service.

""Excavation", an operation for the purpose of movement or removal of earth, rock or the materials in the ground including, but not limited to, digging, blasting, augering, backfilling, test boring, drilling, pile driving, grading, plowing in, hammering, pulling in, jacking in, trenching, tunneling and demolition of structures, excluding excavation by tools manipulated only by human power for gardening purposes and use of blasting for quarrying purposes.

""Excavator", any entity including, but not limited to, a person, partnership, joint venture, trust, corporation, association, public utility, company or state or local government body which performs excavation operations.

""Premark", to delineate the general scope of the excavation or boring on the paved surface of the ground using white paint, or stakes or other suitable white markings on nonpaved surfaces. No premarking shall be acceptable if such marks can reasonably interfere with traffic or pedestrian control or are misleading to the general public. Premarking shall not be required of any continuous excavation that is over 500 feet in length.

""Safety zone", a zone designated on the surface by the use of standard color-coded markings which contains the width of the facilities plus not more than 18 inches on each side.

""Standard color-coded markings", red - electric power lines, cables, conduit or light cables; yellow - gas, oil, street petroleum, or other gaseous materials; orange - communications cables or conduit, alarm or signal lines; blue - water, irrigation and slurry lines; green - sewer and drain lines; white - premark of proposed excavation.

""System", the underground plant damage prevention system as defined in section 76D of chapter 164.

Chapter 82: Section 40A Excavations; notice

Section 40A. No excavator installing a new facility or an addition to an existing facility or the relay or repair of an existing facility shall, except in an emergency, make an excavation, in any public or private way, any company right-of-way or easement or any public or privately owned land or way, unless at least 72 hours, exclusive of Saturdays, Sundays and legal holidays but not more than 30 days before the proposed excavation is to be made, such excavator has premarked not more than 500 feet of the proposed excavation and given an initial notice to the system. Such initial notice shall set forth a description of the excavation location in the manner as herein defined. In addition, such initial notice shall indicate whether any such excavation will involve blasting and, if so, the date and the location at which such blasting is to occur.

The notice requirements shall be waived in an emergency as defined herein; provided, however, that before such excavation begins or during a life-threatening emergency, notification shall be given to the system and the initial point of boring or excavation shall be premarked. The excavator shall ensure that the underground facilities of the utilities in the area of such excavation shall not be damaged or jeopardized.

In no event shall any excavation by blasting take place unless notice thereof, either in the initial notice or a subsequent notice accurately specifying the date and location of such blasting shall have been given and received at least 72 hours in advance, except in the case of an unanticipated obstruction requiring blasting when such notice shall be not less than four hours prior to such blasting. If any such notice cannot be given as aforesaid because of an emergency requiring blasting, it shall be given as soon as may be practicable but before any explosives are discharged.

Chapter 82: Section 40B Designation of location of underground facilities

Section 40B. Within 72 hours, exclusive of Saturdays, Sundays and legal holidays, from the time the initial notice is received by the system or at such time as the company and the excavator agree, such company shall respond to the initial notice or subsequent notice by designating the location of the underground facilities within 15 feet in any direction of the premarking so that the existing facilities are to be found within a safety zone. Such safety zone shall be so designated by the use of standard color-coded markings. The providing of such designation by the company shall constitute prima facie evidence of an exercise of reasonable precaution by the company as

required by this section; provided, however, that in the event that the excavator has given notice as aforesaid at a location at which because of the length of excavation the company cannot reasonably designate the entire location of its facilities within such 72 hour period, then such excavator shall identify for the company that portion of the excavation which is to be first made and the company shall designate the location of its facilities in such portion within 72 hours and shall designate the location of its facilities in the remaining portion of the location within a reasonable time thereafter. When an emergency notification has been given to the system, the company shall make every attempt to designate its facilities as promptly as possible.

Chapter 82: Section 40C Excavator's responsibility to maintain designation markings; damage caused by excavator

Section 40C. After a company has designated the location of its facilities at the location in accordance with section 40B, the excavator shall be responsible for maintaining the designation markings at such locations, unless such excavator requests remarking at the location due to the obliteration, destruction or other removal of such markings. The company shall then remark such location within 24 hours following receipt of such request.

When excavating in close proximity to the underground facilities of any company when such facilities are to be exposed, non-mechanical means shall be employed, as necessary, to avoid damage in locating such facility and any further excavation shall be performed employing reasonable precautions to avoid damage to any underground facilities including, but not limited to, any substantial weakening of structural or lateral support of such facilities, penetration or destruction of any pipe, main, wire or conduit or the protective coating thereof, or damage to any pipe, main, wire or conduit.

If any damage to such pipe, main, wire or conduit or its protective coating occurs, the company shall be notified immediately by the excavator responsible for causing such damage.

The making of an excavation without providing the notice required by section 40A with respect to any proposed excavation which results in any damage to a pipe, main, wire or conduit, or its protective coating, shall be prima facie evidence in any legal or administrative proceeding that such damage was caused by the negligence of such person.

Chapter 82: Section 40D Local laws requiring excavation permits; public ways

Section 40D. Nothing in this section shall affect or impair local ordinances or by-laws requiring a permit to be obtained before excavation in a public way or on private property; but notwithstanding any general or special law, ordinance or by-law to the contrary, to the extent that any permit issued under the provisions of the state building code or state fire code requires excavation by an excavator on a public way or on private property, the permit shall not be valid unless the excavator notifies the system as required pursuant to sections 40 and 40A, before the commencement of the excavation, and has complied with the permitting requirements of chapter 82A.

Chapter 82: Section 40E Violations of secs. 40A -- 40E; punishment

Section 40E. Any person or company found by the department of telecommunications and energy, after a hearing, to have violated any provision of sections 40A to 40E, inclusive, shall be fined \$500 for the first offense and not less than \$1,000 nor more than \$5,000 for any subsequent offense within 12 consecutive months as set forth by the rules of said department; provided, however, that nothing herein shall be construed to require forfeiture of any penal sum by a state

or local government body for violation of section 40A or 40C; and provided, further, that nothing herein shall be construed to require the forfeiture of any penal sum by a residential property owner for the failure to premark for an excavation on such person's residential property.

Attachment III
Ordinance Number 1329 (Dumpster Licenses)

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ORDINANCE NUMBER 1329

Final Publication Number 3203. First Publication in the Chronicle on July 30, 2009.

City of Cambridge

In the Year Two Thousand and Nine

AN ORDINANCE

In amendment to the Ordinance entitled “Municipal Code of the City of Cambridge”

Be it ordained by the City Council of Cambridge, as follows:

Cambridge Municipal Code is hereby amended by adding a new chapter 8.25 entitled Dumpster Licenses:

CHAPTER 8.25

DUMPSTER LICENSES

Sections:

Section 8.25.010 Purpose.

Because the unregulated maintenance and operation of dumpsters, including construction site dumpsters presents a threat to the public health, safety, environment, and general welfare, no person, business, or any other entity shall operate, keep, store, or maintain a Dumpster or Temporary Dumpster (defined below) without first obtaining the Dumpster License required by this chapter, and shall maintain said Dumpster in accordance with said License, this chapter, and any regulation promulgated hereunder.

Section 8.25.020 Definitions.

As used in this chapter, the following words and phrases shall have the meanings given in the following clauses. Where words and phrases are not defined in the following clauses, such words and phrases shall have their ordinarily accepted meanings such as the context implies.

A. “Dumpster” shall mean any container, receptacle, compactor unit, trailer, roll-off, or similar unit with or without wheels that is used for temporary storage, containment, or transport of refuse, debris, trash, garbage, food waste, solid waste, recyclable material, incidental demolition debris, or other discarded or like materials. It shall not apply to ordinary household trash cans of a volume of 50 gallons or less, recycling receptacles of 96 gallons or less, to plastic bags storing these materials in compliance with the regulations of the City of Cambridge, or to

solid waste disposal trucks operated by a company duly licensed by the City of Cambridge License Commission or used or operated by the City of Cambridge.

B. “Temporary Dumpster” shall mean a Dumpster that is used in connection with construction, demolition, fairs or for similar temporary needs, the Dumpster License for which shall be issued for a period not to exceed 30 days, renewable for additional 30 day periods upon application, not to exceed a total period of twelve months.

C. “Lot” shall mean a parcel of land in identical ownership throughout, bounded by other lots or by streets, which is designated by its owner to be used, developed or built upon as a unit, to which a Dumpster serves for waste disposal.

D. “Dumpster License” (also referred to hereafter as “License”) shall mean the License required by this chapter and issued by the Inspectional Services Department upon satisfactory review of the Dumpster License Application and Dumpster Plan.

E. “Dumpster Plan” shall mean an operational and maintenance plan for each Dumpster governed by this chapter. The Dumpster Plan shall also include all information included in the Dumpster License Application (defined in 8.25.040 below).

F. “Responsible Party” shall mean the owner or other person using the Dumpster with an interest in any part or parts of the Lot upon which the Dumpster is used, maintained or stored, any tenant upon the Lot, the property manager for the Lot, and/or any other users of a Dumpster on the Lot.

Section 8.25.030 Applicability.

The Dumpster Ordinance shall apply to all existing and future Dumpsters located within the City.

Section 8.25.040 Dumpster License.

A. License Required. No Dumpster, including a Temporary Dumpster, shall be used, without first obtaining a License from the Commissioner of Inspectional Services, but not including a Dumpster used for one day special events permitted by the City of Cambridge. If a Dumpster is to be located upon a public way, then a permit from the City of Cambridge Traffic, Parking and Transportation Department must also be obtained. If the Commissioner of Inspectional Services determines that a submitted Dumpster License Application is accurate and adequate to keep the site free from debris, refuse, trash, solid waste or like material that is injurious to the public health, safety, and environment, the Commissioner may issue a License for the establishment or Dumpster. Performance of the activities scheduled in the Dumpster Plan shall be a condition of the License and nonperformance of the activities scheduled in the Dumpster Plan shall be a violation of the License and conditions of this chapter.

B. Contents of License Application. A complete Application (also referred to hereafter as “Application”) consists of a completed Application form and a Dumpster Plan attached thereto. The Dumpster License Application form shall be in a form approved by the Commissioner of Inspectional Services. It shall be the responsibility of all Responsible Parties to submit and sign the Application and to take possession of and be jointly responsible for the License. In the event that a Responsible Party terminates use of the Dumpster, then the owner of the Lot shall be required to obtain a new License with any new Responsible Party. All Responsible Parties shall agree to follow the Dumpster Plan, and be jointly and severally liable with the owner of the Lot, and indemnify the City of Cambridge for any damages caused by non-compliance with the duties contained in this ordinance.

C. Dumpster Plan. A Dumpster Plan shall, at a minimum, include the following information, or other information as required by the Inspectional Services Department:

1. The address of the Lot on which the Dumpster is located;
2. The name, address, and telephone number of the owner of the Lot;
3. The name, address, and telephone number of the tenant operator(s) of the establishment(s) located on the Lot which will use the Dumpster;
4. The type of establishment(s) located on the Lot which will use the Dumpster and nature of its (or their) business;
5. A description of how employees or residents are notified about the proper use of a Dumpster and copy of all written materials given to employees or residents;
6. A plot plan accurately depicting the Lot;
7. The location of any Dumpster and associated fencing or screening on the Lot, and the location of the Dumpster in relation to all abutting property;
8. A weekly schedule detailing the times and days of the week for cleaning the Dumpster and Lot, and maintaining the Lot free of windblown litter and refuse;
9. The name of the owner of the Lot or Responsible Party or designee responsible for overseeing the cleaning and maintenance of the Lot;
10. The name, address, contact name, and telephone number of the waste hauling company responsible for servicing the establishment or Dumpster; and the name, address, contact name, and telephone number of the person or entity signing the contract with the waste hauling company;
11. The date, time, and frequency of service by the waste hauling company including proof of recycling and anticipated volume of refuse and recycling based on the previous year's invoices, if applicable;
12. Any and all permits and/or Licenses issued by the Massachusetts Department of Environmental Protection relating to the management, storage, and disposal of solid wastes and hazardous materials and hazardous wastes generated, stored, or disposed on the Lot;
13. Any and all permits and/or Licenses issued by the Cambridge Fire Department, the Inspectional Services Department, the Department of Public Works or other relevant City or governmental agencies;
14. The name, address, and phone number of the pest control company servicing the establishment or Dumpster;
15. Any other information required by the Inspectional Services Department to ensure that the Lot is maintained in a sanitary condition free of debris, refuse, trash, solid waste or like material that is injurious to the public health, safety, and environment; and
16. A copy of the contract with the waste hauling company responsible for servicing the Dumpster.

Section 8.25.050 Dumpster License Fee.

The fee for the License shall be one hundred (\$100.00) dollars. The License shall be applied for annually.

Section 8.25.060 Term of License.

The term of each License shall be one (1) year, except that a License for a Temporary Dumpster shall be for a period not to exceed 30 days, renewable for additional 30 day periods, not to exceed a total period of twelve months. Annually on a date set by the Commissioner of Inspectional Services or designee, all persons who operate or maintain Dumpsters shall file, renew, or amend a Dumpster Plan and obtain a new License.

Section 8.25.070 Location Requirements.

All Dumpsters shall be located at a distance from the Lot line, as approved by the Inspectional Services Department, so as not to interfere with the safety, convenience, or health of abutters, residents, and the public. All Dumpsters shall be placed so that any liquid or runoff from the Dumpster shall not enter any catch basins or storm drains. All Dumpsters shall be placed so as not to interfere with the physical integrity of the curb, sidewalk, and public parking. The location of all Dumpsters shall also be subject to approval by the Cambridge Fire Department and a City of Cambridge Traffic, Parking and Transportation Permit is required for any dumpster to be placed upon a public way.

Section 8.25.080 Container Requirements.

All Dumpsters shall be in new or good condition free of damage caused by wear or misuse that would allow leaks or access by rodents. All Dumpsters shall be covered and secured at all times except when being filled or emptied. Temporary Dumpsters shall be covered when not in use (including overnight) at a minimum with a tight-fitting tarp. All Dumpsters shall be deodorized and washed on a regular schedule. The Commissioner of Inspectional Services, or designee, may require more frequent cleaning, if necessary. If rodent activity or other site hygiene issues are prevalent, the Commissioner of Inspectional Services may require additional design/containment requirements utilizing best available technology.

Section 8.25.090 Screening/Fencing Requirements.

All Dumpsters governed by this ordinance shall be screened or fenced off from view from public ways, sidewalks, and adjoining properties at all sites other than construction sites, unless requirements are waived by the Commissioner of Inspectional Services.

Section 8.25.100 Posting Requirements.

The Dumpster Plan and License shall be posted in a visible location on the Lot or establishment thereon, accessible to an inspector on the premises. All Dumpsters shall display a clearly visible decal or stencil showing the name and telephone numbers of the company/contractor servicing the Dumpster.

Section 8.25.110 Other Requirements.

It is the responsibility of the owner of the Lot and/or Responsible Party to ensure that all other approvals, licenses and permits required by the City of Cambridge and Commonwealth of Massachusetts have been obtained, including but not limited to the mandatory recycling provisions of Chapter 8.24 of the Cambridge Municipal Code. The Dumpster License shall be

applicable only to the owner or tenants or establishments licensed to use the Dumpster and only to the Lot to which the Dumpster serves, and no trash or other items from any other Lots, properties, buildings or other sources may be placed in or transferred to the Dumpster in question. The issuance of this License shall under no circumstances be construed as a waiver from any other license or permit required. It is the responsibility of the owner of the Lot and/or Responsible Party to take appropriate action to immediately cause the Dumpster to be emptied of its contents when full. It is the responsibility of the owner of the Lot and/or Responsible Party to maintain the area free of odors, debris, litter, overflow, and all other nuisances including pests.

Section 8.25.120 Inspections.

A. Authority. In order to properly carry out their respective responsibilities under this Ordinance, and to ensure that the public health, safety and environment are protected from the hazards posed by unsanitary and unhealthy conditions, the Inspectional Services Department is authorized to examine and/or survey at any reasonable time all establishments and Dumpsters licensed hereunder.

B. Systematic Area Inspections. The Inspectional Services Department is authorized to develop and adopt plans and regulations for systematic, periodic area-wide inspections of Dumpsters and establishments required to obtain a License.

C. Interference with Inspection. If any owner, occupant, or other person refuses, impedes, inhibits, interferes with, restricts, or obstructs entry and free access to the Lot, operation, or premises where inspection is authorized by this chapter, the Inspectional Services Department may seek in a court of competent jurisdiction an inspection warrant that allows for the inspection of the Lot and apprise the owner of the Lot and/or Responsible Party concerning the nature of the inspection, the scope of the inspection, and justification for it and may seek the assistance of the Police Department in presenting said warrant.

Section 8.25.130 Violation.

A. The operation or maintenance of any Dumpster governed by this chapter without a License; the failure to operate or maintain the same in accordance with a validly issued License; the interference with an inspection, including inspections conducted pursuant to a validly issued inspection warrant; and/or any other violations of the terms of this ordinance, shall constitute a violation and a citation shall be issued by the Commissioner of Inspectional Services or designee. Each day during which a violation exists shall constitute a separate offense, including but not limited to any days in which the Commissioner of Inspectional Services or designee is forced to obtain and/or exercise an inspection warrant.

B. Notice of violation shall be sent or hand delivered to the offender, the owner of the Lot or Responsible Party at the Lot or establishment thereon, to their last known address, or to addresses listed on the Dumpster Plan. Any violation herein shall be considered a municipal charge as described in G.L. c. 40, §57.

Section 8.25.140 Administrative Hearings.

A. Right to Hearing. Any person upon whom a notice of violation has been served may request a hearing from the Inspectional Services Department by filing a written petition requesting a hearing on the matter with the Inspectional Services Department within seven days after the day the notice of violation was sent or hand delivered.

B. Hearing Notice. Upon receipt of a petition, the Inspectional Services Department shall inform the petitioner of the date, time, and place of the hearing in writing.

C. Time for Hearing. The hearing shall commence within thirty days after the day on which the notice of violation was served. The time period in which the cited violations must be remedied shall be stayed upon receipt of the petition for a hearing until such time as the hearing is held.

D. Hearing of Petitioner. At the hearing, the petitioner shall be given an opportunity to be heard, to present witnesses or documentary evidence, and to show why the notice of violation should be modified or withdrawn. Failure to hold a hearing within the time period specified herein shall not affect the validity of any notice of violation.

E. Final Decision after Hearing; Failure to Comply with Final Order.

1. Within seven (7) days after the conclusion of the hearing, the Inspectional Services Department shall sustain, modify, or withdraw the notice of violation and shall inform the petitioner in writing of its decision and the reasons therefor. If the Department sustains or modifies the notice of violation, said violation shall be remedied within the time period allotted in the original notice of violation or in the modification.

2. If a written petition for a hearing is not filed with the Inspectional Services Department within seven (7) days after the notice of violation has been served, or if after a hearing the notice of violation has been sustained in full or in any part, each day's failure to comply with the notice of violation within the time allotted as issued or modified shall constitute an additional offense, including any days prior to the filing of a written petition, and any days subsequent to the issuance of the written decision by the Commissioner of Inspectional Services, or a designee.

Section 8.25.150 Penalties.

A. Failure to Obtain License. If an owner of a Lot or Responsible Party stores or maintains a Dumpster without first obtaining a License, the Commissioner of Inspectional Services may issue a violation pursuant to the process described in Section 8.25.130, not to exceed three hundred dollars. Each day during which a violation exists shall constitute a separate offense. The Commissioner of Inspectional Services may also seek an injunction from a court of competent jurisdiction prohibiting the operation of the establishment or Dumpster until a License is secured.

B. Failure to Comply With Terms of License. If a Licensee fails to comply with the terms of a License, the Commissioner of Inspectional Services may issue a violation pursuant to the process described in Section 8.25.030, not to exceed three hundred dollars. Each day during which a violation exists shall constitute a separate offense. The Commissioner of Inspectional Services may also suspend the License, after an administrative hearing, and seek an injunction from a court of competent jurisdiction prohibiting the operation of the establishment or Dumpster until the Licensee proves to the court its compliance with the License. If a Licensee fails to comply with the terms of the License three (3) times in the preceding twelve (12) month period, the Commissioner of Inspectional Services or a designee may suspend, cancel, or revoke the License after an administrative hearing. In the event of suspension or cancellation of the License, other municipal agencies issuing licenses and permits will be so notified.

C. Failure to Comply with Notice of Violation. Any person who fails to comply with any notice of violation or other order issued pursuant to this chapter by the Inspectional Services Department, or duly appointed agents or representatives, shall be issued a violation pursuant to the process described in Section 8.25.130, not to exceed three hundred dollars. Each day during which a violation exists shall constitute a separate offense.

D. Interference After Inspection Warrant Presented. Any owner of a Lot or Responsible Party who refuses, impedes, inhibits, interferes with, restricts or obstructs entry and free access to every part of the structure, site, operation or premises where inspection is sought under this chapter after an inspection warrant has been obtained and presented in accordance with Section 8.25.120, shall be issued a violation pursuant to the process described in Section 8.25.130, not to exceed three hundred dollars. Each day during which a violation exists shall constitute a separate offense.

E. Fines. All fines and penalties assessed and collected under this chapter may be enforced pursuant to G.L. c. 40, Section 21D.

Section 8.25.160 Severability.

If any section provided for under this chapter shall be declared invalid for any reason whatsoever, that decision shall not affect any other portion of this chapter, which shall remain in full force and effect; and to this end the provisions of this chapter are hereby declared severable.

Section 8.25.170 Regulatory Authority.

The Commissioner of Inspectional Services shall have the authority to promulgate rules and regulations necessary to enforce this chapter.

Section 8.25.180 Delegation of Authority.

The Commissioner of Inspectional Services may delegate enforcement of this Chapter to any City department authorized to enforce public safety, health, or environmental laws and regulations, including but not limited to any enforcement officer with the Department of Public Works, the Traffic, Parking, and Transportation Department, the License Commission, or the Police Department.

Section 8.25.190 Effective Date.

This chapter shall take effect January 1, 2010.

In City Council September 14, 2009.

Passed to be ordained as amended by a yeas and nays vote:-

Yeas 9; Nays 0; Absent 0.

Attest:- D. Margaret Drury, City Clerk.

A true copy;

ATTEST:-

D. Margaret Drury
City Clerk

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SECTION 01010

SUMMARY OF WORK

PART 1 - GENERAL

1.1 SUMMARY

- A. The Work to be done under this contract consists of the rehabilitation of existing sewer pipe; the installation of new storm drain pipe and structures; the installation of new sanitary sewer pipe and structures; the relocation of existing water mains; the installation of an outfall on the Charles River north of Western Avenue on Memorial Drive; the installation of an isolation gate structure with a slide gate; the installation of a total phosphorous removal structure; overexcavation of peat for a section of Western Avenue and Memorial Drive; full depth roadway construction; asphalt excavation by cold planer; pavement overlay; granite curbing; concrete and brick sidewalk reconstruction; pervious asphalt bicycle track construction; street trees and landscaping including structural soil and passive irrigation system; roadway lighting, traffic signal construction; pavement markings and traffic signage; coordination with public art installation and streetscape furnishings; and the reconstruction of a public park, including stormwater planter system, granite seating and planter elements; automatic irrigation system, and miscellaneous furnishings and appurtenances.
- B. A general description of the Work to be performed under this Contract shall include, but will not be limited to the following construction operations:
1. Coordination with Public and private utilities for the relocation of their facilities as may be required.
 2. Relocation and replacement of existing water mains.
 3. Installation of (Reinforced Concrete Pipe) RCP, (Polyvinyl Chloride) PVC, and (Ductile Iron) DI storm drains with related manholes; installation of (Centrally-Cast Fiber Reinforced Polymer Mortar) FRP and PVC sewer with related manholes; and the replacement of the existing water mains with DI water mains with related hydrants and valves.
 4. Installation of full length cured-in-place pipelining.
 5. Removal and relocation of existing sewer, drain and water services which are in direct elevation or alignment conflict with the Work of this Contract or which may interfere with the installation of that work

as approved by the Owner and Engineer.

6. Demolition and abandonment of existing structures and pipes.
 7. Removal of concrete slab, rail, and rail ties.
 8. Installation of new headwall/outfall to the Charles River
 9. Installation of a roadway lighting system and traffic signals.
 10. Overexcavation of peat within a section of the Western Avenue and Memorial Drive corridors.
 11. Disposal of excess geotechnically; analytically; and logistically unsuitable excavated material.
 12. Reuse geotechnically and analytically suitable excavated material on site as backfill and dispose of excess material from excavation not required for fill or backfill as specified, and to the satisfaction of the Owner.
 13. Remove and Reset or furnish and install new granite curb; cold planing and overlay paving; trench pavement restoration; and installation of new cement concrete and brick sidewalks and cement concrete pedestrian ramps conforming to the latest MA AAB rules and regulations and to the latest ADA standards for accessible design.
 14. Installation of pervious pavement with an underdrain system.
 15. Installation of a rain garden.
 16. Reconstruction of a public park and installation of public art.
 17. Full-depth roadway reconstruction and cold plane and overlay.
 18. Installation of pavement markings.
- C. The work shall conform to such additional drawings, specifications and addenda to these Specifications and Drawings as may be published or exhibited prior to the opening of Bid Proposals or as may be furnished by the Engineer from time to time during the construction.
- D. Work and materials which are necessary in the construction but which are not specifically referred to in the Specification, or shown on the Drawings, but implied by the Contract shall be furnished by the Contractor and included in the Contractor's Unit and Lump Sum Prices Bid. The work and materials shall be such as will correspond with the general character of the work as

may be determined by the Engineer, whose decisions as to the necessity for and character of such work and materials shall be final and conclusive. It is the intent of these specifications to produce a complete, finished job whether shown in every detail or not.

- E. For the purposes of this Contract, anywhere the term “Temporary” is used in the Specifications, in the Plans, in Contract Addenda, in any revisions made to the Contract Documents at any time prior to or during construction, verbally, in writing, in change orders or work change directives or at any other time whether listed here or not, it shall be taken to mean “Temporary” only as it relates to the duration of the Contract. All repairs, restoration, and construction shall be considered permanent.

1.2 CONSTRUCTION SEQUENCE

Inclusion of the following sequencing restrictions does not relieve the Contractor from its responsibility to complete the Work with the specified contract duration, nor does it relieve the Contractor from its responsibility to sequence and carry out the work so as not to cause harm to the existing systems, environment, or community.

- A. Establish baseline Rodent Control
- B. Pre-construction Survey
- C. Establish baseline Sedimentation and Erosion Control
- D. Establish baseline Geotechnical Instrumentation and Monitoring
- E. Mobilization
- F. Establish advance warning Traffic Management
- G. Layout of site work and survey control
- H. Establish the construction dewatering treatment system
- I. Perform Test Pits: All Test Pits identified in the Contract Drawings as well as those by the Owner and Engineer shall be performed and completed prior to any other work commencing on the site.
- J. Prior to installation of the Work the Contractor shall verify the relocation of any existing utilities that are scheduled for relocation, coordinate with the responsible utility, and relocate those utilities which are the Contractor’s responsibility as per these Contract Documents.

- K. Prior to any work adjacent to the existing 48-inch MWRA MET sewer on Western Ave or the 10'-4" x 4'-1" NCRS sewer on Memorial Drive, the contractor shall conduct CCTV inspection.

1.3 UNDERGROUND UTILITIES

- A. The underground utilities shown on the plans have been located primarily from information furnished by others and are considered approximate both as to size and location. There are additional utilities to be encountered that are not shown on the plans, and it shall be the Contractor's responsibility to locate all existing utilities and to protect same from damage or harm. All utilities interfered with or damaged shall be properly restored, at the expense of the Contractor, as required by Owner. Unapproved service interruptions will not be allowed.

1.4 SURFACE RESTORATION

- A. Any damage to the pavement, curbing, or sidewalks outside of the limits of excavation and excavation support as defined in the Contract Documents shall be the responsibility of the Contractor and all costs associated with the repair of the excavation, sub-base, pavement, curbing, and sidewalks shall be fully borne by the Contractor. Repairs shall be immediately made by the Contractor as per the Contract Documents and as required by the Engineer.

1.5 HOURS OF WORK

- A. The hours of work shall be Monday through Friday, 7:00 a.m. – 4:00 p.m. excluding the City of Cambridge Holidays, except for the work within Memorial Drive and the intersection of Memorial Drive and Western Avenue, which must be performed during the restricted hours detailed below:
 1. Work occurring within the traveled way of the Memorial Drive and the intersection of Memorial Drive and Western Avenue shall be performed overnight from 8:00 p.m. to 5:00 a.m. Sunday through Thursday unless otherwise required by the Owner and/or the Department of Conservation and Recreation (DCR).
 2. Work occurring within the embankment of Memorial Drive shall be performed between 9:30 AM and 3:30 PM.
 3. Work occurring on Memorial Drive and in the intersection of Western Avenue and Memorial Drive shall not begin earlier than November 15, 2012 and must be completed prior to November 15, 2013.
 4. For additional requirements and restrictions for work on Memorial Drive and work related to the outfall, refer to DCR Construction

Access Permit that has been appended to these specifications.

- B. During non-work hours (4:00 p.m. – 7:00 a.m. weekdays; weekends and holidays and 5:00 a.m. – 8:00 p.m. weekdays; weekends and holidays for work occurring within Memorial Drive and the intersection of Western Avenue and Memorial Drive), the Contractor shall make the following provisions:
 - 1. Access to all properties shall be maintained. Work zones shall be cleaned, protected and made safe. The Contractor shall minimize the amount of parking restrictions.
 - 2. At the end of each work day, the Contractor shall backfill and pave and/or place steel road plates over all excavations so as to maintain automobile/truck traffic, bicycle traffic, and pedestrian traffic access and flow. Under no circumstances will obstructions or open excavations be allowed during non-work hours. All parking will be given back to the community and businesses during non-work hours. Work zones shall be cleaned, protected and made safe.

1.6 CONTRACTOR USE OF PROJECT SITE

- A. The Contractor's use of the project site shall be limited to its construction operations, including on-site storage of materials, on-site fabrication facilities and field offices.
- B. The Contractor shall determine the location(s) of the staging area(s) to be used for this project and shall obtain approval of the location(s) from the City of Cambridge prior to any mobilization activities.
- C. The Contractor shall maintain access to street parking and driveway parking and access to all properties and businesses outside the work zone during off work hours.

1.7 LIST OF DRAWINGS

- A. The location, general characteristics, and principal details of the work are indicated on a set of drawings entitled "Western Avenue Infrastructure Improvements Project".
- B. The drawings stated above are the Contract Drawings, sometimes referred to herein as the "Drawings." Additional drawings showing details in accordance with which the work is to be done may be furnished from time to time by the Engineer, if found necessary, and shall then become a part of the Drawings.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION (Not Used)

PART 4 – COMPENSATION (Not Used)

END OF SECTION 01010

SECTION 01025

MEASUREMENT AND PAYMENT

PART 1 — GENERAL

1.1 SUMMARY

- A. Payment for the items specified in the Bid Schedule shall include compensation for furnishing all labor, tools, equipment, supplies, and manufactured articles, and for all operations, and incidentals appurtenant to the items of work described, to complete the various items of the Work, all in accordance with the requirements of the Contract Documents, Drawings, Specifications, Addendum, and other modifications issued and approved by the Owner and Engineer.
- B. Payment for the items specified in the Bid Schedule shall include all costs for permits and compliance with the regulations of public agencies having jurisdiction including Safety and Health Requirements of the Occupational Safety and Health Administration of the U.S. Department of Labor (OSHA).
- C. The bid prices listed in the Bid Schedule shall include all Work items described or implied in the Contract Documents, Drawings, Specifications, Addendum, and other modifications issued and approved by the Owner and Engineer, and all other Work items necessary to manufacture, furnish, install and test a complete working project.
- D. The following items are considered “Incidental” to the completion of the Work included in this Contract. These incidental work items shall be included in the Bid Schedule prices and are not included for separate payment. The incidental work items include, but are not limited to:
 - a. Abandonment, removal and disposal of existing, abandoned or relocated private utilities not specified for payment elsewhere
 - b. Establishing and maintaining Construction Baselines and Profile Grade Lines.
 - c. Horizontal and vertical layout and staking
 - d. Dust control
 - e. Construction photographs
 - f. Attending Owner meetings, neighborhood meetings, and all other Construction meetings

- g. Submitting work plans, shop drawings, and materials samples.
- h. Construction of mock-ups and sample panels.
- i. Protection of installed materials from damage, and replacement of damaged materials as directed by the Engineer.
- j. Warrantees and Guarantees as indicated in the Contract Documents.
- k. Maintenance of plant materials as indicated in the Contract Documents.
- l. Concrete encasement of impacted utilities
- m. Street sweeping and removing snow from streets and sidewalks where work is ongoing
- n. Transporting trash and recyclables out of the work area where municipal pickup is hindered
- o. Providing certificates of design where required
- p. Submitting monthly CPM schedules and narratives
- q. Submitting weekly and bi-weekly construction schedule projections and updates
- r. Fulfilling all reporting requirements
- s. Preparation and submission of monthly and final as-built drawing information
- t. Clean-up and restoration of all surface features not included for payment elsewhere.
- u. Obtain all permits including payment of fees
- v. Cast-in-Place Concrete Collars for Pipe to Pipe Connections for Pipe 15-in Diameter or smaller
- w. Demolition and Removal of Pipe 15-in Diameter or smaller
- x. Permanent Masonry Plugs and Bulkheads for Pipe Abandonment 15-in Diameter or smaller
- y. CDF for pipe abandonment 15-in Diameter or smaller
- z. Furnishing and Placing Backfill by one of the approved methods listed below:

1. Reuse excavated material immediately on site at the general area of excavation.
 2. Furnish and install imported suitable backfill
 3. Transport the material to a staging area, stage and protect the material, load the material, transport the material to be used as backfill at the general area of excavation or to another backfill area of equal or greater contamination, where geotechnically suitable.
- aa. Furnishing, installing, compacting and testing gravel sub-base by one of the approved methods listed below:
1. Reuse excavated sub-base material immediately on site at the general area of excavation, as sub-base material
 2. Transport the material to a staging area, stage and protect the material, load the material, transport the material to be used as backfill at the general area of excavation or to another sub-base area of equal or greater contamination, where geotechnically suitable.
- bb. Remove and reset all signs and sign posts, meters, or any other site feature or furnishing not specifically listed for separate payment elsewhere.
- cc. Rodent Control
- dd. Pre- and Post- Construction Video
- ee. Protection of private property including walls at the back of sidewalk.
- ff. Modification, removal, and disposal of existing tree pits
- gg. Temporary pavement for tree pits
- hh. equipment and materials for nighttime work
- E. No separate payment shall be made for any item that is not specifically specified in the Bid Schedule, and all costs therefore shall be included in the prices named in the Bid Schedule for the various appurtenant items of work.

- F. The Contractor and Subcontractors shall not take advantage of any apparent error or omission on the Drawings or in the Specifications. The Contractor and Subcontractors shall make corrections and interpretations as may be deemed necessary for fulfillment of the intent of the Contract Documents at no additional cost to the Owner.
- G. Anywhere in these Contract Documents, the term furnish shall mean manufacture; supply; delivery to the Project site including the actual unloading and unpacking; assembly; erection; placing; installation; anchoring; applying; working to dimension; finishing; curing; protecting; cleaning; testing; start-up; and similar operations unless stated otherwise.

1.2 LUMP SUM ITEMS

- A. Payment for the lump sums shall be full compensation for all labor, materials and equipment required to furnish, install, construct, startup and test the work covered under that lump sum item, whether listed in the related Compensation subsection for each item or not. All supervision; overhead items including but not limited to bonds, insurance, and labor burden; and profit are also included.
- B. Payment shall fully compensate the Contractor for any other work which is not specified or shown, but which is necessary to complete the Work.

1.3 UNIT PRICE ITEMS

- A. Unit prices shall be full compensation for all labor, materials and equipment required to furnish, install, construct, startup and test the work covered under that unit price item, whether listed in the related Compensation subsection for each item or not. All supervision; overhead items including but not limited to bonds, insurance, and labor burden; and profit are also included.
- B. Payment shall fully compensate the Contractor for any other work which is not specified or shown, but which is necessary to complete the Work.

1.4 MEASUREMENT FOR PAYMENT

- A. Work completed to date shall be submitted by the Contractor and substantiated as required by the Engineer.
- B. The Owner and Engineer will review the submittal for completeness and verification. Failure to submit any of the below requirements will be grounds for a rejection of the submitted pay request until such time as the submittals are complete, accurate, up to date, and have been approved by the Owner and Engineer.

1. Include a checklist of completed items. Only items signed-off by the Engineer will be considered for payment.
2. Include red-lined “As-built” drawings indicating degree of completion.
3. Include a revised CPM schedule and narrative as required in the Specifications and showing actual record information.
4. Include a copy of all required test results including, but not limited to geotechnical and settlement monitoring results, compaction test results, concrete strength test results, grain size analysis and analytical test results.
5. Certified pay-rolls for general and all sub-contractors.
6. MBE and WBE reporting and certifications.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION (Not Used)

PART 4 – COMPENSATION (Not Used)

END OF SECTION 01025

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SECTION 01040

PROJECT COORDINATION AND MEETINGS

PART 1 – GENERAL

1.1 SUMMARY

- A. This section includes general coordination requirements including preconstruction conference, site mobilization conference, and progress meetings.

1.2 CONTRACTOR COORDINATION

- A. Coordinate scheduling, submittals, and the Work to assure efficient and orderly sequence of installation of interdependent construction elements.
- B. Coordinate completion of the Work and clean up for Substantial Completion and for portions of Work designated for Owner's partial utilization.
- C. Coordinate access to site for correction of nonconforming Work to minimize disruption of Owner's activities where Owner is in partial utilization.

1.3 PRECONSTRUCTION CONFERENCE

- A. The Owner will schedule a preconstruction conference.
- B. Attendance Required: Owner's representatives, Engineer, Contractor, Contractor's Project Manager and Superintendent and major Subcontractors.
- C. Sample Agenda:
 - 1. Designation of personnel representing the parties in Contract and the Architect/Engineer.
 - 2. Description of the Project background, purpose, basis of design and major elements of the Work.
 - 3. Community Relations requirements
 - 4. Soil and Waste Management requirements
 - 5. Major Geotechnical requirements such as temporary support of excavation; backfill and compaction; geotechnical instrumentation and monitoring, and dewatering.

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6. Requirements and procedures for the submission of change orders and pay requisitions.
7. Requirements, procedures and processing of shop drawings and other submittals; Schedules and schedule updates; substitutions; and Requests for Information.
8. Scheduling of the Work and coordination with other contractors.
9. Review of Subcontractors
10. Continuation of City services (trash and rubbish removal, recycling, street sweeping, and snow removal).
11. Meeting requirements (Progress, Work Shops, etc.)
12. Utility coordination
13. Traffic and pedestrian management requirements
14. Other

1.4 PROGRESS MEETINGS

- A. Project meetings shall be held at a location designated by the Owner and Engineers. Meetings shall be held at weekly intervals, or more frequent intervals if required by the Owner or Engineer.
- B. Attendance Required: Job superintendent, Contractor's Project Manager, major Subcontractors and suppliers, Owner representatives, and Architect/Engineer as appropriate to agenda topics for each meeting.
- C. The Owner or Engineer or their representative will make arrangements for meetings, and record minutes.
- D. The Owner or Engineer or their representative will prepare the agenda and preside at meetings.
- E. Contractor shall provide required information and be prepared to discuss each agenda item.
- F. Sample Agenda:
 1. Review minutes of previous meetings
 2. Community Relations

PROJECT COORDINATION
AND MEETINGS
01040-2

3. Review of work progress. Review of work completed, work on going and work scheduled within the coming month.
4. Field observations, problems, and decisions
5. Identification of problems which impede planned progress
6. Review of submittals schedule and status of submittals
7. Review of RFI and RFP status
8. Proposed Change Orders (PCO), claims, credits, Work Change Directive, and change order status
9. Review of off-site fabrication and delivery schedules
10. Maintenance of progress schedule
11. Corrective measures to regain projected schedules
12. Maintenance of quality and work standards
13. Effect of proposed changes on progress schedule and coordination
14. Other item relating to Work

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION (Not Used)

PART 4 – COMPENSATION (Not Used)

END OF SECTION 01040

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SECTION 01045

CUTTING AND PATCHING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section specifies administrative and procedural requirements for cutting and patching.
- B. Refer to other Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.
 - 1. Requirements of this Section do not apply to mechanical installations.

1.2 SUBMITTALS

- A. Submit proposed procedures for cutting and patching at a minimum of 4 weeks in advance of the time cutting and patching will be performed. The submittal shall contain, but not be limited to the following information:
 - 1. Describe the extent of cutting and patching required and how it is to be performed; indicate why it cannot be avoided.
 - 2. Describe anticipated results in terms of changes to existing or proposed construction; include changes to structural elements and operating components.
 - 3. List firms or entities that will perform Work.
 - 4. Indicate dates when cutting and patching is to be performed.
 - 5. List utilities, service, or performance that will be disturbed or affected and indicate how long service will be disrupted.
 - 6. Where cutting and patching involves addition of reinforcement to structural elements, submit details stamped by a Massachusetts Professional Engineer to show how reinforcement is integrated with the original structure.
- B. Review by the Engineer prior to proceeding with cutting and patching does not waive the Engineer's right to later require complete removal and replacement of a part of the Work found to not meet the requirements of the Contract.

1.3 QUALITY ASSURANCE

- A. Requirements for Structural and Utility Work: Do not cut and patch structural elements in a manner that would reduce their load-carrying capacity or load-deflection ratio.
 - 1. Submit the cutting and patching proposal, including a structural analysis and design of additional reinforcement, stamped by a Massachusetts Professional Engineer, before cutting and patching.

- B. Operational and Safety Limitations: Do not cut and patch operating elements or safety related components in a manner that would result in reducing their capacity to perform as intended, or result in increased maintenance, or decreased operational life or safety.
 - 1. Submit the cutting and patching proposal before cutting and patching the following operating elements or safety related systems:
 - a. Shoring, bracing, and sheeting.
 - b. Primary operational systems and equipment.
 - c. Control systems.
 - d. Electrical wiring systems.

- C. Visual Requirements: Do not cut and patch construction exposed on the exterior, in a manner that would, in the Engineer's opinion, reduce aesthetic qualities, or result in visual evidence of cutting and patching. Remove and replace Work that has been cut and patched that does not meet requirements of the Contract as determined by the Engineer.
 - 1. Retain the original installer or fabricator to cut and patch or if it is not possible to engage the original installer or fabricator, engage another recognized experienced and specialized firm acceptable to the Engineer:

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Use materials whose installed performance will equal or surpass that of existing materials.
- B. Where cutting and patching occurs on exposed exterior structures or work, use materials that are identical to existing materials. If identical materials are not available or cannot be used where exposed surfaces are involved, use materials that match existing adjacent surfaces to the fullest extent possible with regard to visual effect.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Before cutting existing surfaces, examine surfaces to be cut and patched and conditions under which cutting and patching is to be performed. Take corrective action before proceeding, if unsafe or unsatisfactory conditions are encountered.
 - 1. Before proceeding, meet at the site with parties involved in cutting and patching, including but not limited to mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

3.2 PREPARATION

- A. Temporary Support: Provide temporary support of Work to be cut.
- B. Protection: Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of the Project that might be exposed during cutting and patching operations.
- C. Take all precautions to avoid cutting existing pipe, conduit or duct banks that are scheduled to be removed or relocated until provisions have been made to bypass them.

3.3 CUTTING

- A. General: Employ skilled workmen to perform cutting and patching. Complete cutting and patching without delay.
- B. Cut existing construction to provide for installation of other components or performance of other construction activities and the subsequent fitting and patching required to restore surfaces to their original condition.
- C. Cutting: Cut existing construction using methods least likely to damage elements to be retained or adjoining construction. Where possible, review the proposed procedures with the original installer or manufacturer or with an installer or manufacturer with similar experience. Comply with the installer's and / or manufacturer's recommendations.
- D. In general, where cutting is required use hand or small power tools designed for sawing or grinding, not hammering and chopping. Cut holes and slots neatly to size required with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
- E. Cut through concrete and masonry using a cutting machine such as carborundum saw or diamond core drill.
- F. By-pass utility services such as pipe or conduit, before cutting, where services are shown or required to be removed, relocated or abandoned. Cap, valve or plug and seal the remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after by-passing and cutting.

3.4 PATCHING

- A. Inspect and test patched areas to demonstrate integrity of the installation.

3.5 CLEANING

- A. Thoroughly clean areas where cutting and patching is performed or used as access. Remove completely mortar, oils, reinforcing, concrete, masonry and items of similar nature. Thoroughly clean piping, conduit and similar features before finishing is applied. Restore damaged pipe to its original condition.

PART 4 – COMPENSATION (Not Used)

END OF SECTION 01045

SECTION 01060

PERMITS AND REGULATORY REQUIREMENTS

PART 1 - GENERAL

1.1 REGULATORY AGENCIES

- A. The Contractor shall comply with all laws, rules, and regulations and ordinances promulgated by any authority having jurisdiction over the Work.
- B. The Contractor shall be fully responsible for obtaining and complying with all required permit(s). The Contractor shall be responsible for including all costs and fees required to obtain and comply with the permits, in the Bid. The Contractor shall ensure that all necessary permits from the Department of Public Safety, Cambridge Fire Department, Cambridge Police Department, Cambridge Electrical Department, Cambridge Water Department, Cambridge Department of Public Works, Massachusetts Water Resource Authority, Massachusetts Department of Environmental Protection, Massachusetts Bay Transit Authority and all other regulatory agencies and/or inspectional authorities having jurisdiction are obtained and paid for by the Contractor or its subcontractor (s) as appropriate.

1.2 PERMITS OBTAINED BY THE CONTRACTOR

- A. The Contractor or its subcontractor shall be responsible for obtaining; paying for; and complying with, as part of its base Bid, all permits; licenses; certifications; and approvals required for the work of this contract. The Contractor's responsibility includes but is not limited to, all permits required for his equipment, work force, and particular operations such as transportation and storage of fuel, chemicals or other materials and air emission.
- B. At a minimum, the Cambridge Department of Public Works and Cambridge Traffic and Parking Department permits that the Contractor shall be responsible for obtaining, paying for, and complying with include, but are not limited to, the following:
 - 1. NPDES Dewatering Permit
 - 2. Excavation Permit
 - 3. Street Obstruction Permit
 - 4. Sidewalk Obstruction Permit

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5. Street Closing Permit
 6. Curb Cut Permit
 7. Traffic Management Plans including Detours
 8. Pedestrian Management Plans
 9. Water Construction Permit
 - a. The Cambridge Water Department (CWD) will not issue new water construction permits until all requirements for previous (i.e., initial CWD permit) CWD permits are met. These requirements include accurate and legible swing tie dimensions to all new water main gate valves, Tee's and elbows, required CWD "sign off's" on the contractor's copy of the CWD executed permit (when permitted work is complete), test documentation that includes Massachusetts State certified initial chlorination and bacteria testing of new water main work, and pressure test results of new water main work. The contractor is hereby advised that the CWD will not be responsible for the contractor's slip in project schedule if these requirements for permits are not followed."
 10. MWRA wastewater discharge permits for CIPP lining operations.
- C. The Contractor shall be responsible for scheduling and coordinating inspections and receipt of local, state, or federal permits/approvals/certifications for all Work as part of this Contract.
- D. The Contractor shall be responsible for obtaining, paying for and complying with DEP and City of Cambridge Backflow Prevention Permits.

1.3 PERMITS OBTAINED BY THE OWNER

- A. The Owner has obtained the following permits, which are included in the appendices to these Specifications. All other permits, including construction dewatering discharge permits, are the responsibility of the Contractor.
1. City of Cambridge Conservation Commission - Order of Conditions
 2. MWRA 8m Permit
 4. DCR Construction Permit

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- B. The Contractor is solely responsible for the implementation of the permit requirements and shall include as such in the Bid.
- C. The Contractor is solely responsible for any punitive action resulting from any violation of the permit.
- D. Actual permits, issued by the respective agencies will be considered part of this Contract.
- E. The Contractor shall, at a minimum, include compliance with the provisions and requirements of a typical NPDES Construction Dewatering Discharge Permit and typical Cambridge permits listed above. The Contractor will receive no additional compensation for compliance with any permit requirements.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION (Not Used)

PART 4 – COMPENSATION (Not Used)

END OF SECTION 01060

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SECTION 01070

ABBREVIATIONS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Wherever in these Specifications references are made to the standards, specifications, or other published data of the various international, national, regional, or local organizations, such organizations may be referred to by their acronym or abbreviation only. As a guide to the user of these Specifications, the following acronyms or abbreviations which may appear in these Specifications shall have the meanings indicated herein.

1.2 ABBREVIATIONS

AA	Aluminum Association
AAMA	Architectural Aluminum Manufacturer's Association
AAR	Association of American Railroads
AASHTO	American Association of State Highway and Transportation Officials
ACI	American Concrete Institute
ADA	American Disabilities Act
AFBMA	Anti-Friction Bearing Manufacturer's Association, Inc.
AGA	American Gas Association
AGMA	American Gear Manufacturers Association
AI	The Asphalt Institute
AIA	American Institute of Architects
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
AITC	American Institute of Timber Construction
AMCA	Air Moving and Conditioning Association
ANSI	American National Standards Institute, Inc.
APA	American Plywood Association or American Parquet Association, Inc.
API	American Petroleum Institute
APWA	American Public Works Association
ARI	Air-Conditioning and Refrigeration Institute
ASCE	American Society of Civil Engineers
ASLE	American Society of Lubricating Engineers
ASME	American Society of Mechanical Engineers
ASQC	American Society for Quality Control
ASSE	American Society of Sanitary Engineers
ASTM	American Society for Testing and Materials
AWS	American Welding Society
AWWA	American Water Works Association

BBC	Basic Building Code, Building Officials and Code Administrators International
BHMA	Builders Hardware Manufacturer's Association
CABO	Council of American Building Officials
CDA	Copper Development Association
CGA	Compressed Gas Association
CLFMI	Chain Link Fence Manufacturer's Institute
CMA	Concrete Masonry Association
CRSI	Concrete Reinforcing Steel Institute
DCDMA	Diamond Core Drill Manufacturer's Association
DCR	Department of Conservation and Recreation
DHI	Door and Hardware Institute
DIPRA	Ductile Iron Pipe Research Association
EIA	Electronic Industries Association
ETL	Electrical Test Laboratories
EPA	Environmental Protection Agency
FCC	Federal Communications Commission
FCI	Fluid Controls Institute
FM	Factory Mutual System
FPL	Forest Products Laboratory
HI	Hydronics Institute
HPMA	Hardwood Plywood Manufacturers Association
IAPMO	International Association of Plumbing and Mechanical Officials
ICBO	International Conference of Building Officials
IEEE	Institute of Electrical and Electronics Engineers
IES	Illuminating Engineering Society
IP	Institute of Petroleum (London)
IPC	Institute of Printed Circuits
IPCEA	Insulated Power Cable Engineers Association
ISDSI	Insulated Steel Door Systems Institute
ISA	Instrument Society of America
ISEA	Industrial Safety Equipment Association
ISO	International Organization for Standardization
ITE	Institute of Traffic Engineers
MADEP	Massachusetts Department of Environmental Protection
MassDOT	Massachusetts Department of Transportation
MBMA	Metal Building Manufacturer's Association
MIL	Military Standards (DoD)
MBTA	Massachusetts Bay Transit Association
MHD	Massachusetts Highway Department
MPTA	Mechanical Power Transmission Association
MSS	Manufacturers Standardization Society
MUTCD	Manual of Uniform Traffic Control Devices
MWRA	Massachusetts Water Resource Authority
MTI	Marine Testing Institute
NAAMM	National Association of Architectural Metal Manufacturer's
NACE	National Association of Corrosion Engineers

NAGDM	National Association of Garage Door Manufacturers
NB	National Board of Boiler and Pressure Vessel Inspectors (alternate NBBPVI)
NBS	National Bureau of Standards (Now NIST)
NCCLS	National Committee for Clinical Laboratory Standards
NEC	National Electrical Code
NEMA	National Electrical Manufacturer's Association
NETA	International Electrical Testing Association
NFPA	National Fire Protection Association or National Fluid Power Association or National Forest Products Association
NISO	National Information Standards Organization
NLGI	National Lubricating Grease Institute
NMA	National Microfilm Association
NPDES	National Pollution Discharge Elimination
NRCA	National Roofing Contractors Association
NSF	National Sanitation Foundation
NWMA	National Woodwork Manufacturers Association
NWWDA	National Wood Window and Door Association
OSHA	Occupational Safety and Health Administration
PCA	Portland Cement Association
PPI	Plastics Pipe Institute
RCRA	Resource Conservation and Recovery Act
RIS	Redwood Inspection Service
RMA	Rubber Manufacturers Association
RVIA	Recreational Vehicle Industry Association
RWMA	Resistance Welder Manufacturer's Association
SAE	Society of Automotive Engineers
SAMA	Scientific Apparatus Makers Association
SDI	Steel Door Institute
SMA	Screen Manufacturers Association
SMACCNA	Sheet Metal and Air Conditioning Contractors National Association
SPI	Society of the Plastics Industry, Inc.
SPIB	Southern Pine Inspection Bureau
SPR	Simplified Practice Recommendation
SSA	Swedish Standards Association
SSBC	Southern Standard Building Code, Southern Building Code Congress
SSPC	Society for Protective Coating
SSPWC	Standard Specifications for Public Works Construction
TAPPI	Technical Association of the Pulp and Paper Industry
TFI	The Fertilizer Institute
TIA	Telecommunications Industries Association
TPI	Truss Plate Institute
UBC	Uniform Building Code
UL	Underwriters Laboratories, Inc.
WCLIB	West Coast Lumber Inspection Bureau
WCRSI	Western Concrete Reinforcing Steel Institute
WEF	Water Environment Federation

WIC	Woodwork Institute of California
WRI	Wire Reinforcement Institute, Inc.
WWPA	Western Wood Products Association

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION (Not Used)

PART 4 – COMPENSATION (Not Used)

END OF SECTION 01070

SECTION 01090

REFERENCE STANDARDS

PART 1 - GENERAL

1.1 SUMMARY

- A. Titles of Sections and Paragraphs: Captions accompanying specification sections and paragraphs are for convenience of reference only, and do not form a part of the Specifications.
- B. Applicable Publications: Whenever in these Specifications references are made to published specifications, codes, standards, or other requirements, it shall be understood that wherever no date is specified, only the latest specifications, standards, or requirements of the respective issuing agencies which have been published as of the date that the Work is advertised for bids, shall apply; except to the extent that said standards or requirements may be in conflict with applicable laws, ordinances, or governing codes. No requirements set forth herein or shown on the Drawings shall be waived because of any provision of, or omission from, said standards or requirements.
- C. Specialists, Assignments: In certain instances, specification text requires (or implies) that specific work is to be assigned to specialists or expert entities, who must be engaged for the performance of that work. Such assignments shall be recognized as special requirements over which the Contractor has no choice or option. These requirements shall not be interpreted so as to conflict with the enforcement of regulations governing the Work; also they are not intended to interfere with local union jurisdiction settlements and similar conventions. Such assignments are intended to establish which party or entity involved in a specific unit of work is recognized as "expert" for the indicated construction processes or operations. Nevertheless, the final responsibility for fulfillment of the entire set of Contract requirements remains with the Contractor.

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

- A. Without limiting the generality of other requirements of the Specifications, all work specified herein shall conform to or exceed the requirements of applicable codes and the applicable requirements of the following documents.
- B. References herein to "Building Code" or "Uniform Building Code" shall mean Uniform Building Code of the International Conference of Building Officials (ICBO). Similarly, references to "Mechanical Code" or "Uniform Mechanical Code," "Plumbing Code" or "Uniform Plumbing Code," "Fire Code" or "Uniform Fire Code," shall mean Uniform Mechanical Code, Uniform Plumbing Code and

Uniform Fire Code of the International Conference of the Building Officials (ICBO). "Electric Code" or "National Electric Code (NEC)" shall mean the National Electric Code of the National Fire Protection Association (NFPA). The latest edition of the codes as approved by the Municipal Code and used by the local agency as of the date that the Work is advertised for bids, as adopted by the agency having jurisdiction, shall apply to the Work herein, including all addenda, modifications, amendments, or other lawful changes thereto.

- C. In case of conflict between codes, reference standards, drawings and the other Contract Documents, the most stringent requirements shall govern. All conflicts shall be brought to the attention of the Engineer for clarification and directions prior to ordering or providing any materials or furnishing labor. The Contractor shall bid for the most stringent requirements.
- D. The Contractor shall construct the Work specified herein in accordance with the requirements of the Contract Documents and the referenced portions of those referenced codes, standards, and specifications listed herein.
- E. Applicable Standard Specifications: References in the Contract Documents to "Standard Specifications" or SSPWC shall mean the Standard Specifications for Public Works Construction, 1991 Edition unless otherwise stated in the specification section.
- F. References herein to "OSHA Regulations for Construction" shall mean Title 29, Part 1926, Construction Safety and Health Regulations, Code of Federal Regulations (OSHA), including all changes and amendments thereto.
- G. References herein to "OSHA Standards" shall mean, Title 29, Part 1910, Occupational Safety and Health Standards, Code of Federal Regulations (OSHA), including all changes and amendments thereto.
- H. References herein to "MUTCD Standards" shall mean, the latest edition of the Manual for Uniform Traffic Control Devices (MUTCD) published by the US DOT, including all changes and amendments thereto.
- I. References herein to "MassDOT Standards" shall mean, the Massachusetts Highway Department Standard Specifications for Highways and Bridges, latest edition, including all changes and amendments thereto.
- J. References herein to "ADA Standards" shall mean, the Americans with Disabilities Act of 1990 including all changes and amendments thereto.
- K. ASTM: American Society for Testing Materials
- L. AASHTO: American Association of State Highway and Transportation Officials

- M ACI: American Concrete Institute
- N. Final Rule for the Accessibility Guidelines for Recreational Facilities and Outdoor Developed Areas by the Recreational Access Advisory Committee, US Architectural and Transportation Barriers Compliance Board, most recent edition, including all changes and amendments thereto.
- O. MAAB: Massachusetts Architectural Access Board, most current edition.

1.3 REGULATIONS RELATED TO HAZARDOUS MATERIALS

- A. The Contractor is responsible for ensuring that all work included in the Contract Documents, regardless if shown or not, shall comply with all EPA, OSHA, RCRA, NFPA, and any other Federal, State, and Local Regulations governing the storage and conveyance of hazardous materials, including petroleum products.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION (Not Used)

PART 4 – COMPENSATION (Not Used)

END OF SECTION 01090

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SECTION 01105

RODENT CONTROL

PART 1 - GENERAL

1.1 SUMMARY

- A. This section specifies rodent control and general pest control requirements within project areas, and bordering areas as designated by the Owner and Engineer. This work is to be performed prior to demolition, excavation, and site preparation and throughout the Contract, so that rodents and other pests do not disperse from or infest the project area.
- B. The Contractor shall develop and implement an Integrated Pest Management (IPM) approach. As part of that approach, the Contractor shall maintain a cooperative dialogue with appropriate agencies and management/representatives of neighboring properties.
- C. The Contractor shall perform the rodent control tasks described in this Scope of Work and also respond to other pest control needs when required by the Owner.

1.2 SUBMITTALS

- A. Submit to the Engineer copies of pesticide applicator certifications and licenses within ten (10) days of the start of Rodent Control activities and ten (10) days prior to their issuance or renewal for the duration of this Contract.
- B. After performing the survey described in Paragraph 3.2 below and before initiating baiting, submit to the Engineer a written description of proposed pest control procedures, indicating materials, quantities, methods, and time schedule. For all pesticides to be used, submit a copy of the pesticide manufacturer's EPA-approved pesticide label with application directions.
- C. Submit to the Engineer documentation of pest control activities and results and follows:
 - 1. Weekly - Submit data sheets with locations of sites treated, amounts and types of pesticide used, number and types of traps set, survey and inspection results, sanitation conditions, complaint calls investigated, and any problem that occurred.
 - 2. Monthly - Submit a written summary that includes determinable results of the IPM program and recommendations.

3. Quarterly - Submit a map that shows bait stations, manholes, and catch basins where rodent baits are being maintained.

1.3 QUALIFICATIONS

- A. The Contractor shall perform this work at all times in accordance with the following minimum standards and as acceptable to the Owner and Engineer.
 1. The Contractor and key personnel shall have experience with commercial and residential accounts and construction projects; have experience and technical training in vertebrate pest management and integrated pest management; have experience with various rodent control techniques, equipment, and strategies; have training and experience with insect control; and have knowledge of and experience with techniques to reduce non-target hazards.
 2. The supervisor shall be licensed and certified by the Massachusetts Pesticide Bureau and certified in General Pest Control (category 41) and Vertebrate Pest Control (category 44). The supervisor shall have specific training and experience in vertebrate pest management, commercial rodent control, general pest control, and integrated pest management.
 3. Applicators shall be licensed by the Massachusetts Pesticide Bureau and certified in General Pest Control (category 41). Applicators shall have specific training and experience in commercial rodent control and integrated pest management.

1.4 COORDINATION

- A. Perform this Work in cooperation with the other Work performed under the Contract.
- B. Initiate the work on or before field mobilization begins for the Contract and with adequate timing to achieve control before environmental disruptions. Provide a maintenance program until Contract is completed and all equipment and materials are removed.
- C. Perform the Work according to the preliminary schedule described in this section and as accepted or revised by the Owner and Engineer. Estimated durations and start dates may be changed by the Owner or Engineer to suit changes in construction schedules and field conditions. The Work could potentially require performance any day of the week and any hour of the day or night, regardless of weather.
- D. Perform this work in such a manner that toxicant or other control tools do not pose a hazard to persons, domestic animals, or non-target wildlife.

1.5 PERMITS

- A. Obtain and maintain in coordination with the Subcontractor appropriate permit(s) from city or state agencies for pest control activities associated with this Work.
- B. Obtain and maintain in coordination with the Subcontractor all right of entry permits required for the performance of this Work. This includes all utilities and private properties to which entrance is required.

PART 2 - PRODUCTS

2.1 PRODUCTS

- A. Furnish and use only pesticide formulations registered by the U.S. Environmental Protection Agency (EPA) and the Massachusetts Department of Food and Agriculture, where appropriate according to label directions and as acceptable to the Engineer.
- B. Furnish and use devices and supplies (e.g., traps and bait stations) to facilitate the management and effectiveness of the pest control program, where appropriate and as acceptable to the Engineer.

PART 3 - EXECUTION

3.1 MEETINGS

- A. Before proceeding with the Work, all pest control personnel shall attend a Work Shop held by the Contractor and Engineer to discuss planned pest control methods and coordination.
- B. The supervisor shall meet with the Contractor and Engineer weekly to discuss pest control activities.

3.2 SURVEY

- A. Prior to baiting, survey the proposed construction area and accessible or observable bordering areas and record signs of rodent activity and sanitation conditions. Closely inspect all embankments, edge areas, and properties within and abutting the construction area. Maintain survey records in the manner described in Paragraph 3.7 below.
- B. Thoroughly inspect construction area and accessible or observable bordering

areas and any nearby areas designated by the Owner or Engineer, for rodent activity and sanitation deficiencies weekly throughout the duration of this Contract and in accordance with the work schedule. Maintain inspection records in the manner described in Paragraph 3.7 below.

- C. Plan the control program and allocate resources based on survey and inspection data and as acceptable to the Owner.

3.3 APPLICATION FOR RODENT CONTROL

- A. Apply rodenticide in strict accordance with EPA-approved label directions and the Rules and Regulations of the Massachusetts Department of Food and Agriculture. Maintain records of all bait placements in the manner described in Paragraph 3.7 below.

- B. Where appropriate, especially for surface placements of rodent baits, use properly secured and tamper-resistant bait stations consistent with EPA regulation. Individually number and properly identify all bait stations.

- C. Surface Applications

- 1. Initial Surface Baiting

- Rid the construction area of all detectable rodents before construction begins, or as acceptable to the Owner. Bait all observable rodent burrows. Install and secure bait stations at regular and appropriate intervals and locations, and document rodent activity (burrows, droppings, bait consumed, dead rodents). Replenish bait and shift bait stations as necessary to ensure complete control of rodent populations. Bait edge and accessible bordering areas as necessary to ensure that rodents will not be dispersed by construction activities and that rodents will not infest work areas.

- 2. Maintenance Surface Baiting

- Establish a maintenance baiting program prior to mobilization by the Contractor, including construction areas and accessible bordering areas, as acceptable to the Owner. Check bait placements weekly. Use survey and baiting data to determine the most effective distribution of baiting locations and bait quantities. Shift and distribute bait and bait stations as appropriate to ensure continued control.

- D. Subsurface Applications

- 1. General

For situations involving underground construction/demolition, utility relocation, or utility construction, and for other situations when determined necessary by the Owner or Engineer, initiate subsurface baiting and rid underground environments of all detectable rodents before construction begins. Assign an identifying number to each manhole and catch basin where bait is placed so that locations of bait placements can be identified and rodent activity (droppings, bait consumed, dead rats) can be documented. Conduct bait applications during off-peak traffic hours unless otherwise required by the Engineer. Access manholes according to the requirements of appropriate agencies and utility companies. Coordinate the Work with appropriate municipal agencies and utility companies.

2. Initial Subsurface Baiting

Apply appropriate baits to control rodent populations in manholes and catch basins. This will involve suspending and securing bait using noncorrosive wire (e.g., 24 gauge plastic coated). Place bait in all accessible manholes and catch basins within the construction work area. In addition, bait an appropriate set of manholes and catch basins in the blocks bordering the work area and as acceptable to the Owner. Identify all baited manholes and catch basins with a standardized paint mark on the street and a numbered tag to be attached to the suspending wire. Approximately seven days after completion of the first baiting, check all manhole and catch basin baits and record estimates on the amount of bait consumed. Replenish or increase the amount of bait applied according to the amount consumed or as acceptable to the Owner and Engineer. Repeat this process again approximately fourteen days later and until there is little or no bait consumed. Check manholes and catch basins weekly when they repeatedly have 100 percent of the bait consumed.

3. Maintenance Subsurface Baiting

Prior to mobilization by the Contractor, establish a maintenance baiting program appropriate for the rodent infestation patterns identified during initial subsurface baiting. This program shall ensure continued control and shall be performed in a manner acceptable to the Owner and Engineer. Maintain bait in manholes and catch basins that have rodent activity and those that had activity during initial baitings. Check each bait according to rodent activity levels. This could range from weekly to approximately every three months, depending upon the recent history of bait consumption. Use utility maps and baiting data to determine the most effective distribution of baiting locations and bait quantities. Shift and distribute baiting locations as necessary to ensure adequate interception points for controlling immigrating rodents.

E. Cleanup

1. Remove visible rodent carcasses and dispose of them daily consistent with the pesticide label directions and applicable codes, laws, and regulations.
2. Upon completion of any pest control operations at the site, remove remaining bait and dispose of it according to the pesticide label and applicable codes, laws, and regulations. Also remove all wires used for subsurface baiting and any bait stations or traps.

3.4 SANITATION

- A. Prior to construction and throughout the duration of this Contract, identify and document harborage and food sources available to rodents on the construction site and in observable bordering areas. This includes any littering or improper or insufficient use of trash receptacles in construction areas. It also includes any bordering areas with sanitation conditions or structural deficiencies that violate City or State sanitation codes.
- B. Maintain records of sanitation conditions in the manner described in Paragraph 3.7 below.

3.5 COMPLAINT CALLS

- A. During construction, respond to pest-related complaints from the "adjacent" neighborhood (i.e. within 200 feet of the project limits) within 12 hours when required by the Owner or Engineer. Inspect the particular premises and adjacent areas for sanitation and structural deficiencies and also signs of historic and recent pest activity. Provide sanitation and structural maintenance information to the property owner or manager. Use pesticides or traps as necessary and appropriate to resolve the complaint when there is a relationship between the pest infestation and construction activities, or when required by the Owner or Engineer.
- B. Maintain records of all complaints investigated, including location, contact person, inspection results, and actions taken. Document the relatedness of the pest infestation to construction activities.

3.6 GENERAL PEST CONTROL

- A. When required by the Owner or Engineer, the Contractor shall determine appropriate methods for any pest control task not specifically identified above and shall submit them in writing to the Owner and Engineer for approval in advance. Such pest control tasks would relate to unanticipated pest control needs within construction areas or adjacent areas. This could include control of insects

or vertebrates other than rats and mice.

- B. Maintain records of general pest control activities and results in the manner described in Paragraph 3.7 below.

3.7 RECORD KEEPING

- A. Use standardized data sheets acceptable to the Owner and Engineer to maintain accurate records of date, placement, type, and amount of pesticides or other control tools (e.g., traps) applied. Similarly, maintain records of surveys, inspections, changes in pest activity, sanitation conditions, and complaint calls. Submit data in a format acceptable to the Owner and Engineer and as required under Paragraph 1.3 (3) above.

PART 4 – COMPENSATION (Not Used)

END OF SECTION 01105

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SECTION 01108

HEALTH AND SAFETY PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Prepare a Health and Safety Plan (HASP) that meets all applicable state and federal health and safety regulations, including, but not limited to, those listed below. The Contractor shall be solely responsible for developing a HASP suitable for the Contractor's use and all work done by their subcontractors. The Owner, Engineer and/or their representative is not responsible for establishing or enforcing the health and safety requirements of the Contractor, and that nothing herein shall relieve the Contractor from its exclusive responsibility for the health and safety of its employees, and/or its representatives, and/or subcontractors.
- B. The Contractor shall be responsible for being aware of all potential hazards at the site, and reviewing existing information which provides evidence of contamination within the limit of the work.
- C. Copies of the "Oil and Hazardous Materials Findings and Soil Management Recommendations –Western Avenue Infrastructure Improvements Project" Dated June 30, 2011 are attached as Appendix A to these Specifications.
- D. The Contractor shall also be required to defend, indemnify, and hold the City of Cambridge, MA, and the Engineer harmless against any and all claims, liabilities, fines, or penalties arising out of actual or alleged failure of the Contractor and/or its agents, employees, or subcontractors to comply with any health or safety regulation, rule, ordinance, legislation, and/or health and safety plan.
- E. All work required in the Specifications regarding development and implementation of a HASP shall be in accordance with State hazardous waste site regulations (310 CMR 40.0018) and OSHA requirements (29 CFR 1910 and 1926). The HASP shall be submitted to the Engineer prior to site mobilization. Work shall not proceed at the site until the Engineer and the City of Cambridge has received a copy of the Contractor's Health and Safety Plan meeting all the requirements specified herein.
- F. The Contractor shall be responsible for the construction, maintenance, and dismantling of the decontamination areas specified within the HASP. This includes providing all labor, materials, and equipment to prepare, maintain in working order, and remove the decontamination area, including collection

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and disposal of decontamination water and solids, and subsequent dismantling and disposal of materials.

- G. The Contractor is responsible for establishing, implementing and maintaining of ambient air and dust monitoring programs and all other environmental monitoring programs. All such programs shall be operated by the Contractor whenever there are soils handling construction activities occurring at the site.
- H. The Contractor shall be responsible for providing all materials, equipment, and labor associated with applying dust control suppressants, including equipment that shall be required during all soil handling activities, in the event that fugitive dust or excessive odors are encountered.

1.2 DUST CONTROL

- A. During excavation of soil and fill material, dust shall be controlled to limit potential spread of contaminants and potential exposure of contaminants to workers and the public. The dust control measures implemented at the site shall be performed in accordance with this Section.
- B. During the progress of the work, the Contractor will conduct his operations and maintain the area of his activities, including sweeping and sprinkling of water if acceptable to the Engineer, so as to minimize the generation and dispersion of dust.

1.3 AIR MONITORING

- A. Air monitoring shall involve direct reading instruments capable of providing real-time indications of air contaminants to protect on-site personnel and the local population. The Contractor's Site Health and Safety Officer and Superintendent shall be responsible for assuring that monitoring is conducted in an approved manner, that air monitoring/sampling are conducted at a frequency sufficient to ensure accurate assessments of site conditions, and that work practices, engineering controls, and/or personal protective equipment are proper for the conditions.
- B. At a minimum, detectors for organic contaminants shall be utilized to monitor on-site and off-site breathing zones and possible sources of potentially hazardous material (e.g., excavations, regrading, etc.). All personnel shall be made aware of the potential hazards and be informed of air monitoring information. Particular attention to air quality shall be made in the work area during earthwork activities to ensure that contaminants do not escape to the atmosphere and affect off-site population, on-site control, working conditions, and personnel protection measures.

- C. The Contractor shall keep accurate documentation of all air monitoring, which shall be made available to the Owner and Engineer for review at all times.

PART 2 - PRODUCTS

2.1 HEALTH AND SAFETY PLAN AND CERTIFICATIONS

- A. The Contractor shall, prior to the start of work on the site, submit six (6) copies of its site-specific Health and Safety Plan to the Engineer. Submit with the site-specific Health and Safety Plan, a certification that states the following:
 - 1. The Contractor hereby certifies that the Contractor and any workers engaged in work on the project meet the requirements of 29 CFR 1910.120 and the provisions of the American National Standards Institute, Standard Z88.2, for training, medical surveillance, and respirator protection unless the operation does not involve employee exposure or the reasonable possibility for employee exposure to safety or health hazards. These requirements include, but are not limited to, the following items:
 - a. The Contractor's employees have been examined by a licensed physician within the last 12 months, and have been determined to be physically able to perform the work and use the respirator and other protective or safety equipment required for this assignment.
 - b. The employees have received health and safety training for working in environments with known and unknown hazards within the past twelve months.
 - c. The Contractor has established and is maintaining a respiratory protection program that complies with the provision of 29 CFR 1910.134.
 - d. The Contractor maintains appropriate surveillance of the work area conditions and degree of employee exposure or stress.
 - 2. The Contractor shall further certify that only respirators approved or accepted by NIOSH/MSHA shall be provided and used by the Contractor's employees; that each of the Contractor's employees has been properly fitted to the respirators provided by the Contractor, including a test of the face-to-face piece seal; that the Contractor has

provided its employees with written procedures covering the use of respirators in dangerous atmospheres; and that the Contractor has established a program for inspection, maintenance, and care of the respirators.

The certification shall be signed and dated by the Contractor.

3. Work shall not proceed at the project site until the Engineer has received all certification(s) and the Contractor's Health and Safety Plan. Any delays incurred by the Contractor relating to the Health and Safety Plan shall be the responsibility of the Contractor, and constitute no additional costs or claims to the City of Cambridge.

PART 3 - EXECUTION

3.1 HEALTH AND SAFETY PLAN CONTENTS, MAINTENANCE, AND IMPLEMENTATION

- A. The Contractor's Plan shall address the specific work activities to be conducted by the Contractor. The HASP shall include, but not be limited to, the following:
 1. All anticipated hazards based on site conditions, construction activities and the levels of contamination and information presented in previous studies.
 2. Provisions for continually updating the Plan in accordance with any new applicable state and federal regulations or any additional information regarding conditions at the site.
 3. The following information, shall be included in the HASP in accordance with the minimum standards set forth in 29 CFR 1910.120, 29 CFR 1910.1000, and 29 CFR 1926, and 310 CMR 40.0018:
 - a. Contractor's Standard Operating Procedures, including Personnel Training and Field Orientation; Personal Hygiene Requirements and Guidelines; Field Monitoring of Site Contaminants; Respiratory Protection Training and Requirements; Levels of Protection and Selection of Equipment Procedures; Zone Delineation of the Project Site; Site Security and Entry Control Procedures; Contingency and Emergency Procedures; and Listing of Emergency Contacts.
 - b. Identification of Contractor's Site Safety Officer.

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- c. Identification of Contractor's Designated Field Personnel.
 - d. Identification of hazard and risks associated with the Contractor's work.
 - e. Type of Medical Surveillance Program.
 - f. List of all hazardous materials that the Contractor shall have on site; the location of the latest Material Safety Data Sheets (MSDS) for each material listed; and the plan for notifying all on-site personnel, including, but not limited to, the Engineer and/or their representatives, of the presence of hazardous materials on site. If there are no hazardous materials to be brought on site, the Contractor shall provide a written statement to the Engineer and/or their representative, prior to initiating work activities, certifying that the Contractor shall not transport, store, or use hazardous materials on site.
- B. The Contractor shall keep a copy of the HASP on site during all operations and shall conduct daily health and safety meetings. Failure to keep a copy of the HASP on site, or any other breach of the Contractor's Plan, shall be cause for stopping work at the cost of the Contractor. Delays caused by the Contractor's failure to comply with the health and safety regulations, or any health and safety plan, shall not entitle the Contractor to recover any additional costs or time lost. The Contractor shall not be allowed to resume activities until corrective measures are implemented.
- C. Medical surveillance records, OSHA 40-hour training forms, accident forms, and all other documentation requirements of the Contractor's health and safety plan for personnel working on the site shall be up-to-date and kept on file at the site. The Contractor shall provide documentation of employee status upon request of the Engineer.
- D. The Contractor shall make available Level C personal protective equipment and clothing, not including respirators, to the Engineer and/or their representative for use during site inspections by the Engineer and/or their representative, up to a maximum of three (3) complete sets per day. These shall be supplied and maintained at no cost to the Owner and shall be returned to the Contractor upon completion of the work (except for expendable disposal protective clothing). The Contractor shall provide a repository for collection of disposed health and safety materials. Collection and disposal of contaminated expendable supplies shall be the Contractor's responsibility.

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- E. The level of dermal and respiratory protection shall be determined based upon continuous air monitoring to be performed by the Contractor. The Engineer may conduct duplicate air monitoring for quality control purposes. As air monitoring indicates the levels of contaminants in the air, the personal protective equipment shall be determined based upon established standards and the standards set forth in the Contractor's Health and Safety Plan. Regardless, modified Level D protection for all on-site personnel is the minimum project requirement.
- F. The Contractor shall be aware of site-specific requirements, such as site security during non-working hours, limited work space, and minimizing the effects of soil excavation, in preparing its health and safety program.

3.2 ROUTINE SAFETY MEETINGS

- A. The Contractor shall keep a copy of the HASP on site during all operations, and shall conduct routine health and safety meetings to ensure that all work is being performed in accordance with OSHA regulations, the Contractor's HASP, and prior to initiating a new task, following an incident or following any changes to the HASP necessitated by site conditions. Failure to conduct routine safety meetings may be cause for stopping work at the cost of the Contractor.

PART 4 – COMPENSATION (Not Used)

END OF SECTION 01108

Contractor's responsibility as required in the Specifications or after having notified the Cambridge Department of Public Works. Disconnecting and connecting of water services shall be the Contractor's responsibility as required in the Specifications or after having notified the Cambridge Water Department.

- C. Contact the utility companies in advance of construction to allow sufficient time for the utility companies to accomplish the work they are required to perform. Provide the utility company at least thirty (30) days advance notice of scheduled date for commencement of work by the utility company.
- D. Traffic actuated signal operation shall be restored at the intersection of Memorial Drive and Western Avenue through the installation of new wire loops and lead-in cable. The contractor shall install new vehicle detection as shown on the sketch provided with these specifications. The contractor shall test and verify that all three approaches to the intersection have functioning detection.
- E. Work performed by utility companies as part of the Work of this Contract, in order to facilitate the Work of this Contract, and other work performed by utility company solely for the Contractor's convenience, shall be at no additional cost to the Owner.

1.3 DEFINITIONS

- A. Abandoned means that use has been discontinued by the utility company.
- B. To be abandoned means that use will be discontinued as part of the Work of this Contract.
- C. Maintenance means providing continuous and service that meets project requirements during construction.
- D. Maintain complete-in-place means to protect, support, and otherwise maintain the existing condition and function of a facility during construction.
- E. Restoration means replacement of a facility or portions of a facility that have been removed or made inoperative by the Contractor in the performance of the Work.
- F. Utility Company means the company, agency, owner, or operator of the facility concerned.
- G. Temporary Facility means a facility provided, in lieu of an existing or new facility, to ensure continuity of service. When a temporary facility is not

shown on the Contract Drawings, but is provided for the convenience of the Contractor, it shall be constructed at no additional cost to the Owner.

1.4 SUBMITTALS

A. Shop Drawings: Submit the following in accordance with Section 01300 - SUBMITTALS

1. Submit working drawings and, if applicable, shop drawings showing the details, procedures, and scheduling for performance of each utility work. Show actual verified field locations of existing utility facilities that are affected by the Work of this Contract; interferences which these facilities present to the new work; location of settlement markers; method proposed to proceed with the construction; and, if applicable, method of testing and procedure for restoration.
2. Submit to the Engineer specifications and drawings describing the method to be used to temporarily support existing subsurface, surface and overhead utilities during construction. Include working drawings that indicate proposed materials and details.
3. Submit to the Engineer for review a detailed excavation procedure for subsurface utilities. At a minimum, the procedure shall include:
 - a. Equipment to be used for anticipated subsurface utility investigation and excavation.
 - b. Personnel to be used and designated utility coordinator.
 - c. Duration and schedule of investigation and excavation.
 - d. Techniques proposed to isolate and protect existing utilities.
 - e. Method for the Contractor to provide utility information derived from subsurface investigation to field personnel doing excavation.
 - f. A disciplinary plan that delineates all steps to be taken as a result of a utility disruption, including possible removal of Contractor's individuals from the site.
4. Submit an emergency action plan outlining procedures to be followed by the Contractor in case of unplanned utility interruptions or unplanned damage to utilities in service. Obtain concurrence from each affected utility company.

- a. List Contractor's personnel assigned responsible charge for emergency action on site for each shift, and those on call.
 - b. List phone notification numbers for each utility company, fire, and police departments, and other relevant agencies.
 - c. Include copies of utility plans showing the valve or switch locations to isolate each line.
- B. Transmit to the Engineer the as-built utility location survey data as specified in Article 3.10 of this Section.

1.5 APPROVAL BY UTILITY COMPANIES

- A. All personnel performing work on utility facilities shall be fully qualified and able to meet the standards of the affected utility company. If the Contractor does not have the required utility experience, Contractor shall retain a specialist firm acceptable to the affected utility company to perform the Work.
- B. Prior acceptance of temporary support methods for each affected utility facility shall be obtained by the Contractor from each utility company concerned.
- C. Prior permission for disrupting a utility shall be obtained by the Contractor from each utility company concerned.
- D. Prior approval for disrupting fire signal lines, high pressure fire water mains and hydrants, and fire service lines shall be obtained from the Cambridge Fire Department.

1.6 NOTIFICATION

- A. In addition to the initial 30 day utility company notification, the Contractor shall notify the appropriate utility companies and the Engineer at least seven (7) days prior to starting any work involving or adjacent to surface, subsurface, or overhead utility facilities.
- B. NStar Gas Requirements:
 1. If cut-off or connection is expected, notify the NSTAR Gas Company Engineering Department four (4) weeks prior to cut-off or connection to gas main.

2. Immediately notify the Gas Company Engineering Department if surface or subsurface settlement or movement in excess of the design amount is observed, regardless of the proximity to an existing gas facility.

C. National Grid Gas Transmission Requirements:

1. For work adjacent to the 30-inch and 36-inch gas mains at the intersection of Western Avenue and Pleasant St, contractor to use full depth steel sheeting. If the 30-inch or 36-inch gas mains become exposed during construction, contractor shall notify National Grid to inspect the line before backfilling.
2. For any damage to National Grid gas mains, contractor shall call 800-233-5325 immediately. Any damage that may have been made to the pipe or pipe coating shall be repaired prior to backfilling.

1.7 STANDARD SPECIFICATIONS OF UTILITY OWNERS

- A. Specifications and construction methods from each utility owner apply to individual utility specification sections.
- B. It is the Contractor's responsibility to ensure that, unless otherwise specified, the standards for materials and construction methods required by the utility owner are met.

PART 2 - MATERIALS

2.1 GENERAL

- A. Materials for temporary and permanent work shall be of the type, grade, and class specified by reference to utility company standards.

PART 3 - EXECUTION

3.1 GENERAL CONSTRUCTION REQUIREMENTS

- A. Unless otherwise noted, conform to the construction standards, specifications, and standard practices of the affected utility companies. Coordinate with each utility company the work to be done by the Contractor and the work to be done by utility company. Ensure continuity of all existing utility services to all users, except when the utility company determines that temporary interruption is acceptable.

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- B. Unless otherwise indicated, maintain all utility facilities complete in place. Provide temporary support of utilities during construction only by methods acceptable to the utility company concerned.
- C. Provide and maintain all temporary facilities required to provide interim utility service when a utility facility is to be relocated and when a utility facility to be replaced is abandoned prior to replacement.
- D. Where an existing utility facility is encountered that is not indicated or that is determined to be a different utility facility than that indicated, promptly notify the Engineer. The Contractor is responsible for determining the owner of the facility and the disposition of the facility.
- E. All water, sanitary, and storm services must be maintained throughout the project through the use of temporary pumps and piping. Unless otherwise noted, no service interruptions will be permitted.
- F. The Contractor shall dewater existing utility manholes and structures prior to beginning construction. Any dewatered material shall be properly treated and disposed.

3.2 SUBSURFACE UTILITY INVESTIGATION

- A. The Contractor shall conduct test pits as indicated in the Contract Documents.
- B. Vacuum test pits and utility tracing were conducted during the design phase. These findings are included in Appendix D.

3.3 UNSAFE AND UNSUITABLE UTILITY STRUCTURES

- A. If, upon exposure, the condition of a facility to be maintained complete-in-place is found to be unsafe, by the utility company, for support or for maintenance of service, the Contractor shall replace or reconstruct or coordinate the replacement or reconstruction of the facility with the utility Owner and shall promptly notify the Engineer of additional costs anticipated prior to beginning the work.

3.4 ABANDONED FACILITIES

- A. Demolish and remove abandoned utility facilities located within areas of the Work of this Contract. Abandoned facilities that do not interfere with the Work of this Contract may remain.

- B. Do not undertake demolition or removal until written permission for such Work has been obtained from the utility company.
- C. When abandoned facilities are to be left in place, plug or cap the ends of conduits and pipes, and fill with control density fill (CDF) unless otherwise indicated. Remove abandoned utility manholes, junction boxes, and similar structures to a minimum depth of 4 feet below finish grade, and puncture or break the bottom slabs of manholes and similar structure to allow drainage. Backfill and compact excavations resulting from removal of utility facilities as required to restore original grade.

3.5 SETTLEMENT OR MOVEMENT

- A. In case of settlement or other movement that causes or could cause damage, take immediate remedial measures to correct the conditions and repair the damage.

3.6 ACCESS

- A. At all times permit free and clear access to the affected facilities by personnel of the utility companies.
- B. Throughout the construction period, maintain access to all utility vaults and structures.

3.7 SERVICE CONNECTIONS

- A. Work required for maintaining, supporting, relocating, restoring, and constructing all service connections is included as part of the Work of this Contract, even though some existing service connections, for which record information is not available, may not be shown on the Contract Drawings.

3.8 REPAIR AND RESTORATION

- A. Repair all damage to utilities caused by Work of this Contract. Clean all utility structures of dirt caused by Work of this Contract. Immediately notify the Engineer and the utility company of damage to utilities.

3.9 EXCAVATION AND BACKFILL

- A. Perform excavation and backfill in accordance with Section 02210 – EARTH EXCAVATION, BACKFILL, FILL AND GRADING.
- B. Excavation and handling of contaminated soil is specified in Sections 02080 - SOIL AND WASTE MANAGEMENT, and 02095 – TRANSPORTATION AND DISPOSAL OF SOIL AND FILL.

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3.10 CLEANING UP

- A. In accordance with Section 01630 – RESTORATION OF GROUNDS AND CLEANING UP, the Contractor shall, upon completion of the Work, remove all temporary construction facilities, equipment, debris, and unused materials, and put the project area and adjacent affected areas in a neat and clean condition.

3.11 AS-BUILT UTILITY LOCATION SURVEY

- A. For each new or relocated utility installed, including those installed or relocated by others in the Project Area, perform an as-built location survey by coordinates prior to backfilling the excavation.
- B. For each new hardscape feature installed perform an as-built location survey by coordinates. Hardscape features to be surveyed for location and elevation include but are not limited to; top and bottom of curb lines, limits of sidewalks and wheelchair ramps, roadway crown, manhole covers, gate box covers, pavers and limits of loam and seed. Hardscape features to be surveyed for location include but are not limited to; street lighting, pedestrian lighting, pedestrian signals, traffic signals, crosswalks, control panels, benches, trash receptacles, parking and traffic striping, landscaping features, fences and irrigation heads.
- C. The survey data shall be obtained by Global Positioning Survey (GPS) and certified by a Professional Land Surveyor registered in Massachusetts.
- D. A complete digital base plan shall be provided in AutoCAD DWG format Release 2000i or later on a Compact Disk (CD), properly referenced to the coordinate system established in the contract. The following standards shall be applicable:
 - 1. Text as indicated below:

All text shall be drawn using a STYLE of "L100-XX" (where XX refers to the plotted scale) and a font file of "SIMPLEX" as defined in the AutoCAD survey template provided by S E A Consultants Inc. The style shall be defined as a "fixed height" style, and have a height of 0.10 times the drawing plotted scale. (i.e. 4.0 for 40 scale plan, 2.0 for 20 scale etc.).
 - 2. Precision and Accuracy as indicated below:

Horizontal survey:
Precision: Horizontal control and surveyed points shall maintain a minimum precision of 1:10,000.
Accuracy: No more than 10% of the survey points shall be in error by

more than 1/100 inch or 0.25 mm when viewed at the requested scale.

Vertical survey:

Precision: Vertical Control shall have a maximum error of closure no greater than 0.075 feet or 0.02 meters.

Accuracy: No more than 10% of elevations when interpolated from a Surface shall be in error of more than 1/2 a contour interval.

3. Surface Data:

The data format shall conform to Autodesk Land Development Desktop Project files. If the Contractor uses a different software product to create a surface, then the surface must be represented as a TIN (Triangulated Irregular Network) of 3D lines on a separate, distinct layer within the AutoCAD drawing file. 3D faces or 2 dimensional lines are NOT acceptable.

PART 4 - COMPENSATION

Item 1200.1 – Temporary Utility Support and Coordination

METHOD OF MEASUREMENT:

Measurement for payment for Temporary Utility Support and Coordination will be on a percent of the Lump Sum bid calculated by dividing the elapsed time to date by the contractual construction time limit as approved by the Engineer.

BASIS OF PAYMENT/INCLUSIONS:

Payment for Temporary Utility Support and Coordination will be based on the bid for this item in the proposal. Under the Lump Sum Price bid for this item, the Contractor shall furnish all labor, materials, tools, equipment and incidentals required to maintain continuity of gas, telephone, electric, telecommunications, cable TV, steam, and privately owned utilities. The work includes all trunk, supply, transmission, service and main lines impacted by the Work. Under the Lump Sum Price bid for this item, the Contractor shall also furnish all labor, materials, tools, equipment and incidentals to coordinate and/or temporarily support all utilities exposed during the excavation for the installation of the Work; submission of all utility coordination and support work plans and shop drawings; coordinate the protection of and protect all overhead utilities; coordinating with Cambridge Traffic Department and MassDOT for maintenance of traffic signals; coordinating and facilitating with Harvard University and Harvard University's contractors for work beneath and adjacent to the steam tunnel and steam lines; and perform all coordination with the utility companies for the relocation, protection, support, and other work required to facilitate the completion of the project. This Item further includes utility location (Dig Safe); provide, install, maintain, and disconnect portable generators to maintain electrical service to dwellings; coordination of construction with existing utility owners and operators; providing access for utility owners and operators to their respective utilities; and communicating with affected homeowners and residents.

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EXCLUSIONS:

The following items are not included for payment under this item and are included for payment elsewhere; labor, materials, tools, equipment and incidentals required to maintain continuity of water mains; restoration of curbing, sidewalks, and bituminous concrete pavement; providing by-pass pumping of sanitary sewers and storm drains; and temporarily and permanently relocating sanitary sewers, storm drains, water and services for sanitary sewers, storm drains and water mains.

END OF SECTION 01200

SECTION 01300

SUBMITTALS

PART 1 - GENERAL

1.1 SUMMARY

- A. This section includes general requirements for project submittals by the Contractor.

1.2 PROGRESS REPORTS, RECORDS AND DATA

- A. The Contractor shall submit to the Owner such schedules of quantities and costs, progress schedules, payrolls, reports, estimates, records and other data as outlined in Section 01311 – SCHEDULING AND REPORTING and as the Owner may request concerning work performed or to be performed under this Contract.

1.3 OPERATION MANUALS

- A. Unless the specified operations manuals for equipment are submitted along with shop drawings at the time of submission no action will be taken on reviewing the shop drawings. The manuals shall include, at a minimum, operating instructions and recommended maintenance schedules for all the equipment to be furnished.

1.4 SHOP DRAWINGS, SAMPLES, PROJECT DATA

- A. The Contractor shall submit for review by the Engineer eight copies of all shop drawings, setting schedules and such other drawings as may be necessary for the prosecution of the work in the shop and in the field as required by the Drawings, Specifications or the Engineer's instructions. Deviations from the Drawings and Specifications shall be called to the attention of the Engineer at the time of the first submission of shop drawings and other drawings for consideration. The Engineer's review of any drawings shall not release the Contractor from responsibility for such deviations. Shop drawings shall be submitted with such promptness as to cause no delay in his work or the work of any other Contractor.
- B. When submitted for the Engineers' review, all shop drawings shall bear the Contractor's certification that he has reviewed, checked and approved the shop drawings, that they are in harmony with the requirements of the Project and with the provisions of the Contract Documents, and that he has verified all field measurements and construction criteria, materials, catalog numbers and similar data. The Contractor shall also certify that the work represented

by the shop drawings is recommended by the Contractor and the Contractor's Guaranty will fully apply.

- C. All samples called for in the Specifications or required by the Engineer shall be furnished by the Contractor and shall be submitted to the Engineer for his review. Samples shall be furnished so as not to delay fabrication, and to allow the Engineer reasonable time for the consideration of the samples submitted.
- D. Checking of submittals is only for general conformance with the design concept of the project and general compliance with the information given in the contract documents. Any action shown is subject to the requirements of the plans and specifications. Contractor is responsible for: dimensions which shall be confirmed and correlated at the job site; fabrication processes and techniques of construction; coordination of his work with that of all other trades; and the satisfactory performance of his work.
- E. The Contractor may only proceed with fabrication and construction of items with returned submittals marked "No Exception Taken", "Make Corrections as Noted" or "Noted : No Action Required". Resubmit submittals if marked "Rejected", "Revise and Resubmit" or "Submit Specified Item."
- F. The Contractor shall furnish such samples of material as may be required for examination and test. All samples of materials for tests shall be taken according to ASTM Specifications or as provided in the Contract Documents.
- G. All samples shall be submitted by the Contractor with a covering letter indicating that such samples are recommended by the Contractor for the service intended and that the Contractor's Guaranty will fully apply.
- H. All materials, equipment and workmanship shall be in accordance with samples guaranteed by the Contractor and reviewed by the Engineer.

1.5 CONTRACTOR'S ORDER OF CONSTRUCTION

- A. The Contractor shall submit schedules and reporting information in accordance with the requirements of Section 01311 – SCHEDULING AND REPORTING.

1.6 CONTRACTOR'S COST BREAKDOWN

- A. The Contractor shall submit a schedule of values in accordance with the requirements of Section 01301 – SCHEDULE OF VALUES.

1.7 CERTIFICATE OF DESIGN

CERTIFICATE OF DESIGN

The undersigned hereby certifies that he/she is a Professional Engineer registered in the state of _____ and that he/she has been employed by (Name of Contractor) _____ to design _____ in accordance with Specifications Section _____ for the (Name Project) _____. The undersigned further certifies that he/she has performed similar designs previously and has performed the design of the _____; and regulations and professional practice standards; that his/her signature and Professional Engineer (P.E.) Stamp have been affixed to all calculations and drawings used in, and resulting from, the design; and that the use of that stamp signifies the responsibility of the undersigned for that design.

The undersigned hereby certifies that he/she has Professional Liability Insurance and a Certificate of Insurance is attached.

The undersigned hereby agrees to make all original design drawings and calculations available to the City of Cambridge or Owner's representative with seven (7) days following written request therefore by the Owner.

P.E. Name

Contractor's Name

P.E. Registration Number, State of Registration and Discipline

Signature

Signature

Title

Title

Address

Address

Telephone

Telephone

Email Address

Email Address

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION (Not Used)

PART 4 – COMPENSATION (Not Used)

END OF SECTION 01300

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SECTION 01301

SCHEDULE OF VALUES

PART 1 – GENERAL

1.1 DESCRIPTION

- A. This Section defines the process whereby the Schedule of Values shall be developed and incorporated into the cost loading function of the CPM Schedule as specified in Section 01311 – SCHEDULING AND REPORTING. Monthly progress payment amounts shall be determined from the monthly progress updates of the CPM Schedule activities.
- B. The Schedule of Values shall be developed independently but simultaneous with the development of the CPM Schedule activities and logic as follows:

1.2 PRELIMINARY SCHEDULE OF VALUES

- A. The Contractor shall submit a preliminary Schedule of Values for the major components of the work at the Preconstruction Conference. The listing shall include, at a minimum, the proposed value for the following major work components:
 - 1. Mobilization.
 - 2. The total value of civil piping work inclusive of excavation, support of excavation, pipe installation, testing and backfill of pipe or other structures, and all incidental work associated with underground pipe installations. Additionally, this total value shall be broken down into separate values for water lines, drain lines, sanitary sewer lines, and appurtenant work such as manholes and service connections constructed or modified as a part of the work.
 - 3. The total value of the work related to the outfall inclusive of excavation, support of excavation, cofferdam installation, dewatering, concrete culvert installation, structure installation, temporary grading, erosion control, backfill, rip rap installation, embankment restoration and all incidental work associated with the outfall work. Additionally, this total value shall be broken down into separate values for cofferdam installation, dewatering, drain lines and structures, rip rap installation, embankment restoration, and appurtenant work constructed or modified as part of the work.

4. The total value of site civil work inclusive of full depth roadway reconstruction, cold planning, regrading, paving, grading, curbs and sidewalks, and landscaping.
 5. The total value of all other work not specifically included in the above items.
- B. After the Pre-construction Conference, the Contractor and Engineer shall meet and jointly review the preliminary Schedule of Values and make any adjustments in value allocations if, in the opinion of the Engineer, these are necessary to establish fair and reasonable allocation of values for the major work components. Front end loading will not be permitted. The Engineer may require reallocation of major work components from items in the above listing if in the opinion of the Engineer such reallocation is necessary. This review and any necessary revisions shall be completed within fourteen (14) calendar days from the date of Notice to Proceed.

1.3 DETAILED SCHEDULE OF VALUES

- A. The Contractor shall prepare and submit a detailed Schedule of Values to the Engineer within twenty-eight (28) calendar days from the date of Notice to Proceed. The detailed Schedule of Values shall be based on the accepted preliminary Schedule of Values for major work components. Because the ultimate requirement is to develop a detailed Schedule of Values sufficient to determine appropriate monthly progress payment amounts through cost loading of the CPM Schedule activities, sufficient detailed breakdown shall be provided to meet this requirement. The Engineer shall be the sole judge of acceptable numbers, details and description of values established. If, in the opinion of the Engineer, a greater number of Schedule of Values items than proposed by the Contractor is necessary, the Contractor shall add the additional items so identified by the Engineer.
- B. All lump sum, allowance and unit price items included for payment in the Contract shall be included in the schedule of values. Greater detail shall be provided for the following items and as further required by the Engineer.
1. Mobilization by activity.
 2. Scheduling and Reporting broken down by submittal.
 3. Geotechnical Instrumentation and Monitoring
 4. Soil and Waste Management

5. Pre / Post Construction Survey
 6. Utility Coordination
 7. Traffic and Pedestrian Management
 8. All other work not specifically included in the above items shall be broken down as necessary for establishment of pay and Schedule activity items.
- C. The Contractor and Engineer shall meet and jointly review the detailed Schedule of Values within thirty-five (35) calendar days from the date of Notice to Proceed. The value allocations and extent of detail shall be reviewed to determine any necessary adjustments to the values and to determine if sufficient detail has been proposed to provide cost loading of the CPM Schedule activities. Any adjustments deemed necessary to the value allocation or level of detail shall be made by the Contractor and a revised detailed Schedule of Values shall be submitted within thirty-eight (38) calendar days from the date of Notice to Proceed.
- D. Following acceptance of the detailed Schedule of Values, the Contractor shall incorporate the values into the cost loading portion of the CPM Schedule. The CPM activities and logic shall have been developed concurrent with development of the detailed Schedule of Values; however, it shall be necessary to adjust the detailed Schedule of Values to correlate to individual Schedule activities. It is anticipated that instances will occur, due to the independent but simultaneous development of the Schedule of Values and the CPM Schedule activities, where interfacing these two documents will require changes to each document. Schedule activities may need to be added to accommodate the detail of the Schedule of Values. Schedule of Value items may need to be added to accommodate the detail of the CPM Schedule activities. Where such instances arise, the Contractor shall propose changes to the Schedule of Values and to the CPM Schedule activities to satisfy the CPM Schedule cost loading requirements.

1.4 CROSS REFERENCE LISTING

- A. To assist in the correlation of the Schedule of Values and the CPM Schedule, the Contractor shall provide a Cross Reference Listing which shall be furnished in two parts. The first part shall list each Scheduled Activity with the breakdown of the respective valued items making up the total cost of the activity. The second part shall list the valued item with the respective Scheduled Activity or Activities that make up the total cost indicated. In the case where a number of schedule items make up the total cost for a valued item (shown in the Schedule of Values) the total cost for each scheduled item should be indicated.

- B. These listings shall be updated and submitted in conjunction with the CPM monthly submittals as stated in Specification Section 01311 – SCHEDULING AND REPORTING.
- C. Approved change orders reflected in the CPM Schedule shall be incorporated into the Schedule of Values as a single unit identified by the change order number.

1.5 CHANGES TO SCHEDULE OF VALUES

- A. Changes to the CPM Schedule which add activities not included in the original schedule but included in the original work (schedule omissions) shall have values assigned as approved by the Engineer. Other activity values shall be reduced to provide equal value adjustment increases for added activities as approved by the Engineer.
- B. In the event that the Contractor and Engineer agree to make adjustments to the original Schedule of Values because of inequities discovered in the original accepted detailed Schedule of Values, increases and equal decreases to values for activities may be made.

1.6 LIQUIDATED DAMAGES

- A. The Schedule of Values information is an integral part of the scheduling and reporting under Section 01311 – SCHEDULING AND REPORTING and the progress payment information. As such, it is critical information to evaluating the project's progress and the proper planning of the Owner's and Engineer's work effort as well as their financial obligations associated with this Project. Accordingly, if any submittal required by this Section is found to be incomplete or is submitted later than required, the Owner will suffer financial loss and, accordingly, liquidated damages will be assessed against the Contractor in accordance with the Agreement.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION (Not Used)

PART 4 – COMPENSATION (Not Used)

END OF SECTION 01301

SECTION 01311

SCHEDULING AND REPORTING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section includes scheduling and reporting requirements of the Contractor.

1.2 GENERAL

- A. The scheduling of the Work under the Contract shall be performed by the Contractor in accordance with the requirements of this Section. The development of the schedule, the cost loading of the schedule, monthly payment requisitions and project status reporting requirements of the Contract shall employ computerized Critical Path Method (CPM) scheduling. The CPM Schedule shall be cost loaded based on the schedule of values as approved by the Owner in accordance with the requirements of Section 01301 – SCHEDULE OF VALUES. The CPM schedule and all reports should be prepared with Primavera P3, Version 2.0B software. Where submittals are required hereunder, the Contractor shall submit four copies of each submittal item.

1.3 INITIAL QUALIFICATIONS

- A. The Contractor shall submit a statement of computerized CPM capability at the First Progress Meeting verifying that either the Contractor has in-house capability qualified to use CPM techniques and the Primavera 3 Version 2.0B software or that the Contractor will employ a CPM consultant so qualified. In either event the statement shall identify the individual who will perform the CPM scheduling. Capability shall be verified by description of construction projects on which the individual has successfully applied computerized CPM and shall include at least two projects of similar nature, scope and value not less than one-half the Total Bid Price of this project. The statement shall also provide the contact persons for the referenced projects with current telephone and address information.

1.4 INITIAL SCHEDULE SUBMITTALS

- A. The Contractor shall submit two short term schedule documents at the First Progress Meeting which shall serve as the Contractor's Plan of Operation for the initial 60 day period of the Contract Time and to identify the manner in which the Contractor intends to complete all work within the Contract Time. The Contractor shall submit: (1) a 60 day Plan of Operation bar chart, and (2) a project overview bar chart type plan for all work as indicated below.

1. 60-Day Plan of Operation: During the initial 60 days of the Contract Time, the Contractor shall conduct Contract operations in accordance with the 60-day bar chart Plan of Operation. The bar chart so prepared and submitted shall show the accomplishment of the Contractor's early activities (mobilization, permits, submittals necessary for early material and equipment procurement, submittals necessary for long lead equipment procurement, CPM submittals, initial site work and other submittals and activities required in the first 60 days).
 2. Project Overview Bar Chart: The overview bar chart shall indicate the major components of the project work and the sequence relations between major components and subdivisions of major components. The overview bar chart shall indicate the relationships and time frames in which the various components of the Work will be made substantially complete and placed into service. Each major component and subdivision component shall be accurately plotted on time scale sheets not to exceed 36-inch by 60-inch in size. Not more than three sheets shall be employed to represent this overview information.
- B. The Owner and the Contractor shall meet to review and discuss the 60-day plan of operations and project overview bar chart within one week after they have been submitted to the Owner. The Contractor shall make corrections to the schedules necessary to comply with the Contract requirements and shall adjust the schedules to incorporate any missing information requested by the Owner.

1.5 CPM SCHEDULE SUBMITTALS

- A. Original CPM Schedule Submittal: Within 30 calendar days after the commencement date stated in the Notice to Proceed, the Contractor shall submit for review by the Owner a hard copy of the CPM Network Schedule. This submittal shall have already been reviewed and approved by the Contractor's Project Manager, Project Superintendent, and the Project Estimator prior to submission. The CPM Schedule shall be a time-scaled network diagram of the "i-j" activity-on-arrow or precedence type. The Network Diagram shall describe the activities to be accomplished and their logical relationships and show the Critical Path.
- B. As stated in Paragraph 1.7.F herein, all float indicated in the schedule shall belong to the project. The Computerized Schedule Report tabulations shall include the following:
 1. Report of activities sorted by Activity Number.

2. Report of activities sorted by Early Start date.
 3. Report of activities sorted by Total Float.
 4. Report of activities sorted by Responsibility Code. Responsibility Codes shall be established for the Contractor, Owner, subcontractors, suppliers, etc. These codes shall be identified in the Network Diagram.
 5. A successor-predecessor report which shall identify the successor and predecessor activities for each activity and ties between schedule activities.
- C. Original CPM Schedule Review Meeting: The Contractor shall, within 40 calendar days from the commencement date stated in the Notice to Proceed, meet with the Owner and Engineer to review the original CPM schedule submittal. The Contractor shall have the Project Manager, Project Superintendent, and the Project Scheduler in attendance. The Owner's review will be limited to the submittal's conformance to the Contract requirements. However, the review may also include:
1. Clarifications of the design intent, process, and startup requirements.
 2. Directions to include activities and information missing from the submittal.
 3. Requests to the Contractor to clarify the schedule.
- D. Revisions to the Original CPM Schedule: Within 50 calendar days after the commencement date stated in the Notice to Proceed, the Contractor shall have revised the original CPM schedule submittal to address all review comments from the original CPM schedule review meeting and resubmit the network diagrams and reports for the Owner's review. The Owner, within 14 calendar days from the date that the Contractor submitted his revised schedule will either (1) accept the schedule and cost loaded activities as submitted, or (2) advise the Contractor in writing to review any part or parts of the schedule which either do not meet the Contract requirements or are unsatisfactory for the Owner to monitor the project's progress and status or evaluate monthly payment requests by the Contractor. The Owner may accept the schedule with conditions that the first monthly CPM schedule update be revised to correct deficiencies identified. When the schedule is accepted, it shall be considered as the "Original CPM Construction Schedule" until an updated schedule has been submitted. The Owner reserves the right to require that the Contractor adjust, add to, or clarify any portion of the schedule which may later be discovered to be insufficient for the monitoring of the Work or approval of partial payment requests. No additional compensation will be provided for such adjustments, additions or clarifications.

- E. Acceptance: The acceptance of the Contractor's schedule by the Owner will be based solely upon the schedule's compliance with the Contract requirements. By way of the Contractor assigning activity duration and proposing the sequence of the Work, the Contractor agrees to utilize sufficient and necessary management and other resources to perform the work in accordance with the schedule. Upon submittal of a schedule update, the updated schedule shall be considered the "current" project schedule.
- F. Submission of the Contractor's progress schedule to the Owner shall not relieve the Contractor of total responsibility for scheduling, sequencing, and pursuing the Work to comply with the requirements of the Contract Documents, including adverse effects such as delays resulting from ill-timed work.
- G. Monthly Updates and Periodic CPM Schedule Submittals: Following the acceptance of the Contractor's Original Construction Schedule, the Contractor shall monitor the progress of the Work and adjust the schedule each month to reflect actual progress and any changes in planned future activities. Each schedule update submitted must be complete including all information requested in the original schedule submittal and that shown in Paragraph 1.7. Each update shall continue to show all work activities including those already completed. These completed activities shall accurately reflect the "as built" information by indicating when the work was actually started and completed.
- H. Neither the submission nor the updating of the Contractor's original schedule submittal nor the submission, updating, change or revision of any other report, curve, schedule or narrative submitted to the Owner by the Contractor under this Contract, nor the Owner's review or acceptance of any such report, curve, schedule or narrative shall have the effect of amending or modifying, in any way, the Contract completion date or milestone dates or of modifying or limiting, in any way, the Contractor's obligations under this Contract. Only a signed, fully executed change order can modify these contractual obligations.
- I. Weekly schedule updates shall be submitted by the Contractor and will be reviewed with the Contractor during the weekly construction progress meetings. The goal of these meetings is to enable the Contractor and the Owner to initiate appropriate remedial action to minimize any known or foreseen delay in completion of the Work and to determine the amount of Work completed since the last month's schedule update. The status of the Work will be determined by the percent complete of each activity shown in the Network Diagram. These meetings are considered a critical component of the overall monthly schedule update submittal and the Contractor shall have appropriate personnel attend. As a minimum, these meetings shall be attended by the Contractor's Project Manager and General Superintendent.

- J. The Contractor shall submit the revised CPM Network Diagram, the revised successor/predecessor report, the Project Status Reports as defined by Paragraph 1.8 of this Section with the Contractor's Application for Payment. Applications for Payment which are submitted without the proper CPM Updates shall be held until the Contractor has satisfied the Contract requirement. Within five (5) working days of receipt of the above noted revised submittals, the Owner will either accept or reject the monthly schedule update submittal. If accepted, the percent complete shown in the monthly update will be the basis for the Application for Payment to be submitted by the Contractor. If rejected, the update shall be corrected and resubmitted by the Contractor before the Application for Payment for the update period can be processed.
- K. Schedule Revisions: The Contractor shall highlight or otherwise identify all changes to the Network Diagram Schedule Logic or activity durations made from the previous schedule. The Contractor shall modify any portions of the CPM schedule which become infeasible because of activities behind schedule or for any other valid reason.

1.6 CHANGE ORDERS

- A. Upon written approval of a change order, or upon written receipt by the Contractor of authorization to proceed with additional work, the change shall be reflected in the next submittal of the CPM schedule by the Contractor. The Contractor shall utilize a sub-network in the schedule depicting the changed work and its effect on other activities. This sub-network shall be tied to the main network with the appropriate logic so that a true analysis of the Critical Path can be made.

1.7 CPM STANDARDS

- A. Definitions: CPM, as required by this Section, shall be interpreted to be generally as outlined in the Association of General Contractors (AGC) publication, "The Use of CPM in Construction." except that either "i-j" arrow diagrams or precedence diagramming format may be utilized. In the case of conflicts between this specification and the AGC Document, this specification shall govern.
- B. Construction Schedules: Construction schedules shall include a graphic network diagram and computerized construction schedule reports as described in Paragraph 1.8.
- C. Networks: The CPM network shall be in a form of a time scaled "i-j" activity-on-arrow or precedence type diagram and may be divided into a number of separate sheets with suitable match lines relating the interface

points among the sheets. Individual sheets shall not exceed 36-inch by 60-inch.

- D. All construction activities and procurement shall be indicated in a time-scaled format and a calendar time line shall be shown along the entire sheet length. Each activity arrow or node shall be plotted so that the beginning and completion dates of each activity are accurately represented along the calendar time line. All activities shall be shown using the symbols that clearly distinguish between critical path activities, non-critical activities and free float for each non-critical activity. All activity items shall be identified by their respective Activity Number, Responsibility Code, Work Duration, and their Dollar Value. All non-critical path activities shall show their total float time in scale form by utilizing a dotted line or some other graphical means.
- E. Duration Estimates: The duration estimate indicated for each activity shall be computed in working days and shall represent the single best estimate considering the scope of the activity work and resources planned for the activity. Except for certain non-labor activities, such as curing of concrete or delivery of materials, activity duration shall not exceed 10 working days nor be less than one working day unless otherwise accepted by the Owner.
- F. Float Time: Float time shall be as follows:
 - 1. Definition: Unless otherwise provided herein, float as referenced in these documents, is total float. Total float is the period of time measured by the number of working days each non-critical path activity may be delayed before it and its succeeding activities become part of the critical path. If a non-critical path activity is delayed beyond its float period, that activity then becomes part of the critical path and controls the end date of the project. Thus, the delay of the non-critical path activity beyond its float period will cause delay to the project itself.
 - 2. Float is not for the exclusive benefit of the Contractor, but is an expiring resource available to the Owner, or the Contractor, to accommodate changes in the Work, however originated, or to mitigate the effect of events which may delay performance or completion of all or part of the Work within the Late Dates, the Contractor's anticipated completion, or Contract Time. Contract time extensions for the Contract performance will be granted only to the extent that delays or disruptions to affected work paths exceed total float along those paths of the current Working Schedule (updated schedule) in effect at the time of delay or disruption. Delays and disruptions which cause the end date of the Work to exceed current contract completion date must be beyond control and without fault or negligence of the Contractor or any Subcontractor at

any tier. In the event that the delays or disruptions impact an already negative float path, the Contractor will not receive a time extension unless and until the activity with the highest negative float is driven even further negative. Delays or disruptions are not considered a basis for time extension to this contract unless and until such delays or disruptions are resolved as set forth in the General Conditions.

3. Pursuant to the float sharing requirements of this Section, the use of float suppression techniques such as preferential or logic sequencing (crew movement, equipment use, etc.), special lag/lead restraints, and extended activity times or duration, imposed dates, scheduling of work not required for a Contract Time as required work, and others, are expressly prohibited. Use of float time disclosed or implied by use of alternate float suppression techniques shall be shared to the benefit of both the Owner and the Contractor. Justify use of preferential sequencing, special lag/lead relationships and other network techniques that may be construed as float suppression techniques as being necessary for efficient utilization of resources in execution of the Contract. Use of any network techniques solely for the purpose of suppressing float will be cause for rejection of schedule submittal. The Contractor shall adjust or remove any float suppression techniques as a prerequisite to a request for an increase in Contract Price or Contract Time.

1.8 SCHEDULE REPORTS (FORMAT)

- A. Schedule Reports: Schedule Reports shall be prepared based on the Construction Schedule, and shall include the following minimum data for each activity:
 1. Activity Numbers and Responsibility Codes.
 2. Work Order No.
 3. CIP No.
 4. Estimated Activity Duration.
 5. Activity Description.
 6. Activity's Percent Completion.
 7. Early Start Date (Calendar Dated).
 8. Early Finish Date (Calendar Dated).
 9. Late Start Date (Calendar Dated).

10. Late Finish Date (Calendar Dated).
 11. Status (Whether Critical).
 12. Total Float for Each Activity.
 13. Free Float for Each Activity.
 14. Cost Value for Each Activity.
- B. Project Information: Each Schedule Report shall be prefaced with the following summary data:
1. Project Name.
 2. Contractor.
 3. Type of Tabulation.
 4. Project Duration.
 5. Contract Completion Date (revised to reflect time extensions).
 6. The Commencement Date Stated in the Notice to Proceed.
 7. The Data Date and Plot Date of the Network Diagram.
 8. If an update, cite the new schedule completion date.

1.9 PROJECT STATUS REPORTING

- A. In addition to the submittal requirements for the CPM scheduling identified in this Section, the Contractor shall provide monthly project status reports (Overview Bar Chart and a written narrative report) to be submitted in conjunction with the revised CPM Schedules as specified in Paragraph 1.4. Status reporting shall be in the form specified below.
- B. The Contractor shall prepare and submit monthly an Overview Bar Chart schedule of the major project components. The overview bar chart schedule shall be a summary of the current CPM schedule (original and as updated and adjusted throughout the entire construction period). It shall be limited to not more than four sheets which shall not exceed 8-1/2-inch by 11-inch. The major project components shall be represented as time bars which shall be subdivided into various types of work.
- C. Each major component and subdivision shall be accurately time scale plotted consistent with the project overview bar chart specified above. It shall represent the same status indicated by early start and finish activity information contained in the latest update of the CPM schedule. In addition,

a percent completion shall be indicated for each major component and subdivision. The initial submittal of the overview bar chart schedule shall be made at the time that the revised original CPM schedule is submitted to the Owner. The Contractor shall amend the overview schedule to include any additional detail required by the Owner. The Contractor shall include any additional information requested by the Owner at any time during the construction of the Work.

- D. The Contractor shall prepare monthly written narrative reports of the status of the project for submission to the Owner. Written status reports shall include:
1. The status of major project components (Percent Complete, amount of time ahead or behind schedule) and an explanation of how the project will be brought back on schedule if delays have occurred.
 2. The progress made on critical activities indicated on the CPM schedule.
 3. Explanations for any lack of work on critical path activities planned to be performed during the last month.
 4. Explanations for any schedule changes, including changes to the logic or to activity duration.
 5. A list of the critical activities scheduled to be performed in the next two month period.
 6. The status of major material and equipment procurement.
 7. The value of materials and equipment properly stored at the site, but not yet incorporated into the work-in-place.
 8. Any delays encountered during the reporting period.
 9. An assessment of inclement weather delays and impacts to the progress of the Work.
 10. A statement as to the adequacy of remaining contract time to complete Work.
- E. The Contractor may include any other information pertinent to the status of the project. The Contractor shall include additional status information requested by the Owner.

1.10 INCLEMENT WEATHER PROVISIONS OF THE SCHEDULE

- A. The Contractor's construction schedule shall include lost days on the CPM schedule's critical path due to inclement weather during an active period of Work. The Contractor's schedule shall also include lost days due to an inclement weather related shutdown at the requirement of the Owner, see Article 2 of the Special Conditions.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION (Not Used)

PART 4 – COMPENSATION (Not Used)

END OF SECTION 01311

SECTION 01380

CONSTRUCTION PHOTOGRAPHS

PART 1 - GENERAL

1.1 CONSTRUCTION PHOTOGRAPHS

- A. The Contractor shall arrange for a professional photographer to take photographs during construction.
- B. Sufficient photographs to document the work, but no less than twelve, shall be taken per month. Five 8-inch by 10-inch glossy face prints of each photograph plus three compact discs (CD's) with digital images shall be furnished on a monthly basis. The Owner shall receive two sets with a CD, the Engineer shall receive two sets with a CD, and the Contractor shall receive the remaining set and CD. Each print shall be mounted on cloth with a flap for three ring binders. Each print shall be identified with project name, date, job number, and location of photograph.
- C. Monthly photographs shall be inserted in three ring binders identified with project name, job number and date.
- D. Contractor shall submit photographic negatives with photographs to the Owner.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION (Not Used)

PART 4 – COMPENSATION (Not Used)

END OF SECTION 01380

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SECTION 01390

PRE CONSTRUCTION SURVEY

PART 1 - GENERAL

1.1 SUMMARY:

- A. Provide construction videos and photographs pertinent to the work during the Contract period specified.
- B. Perform pre-construction conditions surveys on all exterior surface features and building exterior surfaces and interiors as shown on the Drawings.
- C. Perform post-construction survey at properties where a damage claim has been reported. Assume five properties require post-construction survey.

1.2 SYSTEM DESCRIPTION:

- A. Work under this section includes photography and video recording of surface conditions of interior and exterior of building and exterior areas and structures as indicated on the drawings.
- B. Perform photography and video recording:
 - 1. Before commencement of work.
 - 2. After completion of construction activities at areas where damage claims have been reported.

1.3 QUALITY ASSURANCE

- A. Qualifications
 - 1. The company engaged for professional photography shall, during the past 5 years, have successfully completed photographing and video recording three construction projects of similar scope and dollar value as the construction project which is the subject of this Contract.
 - 2. Qualifications of the firm performing the pre- and post-construction building surveys:
 - a. Inspections shall be performed by or under the direct supervision of a Registered Professional Engineer, licensed in the state of

Massachusetts. This individual shall have at least 3 years' experience in the inspection or design of residential and commercial structures.

1.4 SUBMITTALS:

- A. Submit in accordance with Section 01300 Submittals.
- B. Submit prior to performing any photography and video work, the qualification of the firm performing the photography and video recording work. Include a list of projects to demonstrate compliance with paragraph 1.3.A.1 of this section. For each project, include project name, location, owner, year(s), name of general contractor, and current address and phone number of the owner or owner's representative.
- C. Submit copies of all videos as follows:
 - 1. Four (4) copies of the pre-construction video to the ENGINEER within 30 days after Notice to Proceed.
 - 2. Format shall be DVD.
- D. Submit copies of photographs as follows:
 - 1. Photographic compact discs (photo CDs) and prints of each view. Submit two sets of prints and three photo CDs.
 - 2. Each print shall be identified and mounted as herein specified.
- E. Submit written release(s) from the photographer and photographic studio covering all videos, photographs (prints), and photo CDs of images taken as specified. Submit each release at the time of development of the subject video and/or photograph.
- F. Within 30 days of Notice to Proceed, submit the qualifications of Professional Engineer(s) that will perform the "before and after" condition survey of building as specified in paragraph 3.1 of this section.
- G. Within 30 days of Notice to Proceed, submit four (4) copies of pre-construction ("before") "Building Condition Survey" reports and videos (on DVD) of buildings as indicated in paragraph 3.1 to ENGINEER.

1.5 SEQUENCING AND SCHEDULING:

- A. Pre-construction photography and video, including pre-construction building surveys and exterior areas shall be completed prior to beginning of construction.
- B. Post-construction building condition survey work: only of areas where a damage claim has been reported.
- C. Dates for other photography and video recording at the site shall be coordinated with the ENGINEER.

1.6 WORKSITE CONDITIONS

- A. Right of entry for building conditions survey: Contractor shall obtain the right of entry for all structures to be surveyed.
 - 1. Prior to contacting the individual building owners, the ENGINEER will provide a general notice describing the project and the need to obtain access to each building. The Contractor shall not contact individual building owners until at least 2 weeks after the ENGINEER has provided notice to the building owners.

PART 2 - PRODUCTS

2.1 MATERIALS:

A. Video:

- 1. Format: Digital recorded and submitted on DVD.
- 2. Video Identification:
 - a. Video Number: #####-yyy

Where: ### = Contract Number
yyy = video number, sequentially numbered 001

- b. Clearly identify and indicate:
 - 1) Project name and Contract No.
 - 2) General description of the subject(s) of the video.
 - 3) Date (s)

3. Log of Videos: Provide a binder with the log of all videos taken for this Contract. Format of the log shall be tabular and shall include a description of each photograph that includes all the information specified in paragraph 2.1.A.2 of this section.

B. Photographs:

1. Prints:

- a. Type: Color prints from digital or film negatives for color photography.
- b. Finish: smooth glossy surface.
- c. Size: 8-inch x 10-inch plus suitable margin for identification.
- d. Paper weight: Single weight.
- e. Electronic format: photographic compact disc (photo CD).

2. Print identification:

- a. Photograph number:####-yyy-zz

Where: ##### - Contract Number

yyy – roll of film, sequentially numbered from 001

zz – Photograph number, sequentially numbered from
01 for each
roll of film

- b. Clearly identify and indicate:

- 1) Project name and Contract No.
- 2) The location (e.g., station number) where the photograph was taken.
- 3) The view/orientation of the photograph (compass direction and vertical declination of view (e.g., horizontal, looking up, looking down, etc.)
- 4) Identification of main features in view.
- 5) Any other data and information pertinent to the purpose and identification of the exposure.
- 6) Date and time.

- 7) Weather conditions (for exterior shots).
 - c. Each print shall be identified with information on it in a manner that results in minimum interference with exposure printed.
3. Print mounting:
 - a. Each print shall be inserted in a clear plastic photograph holder jacket.
 - 1) Material or fabrication shall not cause discoloration
 - 2) Holder shall be designed to prevent print from slipping out of envelope.
 - 3) Holder shall permit convenient removal and insertion of print.
 - 4) Holder shall have a reinforced binding edge suitable for binder herein specified.
4. Print Filing Binder:
 - a. Binders shall be sturdy and durable.
 - b. Provisions for labeling front cover and binding face:
 - 1) Label front of each binder with: Project name, Contract No., "Project Photographs, Volume No. __", dates covered by photographs included in the binder.
 - c. Binders shall be a size suitable for filing mounted prints.
 - d. Permit convenient removal and insertion of mounted prints.
 - e. Include a tabular index of all photographs, describing each photograph in the binder and including the information specified in paragraph 2.1.B.2 of this section.
 - f. Include the photo CD(s) that contain the digital images of all the photographs that are included in the binder. Provide a sleeve or pocket in the binder for storing the photo CD(s). Each photo CD shall be numbered with a sequential number.

5. Master Log of Photographs: Provide a binder with the master log of all photographs taken for this Contract. Format of the log shall be tabular and shall include a description of each photograph that includes all information specified in paragraph 2.1.B.2 of this section. For each photograph indicate the CD it is included on.
 - a. Include a separate tabular log of all photo CD(s) and cross-reference which photo numbers are included on each photo CD.

PART 3 - EXECUTION

3.1 GENERAL PHOTOGRAPH AND VIDEO RECORDING:

A. General:

1. All views shall contain a relative dimension reference that is easily recognizable. In views where dimensions are critical use a recognizable measuring device such as folding ruler or measuring tape in a manner that the markings are clean and sharp in the photograph and the device located in close relationship to the subject of the photograph.

B. Detailed examination of the above grade structures, buildings and outside areas shall include documentation of exterior visual survey of the property, on-site improvements and plantings; detailed video inspections of the exteriors of buildings; color photographs of the exteriors showing visually evident structural faults, including but not limited to:

1. exterior façade and interior for structures indicated in the Contract Drawings.
2. location and size of cracks in exterior/interior walls, especially instances of cracked or missing plaster within defined survey areas;
3. damaged masonry or roofing within the defined survey areas;
4. damaged windows or doorway within the defined survey areas;
5. walls which are not vertical within the survey area;
6. damage to foundation, including exterior/interior basement walls; and tightness of fit of doors and windows with respective jambs.;
7. sidewalks, paved areas, utility poles, stairways, patios, retaining walls, and landscaped areas.

PART 4 – COMPENSATION (Not Used)

END OF SECTION 01390

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SECTION 01400

QUALITY CONTROL

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section includes quality assurance and control of installation and manufacturer's field services and reports.

1.2 WATERTIGHTNESS

- A. All structures, pipes, and equipment which are to contain water shall be watertight under all operating conditions for which they are intended. The Contractor shall furnish all labor, materials and equipment and do all work required by the Engineer to make all such parts of the work watertight, or to replace them if in the opinion of the Engineer any leakage is excessive. All such parts of the work filled with water for testing watertightness shall be left filled as ordered by the Engineer.

1.3 LAYOUT OF WORK

- A. The Contractor shall employ at his own expense a Massachusetts Registered Land Surveyor, acceptable to the Engineer and direct him to establish an initial "Construction Base Line" as indicated on the Drawings. Said base line shall be staked at 25 foot stations. The Engineer shall also provide bench mark information on the Drawings or separately in writing. The Contractor shall do all layout of the work from said base line and bench marks.
- B. The Contractor shall employ, at his own expense, a Registered Land Surveyor, approved by the Engineer and cause him to establish permanent bench marks during the entire progress of the work, to which easy access may be made to determine and assure all lines and grades and to verify same from time to time. The Contractor shall keep on the job a level and transit and allow the Owner's Representative and the Engineer unrestricted use of same at the work site. Such check shall not be considered as approval of the Contractor's work.
- C. The Contractor shall maintain the construction base line stakes at all times. Should stakes or marks be destroyed during the course of the work, by the Contractor or by others, the Contractor shall, at his own expense, provide the services of a Massachusetts Registered Land Surveyor, acceptable to the Engineer, to reestablish such stakes and marks.

1.5 CARE OF WATERCOURSES

- A. The Contractor shall maintain the flow in all watercourses, whether open channels or in pipes, in all sewers and other pipes interfered with in the line of work and convey the flow to a suitable point of discharge so as not to flow upon the work or create a nuisance. In the discharge of water removed from the excavations by pumping or by gravity similar precautions shall be observed as well as those outlined in specifications relating to contaminated and hazardous materials.

1.6 HYDRANTS

- A. Fire hydrants on or adjacent to the work shall be kept accessible to fire-fighting equipment at all times.

1.7 MANUFACTURER'S FIELD SERVICES AND REPORTS

- A. When specified in individual specification sections, provide material or product supplier's or manufacturer's technical representative to observe site conditions; conditions of surfaces and installation; quality of workmanship; start-up of equipment; operator training, testing, adjustment, and balance of equipment as applicable; and to initiate operation, as required. Conform to minimum time requirements for start-up operations and operator training if defined in specification sections.
- B. At the Owner's or Engineer's request, submit qualifications of the manufacturer's representative 15 days in advance of required representative's service. The representative shall be subject to approval of the Owner and Engineer.
- C. Manufacturer's representative shall report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturer's written instructions. Submit reports within 14 days of observation to Engineer for review.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION (Not Used)

PART 4 – COMPENSATION (Not Used)

END OF SECTION 01400

SECTION 01500

TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 PLANT

- A. The Contractor shall furnish plant and equipment which will be efficient, appropriate and large enough to secure a satisfactory quality of work and a rate of progress which will insure the completion of the work within the time stipulated in the Contract. If at any time such plant appears to the Engineer to be inefficient, inappropriate or insufficient for securing the quality of work required or for producing the rate of progress aforesaid, he may order the Contractor to increase the efficiency, change the character or increase the plant equipment, and the Contractor shall conform to such order. Failure of the Engineer to give such order shall in no way relieve the Contractor of his obligations to secure the quality of the work and rate of progress required.

1.2 SUBMITTALS

- A. The Contractor shall submit a complete work plan including: proposed hours of operation, sequencing of work, number of shifts, number of work crews, and anticipated conflicts with existing utilities and facilities throughout the project. The work plan shall also include dates for temporary facility service interruption and required utility relocation. The plan shall also include a detailed schedule of all cooperation requirements with owners/operators of existing utilities and facilities.

1.3 PRIVATE LAND

- A. The Contractor shall not enter or occupy private land outside of easements, except by permission of the Owner.

1.4 PIPE LOCATIONS

- A. Pipelines shall be located substantially as indicated on the Drawings, but the Engineer reserves the right to make such modifications in locations as may be found desirable to avoid interference with existing structures or for other reasons. Where fittings are noted on the Drawings, such notation is for the Contractor's convenience and does not relieve him for laying and jointing different or additional items where required.

1.5 HAULING, HANDLING AND STORAGE OF MATERIALS

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- A. The Contractor shall, at his own expense, handle and haul all materials furnished by him and shall remove any of his surplus materials at the completion of the work. The Contractor shall provide suitable and adequate storage for equipment and materials furnished by him and shall be responsible for any loss or damage to any equipment or materials by theft, breakage, or otherwise. 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.

1.6 OPEN EXCAVATIONS

- A. All open excavations shall be adequately safeguarded by providing temporary barricades, steel plates, caution signs, concrete barriers, protective 7' tall fencing, lights and other means to prevent accidents to persons, and damage to property. The Contractor shall, at his own expense, provide suitable and safe means for completely covering all open excavations and for accommodating pedestrian and/or vehicular travel when work is not in progress. Bridges provided for access to private property during construction shall be removed when no longer required. 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. 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 open trench.
- B. Trenches greater than 10 feet deep in the public right of way may be secured overnight using steel plates. Up to two steel plates may be used and each plate shall be pinned and beveled as indicated in the Drawings. Steel plates shall not be used without the Owner's written permission. Steel plates shall have 18-inches overlap on the sides. For cases where the trench is greater than 7 feet wide, the trench may be plated overnight with approval of the Owner, but the work zone shall be closed off to pedestrian and vehicular traffic. The Contractor shall not close down any road until a site-specific 24-hour traffic management plan has been reviewed and approved by the Owner and the Engineer, and implemented by the Contractor.

1.7 TEST PITS

- A. Test pits for the purpose of locating underground pipeline or structures in advance of the construction shall be excavated and backfilled by the Contractor at the requirements of the Engineer and/or as shown on the Drawings. Test pits shall be backfilled immediately after their purpose has been completed and the surface restored and maintained as required by the Engineer.

1.8 PROTECTION AND RELOCATION OF EXISTING STRUCTURES AND UTILITIES

- A. The Contractor shall assume full responsibility for the protection of all buildings, structures, and utilities, public or private, including poles, signs, services to buildings, utilities in the street, gas pipes, water pipes, hydrants, sewers, drains, and electric and telephone cables, fiber optic lines, fire signals, steam, cable television cables, whether or not they are shown on the Drawings. The Contractor shall carefully support and protect all such structures and utilities from injury of any kind. The Contractor shall notify the owner/operator of the proposed work and proposed protection plan so the owner/operator can review and approve protection measures. The Contractor is required to comply with all provisions of Massachusetts General Laws Chapter 353 entitled "Excavations-Public Ways-Notice Requirements" otherwise known as Dig Safe. Any damage resulting from the Contractor's operations shall be repaired by him at his expense.
- B. Assistance will be given the Contractor in determining the location of existing services. The Contractor, however, shall bear full responsibility for obtaining all locations of underground structures and utilities. Services to buildings shall be maintained and all costs or charges resulting from damage thereto shall be paid by the Contractor.
- C. Protection and temporary removal and replacement of existing utilities and structures as described in this section shall be a part of the work under the Contract and all costs in connection therewith shall be included in the unit prices established in the Contract. The Contractor will be responsible for the removal and replacement of existing utilities or coordination with the owners/operators of the existing utilities and assisting the existing utilities where required.
- D. If, in the opinion of the Engineer, permanent relocation of a utility owned by the City of Cambridge is required, that is not shown on the plans or the specifications; he may require the Contractor, in writing, to perform the work. Work so ordered will be paid for as extra work under provisions of the General Conditions. If relocation of a privately owned utility is required, the Contractor will notify the utility to perform the work as expeditiously as possible. The Contractor shall fully cooperate with the Owner and utility, and shall have no claim for delay due to such relocation. The Contractor shall notify public utility companies in writing at least seven days (excluding Saturdays, Sundays and legal holidays) before excavating or working in any public way. The Contractor shall notify public utilities 30 days prior to any service call wherever possible.

1.9 WATER FOR CONSTRUCTION PURPOSES

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- A. The Contractor will be allowed to purchase water from the City of Cambridge, MA for construction testing and start-up purposes.
- B. The express approval of the Cambridge Water Department shall be obtained before water is used. Water shall be metered as specified by the Cambridge Water Department. Hydrants shall only be operated under the supervision of Cambridge Water Department personnel.
- C. No direct cross connections will be permitted between the public water supply and the new water mains, or any other point where the possibility of backflow of contaminated water exists. All connections to points where there is the possibility of backflow shall be arranged to prevent backflow and shall be approved by the City's Plumbing Inspector before they are put into operation.

1.10 PROTECTION OF CONSTRUCTION AND EQUIPMENT

- A. All newly constructed Work shall be carefully protected. No driving or wheeling, walking or placing of heavy loads on newly constructed Work shall be allowed. All portions damaged shall be reconstructed, repaired, or replaced by the Contractor at his own expense.
- B. All elements of the Work shall be protected in a manner approved by the Engineer. Should any part of the Work become heaved, cracked, or otherwise damaged, all such damaged portions of the Work shall be completely repaired and made good by the Contractor at his own expense as required by of the Engineer.
- C. If, in the final inspection of the Work, any defects, faults or omissions are found, the Contractor shall cause the same to be repaired or removed and replaced by proper materials and workmanship without extra compensation for the materials and labor required. Further, the Contractor shall be fully responsible for the satisfactory maintenance and repair of the construction and other work undertaken herein for at least the guarantee period described in the Contract Documents.
- D. The Contractor shall take all necessary precautions to prevent damage to all elements of the Work due to water pressure during and after construction and until such Work is accepted and taken over by the Owner.

1.11 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

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execution of the Work on the part of the Contractor, such property shall be restored by the Contractor at his expense to a condition similar or equal to that existing before the damage was done or he shall make good the damage in another manner acceptable to the Owner and Engineer.

- B. Along the location of this Work, all fences, walks, bushes, trees, shrubbery, and other physical features shall be protected and restored in a thoroughly workmanlike manner. Fences and other features removed by the Contractor shall be replaced in their original location or at a location indicated on the Drawings as soon as conditions permit. All grass areas beyond the limits of construction which have been damaged by the Contractor shall be graded and seeded.
- C. Trees close to the work shall be boxed or otherwise protected against injury. No trees shall be cut, braced, or damaged without prior notification of the City Arborist.
- D. The protection, removal, and replacement of existing physical features along the line of work shall be a part of the work under the Contract, and all costs in connection therewith shall be included in the Bid Proposal unless a Bid Item has been established elsewhere in these Construction Documents for the express payment of that specific item of Work.

1.12 INSTALLATION OF EQUIPMENT

- A. All wedges, shims, filling pieces, keys, packing, red or white lead grout, or other materials necessary to properly align, level and secure apparatus in place shall be furnished by the Contractor. All parts intended to be plumb or level must be proven exactly so. Any grinding necessary to bring parts to proper bearing after erection shall be done at the expense of the Contractor.

1.13 SLEEVES AND OPENINGS

- A. The Contractor shall provide all openings, channels, etc., and install anchor bolts and other items to be imbedded in concrete, as required to complete the work under this Contract, together with those required by subcontractors, and shall do all cutting and patching excepting cutting and patching of materials of a specific trade and as stated otherwise in the following paragraph.
- B. Subcontractors shall furnish all sleeves, inserts, hangers, anchor bolts, etc., required for the execution of their work. It shall be their responsibility before the work of the Contractor is begun to furnish him with the above items and with templates, drawings or written information covering chases, openings, etc., which they require, and to follow up the work of the Contractor as it progresses, making sure that their drawings and written instructions are carried out. Failing to do this, they shall be responsible for the cost of any

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corrective measures which may be required to provide necessary openings, etc. If the Contractor fails to carry out the requirements given him, covering details and locations of openings, etc., he shall be responsible for any cutting and refinishing required to make the necessary corrections. In no case shall beams, lintels, or other structural members be cut without the approval of the Engineer.

1.14 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. 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 as required by the Owner and Engineer. The Contractor shall reimburse the Owner for any expenses, losses or damages incurred in consequence of any defect, error, omission or act of the Contractor or his employees, as required by the Owner and Engineer, occurring previous to the final payment.

1.15 TEMPORARY UTILITIES

- A. Temporary Light and Power: The Contractor shall at his own expense, provide his own temporary light and power as required for the prosecution and completion of work, including light and power for the construction and engineering trailers as well as light and power for dewatering pumps, and trench and staging area lighting.
- B. Temporary Heat: The Contractor shall, at his own expense, provide sufficient temporary heat to maintain minimum temperatures specified elsewhere, in all areas designated elsewhere in these documents.
- C. Temporary Telephone: The Contractor shall have installed at his own expense a job telephone for his use, one for the Engineer, a fax line for the Engineer, and a computer dedicated phone line for the Engineer. The Contractor shall pay all phone charges.
- D. Temporary Water: Water for drinking purposes and other usage will be provided by the Contractor at his own expense.
- E. Sanitary Provisions: The Contractor shall provide and maintain sanitary accommodations for the use of his employees and the Engineer, as may be necessary to comply with the requirements and regulations of the local and

state departments of health.

F. Maintaining Operation of the Existing Facilities:

1. The Contractor shall provide temporary utilities and/or cooperate with utilities to maintain full service to the residences and buildings in the project area. The Contractor shall be responsible for careful consideration of the construction scheduling and anticipation of potential interferences with existing utilities, operations and structures. The Contractor shall maintain close communications with the Engineer and provide the Engineer with a detailed description of each proposed activity sufficiently in advance of its commencement for review and comments to be made.
2. Temporary facilities which may be required include, but are not limited to, electrical power; lighting; heating; cooling; ventilating; telephone; cable television; potable water; fire protection; drainage; sanitary facilities; trench covers; protection of existing utilities; structures; streams; trees and shrubs; access roads; sewage conveyance; piping; and pumping. The Contractor will be responsible for providing, connecting, and maintaining emergency generators to serve homes in the event temporary electrical services cannot be established by the power company. The Contractor will be responsible to furnish a licensed electrician to connect the houses to the emergency generators, maintain the generators 24 hours a day, and disconnect the houses when service can be reestablished to the power lines. The generators will be provided and maintained at no additional cost to the Owner.
3. The Contractor shall coordinate efforts with the owners and/or operators of the existing facilities to avoid any service interruption. The Contractor shall keep utilities informed of proposed work activity and notify utilities of required work four weeks in advance. The Contractor must schedule work to avoid repeated, unnecessary, or last minute service calls by the owners/operators of existing facilities.

1.16 ACCESS TO THE WORK

- A. The Contractor shall provide sufficient and proper facilities at all times for inspection of all work under this project in preparation or in progress, by the Owner, the agents and employees of the Owner, by authorized representatives of the Commonwealth of Massachusetts and the Federal Government and by the Engineers.
- B. The Contractor shall furnish the Engineer or his authorized representative

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and other personnel mentioned above with such facilities and assistance as are necessary to ascertain performance of the work in accordance with the plans and specifications.

- C. The Contractor must provide sufficient and safe access to existing facilities for the owners/operators of existing facilities to maintain service.

1.17 POLLUTION CONTROL

- A. The Contractor shall conduct clean-up and disposal operations, as necessary, to comply with state and local ordinances and anti-pollution laws.
- B. Outdoor burning of rubbish and waste material on the site will not be permitted.
- C. Disposal of volatile fluid wastes (such as mineral spirits, oil, gasoline, or paint thinner) in storm or sanitary sewer systems or into streams or waterways is not permitted.

1.18 ENGINEER'S FIELD OFFICE

- A. The Contractor shall provide and maintain at an approved location at or near the site, for the duration of the Contract, a separate office trailer, minimum dimension 13' – 8" x 64' feet for the exclusive use of the Engineer and Owner. The office trailer shall include two 14' to 15' offices at either end of the trailer with a 35' +/- center common space. The office trailer will not be shared with the Contractor. The plans and construction of the office shall be approved by the Engineer and Owner. Trailers shall have a plywood "Skirt" installed around the lower exterior perimeter.
- B. The office shall be equipped with electric lights, heating facilities, air conditioners, eight telephone services (two telephone, two fax, and four DSL internet connections), water and sanitary conveniences (flush toilet) complete with water and sewer service hook-up. Doors and windows shall be equipped with locks and the windows shall have security bars and horizontal blinds. The office shall be equipped with the following furniture and accessories:
 - 1. 2 flat top desks with drawers
 - 2. 4 desk lamps
 - 3. 2 tables at least 2 feet 8-inches wide and 6 feet long
 - 4. 2 drafting tables with lamps
 - 5. 4 desk chairs with casters and 2 adjustable drafting stool with casters
 - 6. (4) 4-section fireproof lockable file case
 - 7. 12 metal folding chairs
 - 8. 1 dustpan

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9. 1 corn broom
10. 2 wall clocks
11. (3) 10 gallon wastepaper baskets
12. 2 NEW cordless telephones
13. 1 locker for survey equipment
14. Minimum (2) 5000 BTU air conditioners
15. 2 NEW telephone answering machines with time and date stamp
16. 2 NEW 4-cubic foot refrigerator and microwave
17. 1 individual cup Coffee Maker
18. (3) 5-pound fire extinguisher
19. 2 industrial type first aid kit
20. (4) 36" x 48" Dry Erase Boards with Cleaner, Erasers, and Markers
DSL Service for the trailer (see above)
21. 1 photocopy machine Konica 7130 or approved equal, capable of scanning to remote e-mail locations and capable of being used as a fax machine.
22. 1 NEW color scanner, Epson GT 15000 Flatbed (TO BE TURNED OVER TO THE OWNER AFTER CONTRACT COMPLETION)
23. 2 NEW Digital Cameras,
(1) Sony DSC-W650 16 MP Cybershot with 16.1 Mpix; 5x optical zoom; 3.0" LCD screen, 16 GB Memory Stick PRO DUO Media or equivalent
(1) Panasonic –Lumix DMC-GFC3KK 12.1 Mpix Digital Camera, 3.0" LCD screen, 16 GB flash memory card SDHC or equivalent (TO BE TURNED OVER TO THE OWNER AFTER CONTRACT COMPLETION)
24. Shelving, closets and plan racks as may be required
25. 1 Automatic electric calculator with printer
26. 1 potable water cooler with hot and cold taps
27. 2 NEW Automatic levels equal to TOPCON AT G6 with aluminum dome head tripod (TO BE TURNED OVER TO THE OWNER AFTER CONTRACT COMPLETION)
28. 2 NEW 25-foot fiberglass level rod (TO BE TURNED OVER TO THE OWNER AFTER CONTRACT COMPLETION)
29. 2 NEW 2' Smart Levels (TO BE TURNED OVER TO THE OWNER AFTER CONTRACT COMPLETION)
30. 2 NEW printers (TO BE TURNED OVER TO THE OWNER AFTER CONTRACT COMPLETION). Printers shall be Hewlett-Packard LaserJet All-In-One Network-Ready Black-and-White Printer/ Copier/ Scanner/ Fax, Model 3390.
31. 4 NEW Laptop Computers (TO BE TURNED OVER TO THE OWNER AFTER CONTRACT COMPLETION) meeting the following requirements:

Computers shall be NEW Panasonic Toughbook 53

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2.5 GHz Intel Core Processor
4GB RAM
Hard Drives : 320GB Hard Drive
DVD Multi Recorder
10/100/1000 Ethernet
WiFi 802.11a/b/g
Bluetooth Module
Microsoft Windows 7 Business
Microsoft Office 2010
14" HD LED Display
Mouse : USB 2-Button Optical Mouse with Scroll including mouse pad
Carrying Cases: Large Nylon Carrying Case
Verizon Wireless Broadband Service V620 Air Card (PCMCIA)
including all monthly charges for the duration of the Contract.

Include all cable, manuals, and associated equipment. Manufacturer on site warranty shall cover the time period of the Contract. An additional 4 Year Limited Warranty plus 4 Year NBD On-site Service and CompleteCare shall be carried for all computers.

- C. The Contractor shall maintain the office during construction and remove it upon completion of the work. The cost for operation of the Engineer's field office shall be the responsibility of the Contractor and included into his Bid price. Operation and maintenance shall include: supplying toilet paper, paper towels, coffee (assortment of individual cups), liquid hand soap, paper, calculator paper, bottled water, marking paint in assorted colors, monthly utility costs, heating, cooling costs, restocking the first aid kit, cleaning of the copier on a monthly basis, and cleaning of the inside of the trailer on a weekly basis.
- D. The Contractor shall pay the regular monthly service charges and for long-distance calls.
- E. As part of the field office cost, the Contractor shall supply up 4 (four) Verizon or AT&T Iphone 4S or equivalent model acceptable to the Engineer for the use by the Owner and Engineer. Cellphones shall have the following minimum features; texting services; color display; speaker phone; camera; web and e-mail capable; wi-fi capable; touchscreen display; etc. The Contractor shall have a Verizon or AT&T Wireless representative provide a service demonstration for the Project Team and shall connect all internet and e-mail access. Contractor shall pay for the cost of the phone, maintenance and all monthly service and telephone charges for the duration of the Contract. A baseline program of 4000 monthly minutes and unlimited direct connect and e-mail usage shall be included.

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- F. The Engineer's field office shall be delivered to the site and fully set-up as described above two (2) weeks prior to work beginning on the site.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION (Not Used)

PART 4 – COMPENSATION (Not Used)

END OF SECTION 01500

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SECTION 01505

MOBILIZATION

1505.1

MOBILIZATION

LUMP SUM

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes mobilization consisting of obtaining all permits; moving all plant and equipment onto the site required for the first month's operations; furnishing and erecting plants, temporary buildings, and project and other construction facilities; erecting project signs and traffic management signs; implementing security features and requirements; all as required for the proper performance and completion of the Work. Mobilization shall further include the following principal items:

1. Installing temporary construction power, wiring, and lighting facilities.
2. Developing construction water supply.
3. Providing field office trailers for the Contractor and the Engineer, complete with all specified furnishings, office equipment, communications facilities, fax machines, cameras, computers, and utility services.
4. Providing and setting cellphones for the Owner and Engineer as specified.
5. Providing on-site sanitary facilities and potable water facilities.
6. Arranging for and erection of Contractor's work and storage/staging yard(s).
7. Having all OSHA required notices and establishment of safety programs.
8. Having the Contractor's superintendent at the job site full time.
9. Submitting initial submittals.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION (Not Used)

PART 4 – COMPENSATION

Item 1505.1 - Mobilization

METHOD OF MEASUREMENT:

Payment for Mobilization will be at lump sum price bid for this item in the proposal and shall be payable when the Contractor is operational on the site. Operational is defined as the substantial commencement of work on site as described in the following paragraph. The Lump Sum price bid for mobilization shall not exceed 5 percent of the Total Amount of Bid.

BASIS OF PAYMENT:

Under the Lump Sum price bid for Mobilization, the Contractor shall move his equipment to the site and prepare to begin construction. Mobilization shall include all costs of initiating the Contract, exclusive of the cost of materials. Mobilization includes securing and constructing a staging area(s) for materials and office trailers; furnishing office trailers fully equipped and supplied; furnishing cellphones for the Owner and Engineer; furnishing and paying for all utilities, broadband, and cellphone services for the duration of the Contract; furnishing and installing pre-construction traffic management signage; fabrication and installation of project sign; furnishing water, sewer, power and communication services for the office trailers; distributing contact numbers for Contractor's staff to Owner and Engineer; submission and approval of initial shop drawings; submission and approval of CPM schedule; submission and approval of Traffic Management Plans; submission and approval of initial work plans and sequencing plans; obtaining all necessary permits; installing temporary power, lighting and water for construction purposes; implementing security features; furnishing and installing temporary sanitary facilities; transporting all necessary trucks and construction equipment to the site necessary to begin construction; and all other work necessary to start Construction.

END OF SECTION 01505

SECTION 01560

TEMPORARY ENVIRONMENTAL CONTROLS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section includes temporary environmental controls necessary for the project including dust abatement, rubbish control, sanitation, chemicals, and cultural resources. Snow removal and sweeping of streets and sidewalks are discussed in Section 01570 - MAINTENANCE AND PROTECTION OF TRAFFIC.

1.2 DUST ABATEMENT AND CONTROL

- A. The Contractor shall prevent its operation from producing dust in amounts damaging to property, cultivated vegetation, or domestic animals, or causing a nuisance to persons living in or occupying buildings in the vicinity. The Contractor shall be responsible for any damage resulting from dust originating from its operations. The dust abatement measures shall be continued until the Contractor is relieved of further responsibility for the Work. Dust abatement measures shall include but not be limited to spraying water, applying calcium chloride, or placing temporary pavement on and around trenches and at work sites.
- B. During excavation of soil/fill material dust shall be controlled to limit potential spread of contaminants and potential exposure of contaminants to workers and the public.
- C. Ambient dust levels at the site shall be monitored by the Contractor prior to construction. During construction, real-time dust monitoring shall be conducted during any soil/fill handling activities. The monitoring shall consist of total dust testing using MIE, Inc. Miniram PDM-3 Dust Monitors, or like instruments. The total dust criteria at the site shall conform to the requirements of the HASP. Should fugitive dust quantities exceed 20 percent of the ambient level, the Contractor shall perform additional measures to reduce the total dust concentrations.
- D. Nuisance dust levels may be encountered during regrading activities and excavation. Dust levels shall be reduced by pre-wetting the surface soils and by establishing and maintaining clean access roads. The Contractor's Dust, Vapor, and Odor Control Plan shall describe the procedures and materials to minimize dust. The Contractor shall refer to Section 02080 - SOIL AND WASTE MANAGEMENT for the Dust, Vapor and Odor Control Plan submittal requirements. At a minimum, the Contractor shall provide clean

water, free from salt, oil, and other deleterious materials.

- E. Areas of exposed earth to be excavated shall be lightly sprayed with water before excavation. Additional water spray may be utilized only when any indication of excessive dust is observed. The Contractor shall minimize the use of water within the limits of excavation.
- F. Access roads shall be sprayed with water on a regular basis to minimize the generation of dust.

1.3 RUBBISH CONTROL

- A. During the progress of the Work, the Contractor shall keep the Site and other areas used by it in a neat and clean condition and free from any accumulation of rubbish. The Contractor shall dispose of all rubbish and waste materials of any nature occurring at the Site and shall establish regular intervals of collection and disposal of such materials and waste. The Contractor shall also keep its haul roads free from dirt, rubbish, and unnecessary obstructions resulting from its operations. Disposal of all rubbish and surplus materials shall be off the Site in accordance with local codes and ordinances governing locations and methods of disposal, and in conformance with all applicable safety laws, and to the particular requirements of Part 1926 of the OSHA Safety and Health Standards for Construction.
- B. In the event that the Contractors work zone restricts municipal trash or recycling collection or makes it difficult for residents to bring trash or recycling to the street, the Contractor shall collect all trash and recycling within the work zone and transport it outside the work zone for municipal collection. Return trash and recycling receptacles back to respective properties.

1.4 SANITATION

- A. Toilet Facilities: Fixed or portable chemical toilets shall be provided wherever needed for the use of employees. Toilets at construction job sites shall conform to the requirements of Part 1926 of the OSHA Standards for Construction.
- B. Sanitary and Other Organic Wastes: The Contractor shall establish a regular daily collection of all sanitary and organic wastes. All wastes and refuse from sanitary facilities provided by the Contractor or organic material wastes from any other source related to the Contractor's operations shall be disposed of away from the Site in a manner satisfactory to the Work and in accordance with all laws and regulations pertaining thereto.

1.5 CHEMICALS

- A. All chemicals used during project construction or furnished for project operation, whether defoliant, soil sterilant, herbicide, pesticide, disinfectant, polymer, reactant or of other classification, shall show approval of either the U.S. Environmental Protection Agency or the U.S. Department of Agriculture. Use of all such chemicals and disposal of residues shall be in strict accordance with the printed instructions of the manufacturer.

1.6 CULTURAL RESOURCES

- A. The Contractor's attention is directed to the National Historic Preservation Act of 1966 (16 U.S.C. 470) and 36 CFR 800 which provides for the preservation of potential historical architectural, archaeological, or cultural resources (hereinafter called "cultural resources").
- B. The Contractor shall conform to the applicable requirements of the National Historic Preservation Act of 1966 as it relates to the preservation of cultural resources.
- C. In the event potential cultural resources are discovered during subsurface excavations at the site of construction, the following procedures shall be instituted:
 - 1. The Engineer will issue a Field Order requiring the Contractor to cease all construction operations at the location of such potential cultural resources find.
 - 2. Such Field Order shall be effective until such time as a qualified archaeologist can be called to assess the value of these potential cultural resources and make recommendations to the State Historic Preservation Office.
- D. If the archaeologist determines that the potential find is a bona fide cultural resource, at the direction of the State Historic Preservation Office, the Contractor shall suspend work at the location of the find under the provisions for changes contained in the General Conditions.

1.7 NOISE CONTROL

- A. The Contractor shall comply with the City of Cambridge Noise Ordinance.
- B. The Contractor shall make every effort to minimize noises caused by his/her operations. Equipment shall be equipped with silencers or mufflers designed to operate with the least possible noise in compliance with State and Federal (OSHA) regulations.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION (Not Used)

PART 4 – COMPENSATION (Not Used)

END OF SECTION 01560

SECTION 01568

EROSION CONTROL, SEDIMENTATION AND
CONTAINMENT OF CONSTRUCTION MATERIALS

1568.1 SEDIMENTATION AND EROSION CONTROL LUMP SUM

PART 1 - GENERAL

1.1 SUMMARY

- A. The Contractor shall provide all work and take all measures to control soil erosion resulting from construction operations, prevent flow of sediment from construction site, and contain construction materials (including excavation and backfill) within protected areas as to prevent damage to any stream or wetlands.

- B. The work of this Section shall consist of providing all labor, equipment, materials, incidental work, and construction methods necessary to provide and install erosion and sediment control, and related items as indicated in the Contract Documents and/or specified herein and includes but is not limited to the following:
 - 1. Reflagging wetland limits.

 - 2. Installing Floating Turbidity Curtain and Floating Siltation Curtain System

 - 3. Installing silt fence and straw bales.

 - 4. Meeting all conditions for erosion control specified in the Conservation Commissions' Order of Conditions as contained in the Contract Documents.

 - 5. Protection of existing and new catch basins.

1.2 SUBMITTALS

- A. Shop Drawings: Submit the following in accordance with Section 01300 - SUBMITTALS:
 - 1. Two weeks prior to the start of the work, the Contractor shall submit for review, a plan with detailed sketches showing the proposed methods to be used for controlling erosion during construction.
 - 2. Contractor shall submit manufacturer's literature describing products,

installation procedures, and routine maintenance of the sediment filter device and straw bales and siltation fence.

3. Contractor shall submit one sample of a sediment filter fabric device as produced by the manufacturer for the City's Approval.

1.3 QUALITY ASSURANCE

- A. Use acceptable procedures, including water diversion structures, diversion ditches, straw bales, settling basins, and sediment filter devices.
- B. Operations restricted to areas of work indicated on Contract Drawings.
- C. If construction materials are washed away during construction, contractor shall remove materials from fouled areas.
- D. The Engineer has the authority to limit surface area of erodible earth material exposed by clearing and grubbing, excavation, borrow and fill operations and to direct immediate permanent or temporary pollution control measures to prevent contamination of any stream, or wetlands, including construction of temporary berms, dikes, dams, sediment basins, sediment traps, slope drains, and use of temporary mulches, mats, or other control devices or methods as required to control erosion.

1.4 EROSION CONTROL PRINCIPLES

- A. The Contractor shall provide current best practices of sedimentation and erosion control during construction according to the MA DEP Erosion and Sediment Control Guidelines. Control measures shall prevent all wind and water caused erosion, siltation and sedimentation of stockpiled materials into wetlands, waterways, construction areas, adjacent areas and off-site areas. Erosion Control Best Practices shall be accomplished adjacent to or in the following work areas:
 1. Soil stockpiles and on-site storage and staging areas.
 2. Cut and fill slopes and other stripped and graded areas.
 3. Adjacent to wetlands or other protected areas as shown on the Contract Documents.
 4. Catch basins within the Project Area.
- B. Means of protection as noted on the Contract Documents indicate the minimum provisions necessary. Additional means of protection shall be provided by the Contractor as required for continued or unforeseen erosion problems, at no additional expense to the Owner. The Contractor shall be

responsible to provide all materials and labor necessary to comply with the Amended Order of Conditions issued by the City of Cambridge Conservation Commission.

- C. Daily inspection and maintenance of all sediment control structures shall be provided to ensure intended purpose is accomplished. Sediment control measures shall be in working condition at the end of each day.
- D. After 0.5 inches in a 24 hour period rainfall, sediment control structures shall be inspected for integrity. If, after any rainfall amount, damage has occurred to any/all erosion control devices or measures they shall be repaired immediately and the Cambridge Conservation Commission shall be notified immediately.

1.5 RELATED SECTIONS

- A. Appendix F – Order of the Conditions

PART 2 – PRODUCTS

2.1 STRAW BALES

- A. Straw bales for construction of erosion control devices shall be new, firm, wire- or nylon-bound livestock feed-grade straw. Straw shall be from threshed grain free of seed and seed heads. It must be free from rot or mold and the moisture content cannot exceed 15 percent by weight at the time of weighing.
- B. The straw shall be securely baled with biodegradable twine of adequate size to allow for possible rusting while in use and to permit rehandling when the bale is in a saturated condition.
- C. Individual bales shall be of a longitudinal shape not exceeding 100 pounds when weighed.

2.2 WOOD STAKES

- A. 2-in. by 2-in. by 3-ft.

2.3 SILT FENCE

- A. Silt fence shall consist of 4 ft. hardwood stakes, and fence fabric.

1. Fence fabric shall be specified under the work of Section 02210, Earth Excavation, Backfill, Fill, and Grading, of this Specification and provided, installed and paid for under the work of this Section.
2. Provide 1-1/4 in. x 1-1/4 in. by 4 ft. long hardwood stakes to support fence fabric.
3. Removal of silt fence is required post construction.

2.4 FLOATING TURBIDITY CURTAIN AND FLOATING SILTATION CURTAIN SYSTEM

- A. The floating turbidity curtain and floating siltation curtain, hereafter referred to as the “curtain system” shall be deployed together to minimize the disturbance from construction activities to the waterway. Deployment of the curtain system shall be in accordance to the sequence of construction and the construction drawings.
- B. The curtain system shall be of a bright colored material (i.e. yellow, orange, etc.) to attract the attention of nearby boaters. Floating flashing marker lights constructed of PVC material shall be attached to the floating siltation curtain every 100 FT as shown on the construction drawings. Marine marker buoys with reflective markings shall be anchored in the waterway every 100 feet at a distance no less than 20 FT from the floating siltation curtain. The marine marker buoys shall be equipped with a flashing light and have an orange diamond symbol with black lettering that warns boaters of the construction area. All flashing lights shall be controlled by a photocell that turns the light on at dusk and off at dawn and shall be maintained while the curtain system is deployed in the waterway.
- C. The floating turbidity curtain shall be a Type II design to withstand moderate currents and wave action. The turbidity curtain shall be made of an impervious 22 oz – 500 lb/inch tensile strength PVC fabric. All fabric seams shall be heat sealed and resistant to marine growth, ultraviolet light, and mildew. The curtain shall use a marine quality polystyrene flotation fully encased in 22 oz PVC Fabric. Horizontal loads shall be carried by galvanized steel cable to anchors. The curtain shall be ballasted with a galvanized steel chain and anchor points provided at least every 50-feet. An opening, no greater than 1-foot, shall be maintained between the bottom of the turbidity curtain and the river bottom. The curtain shall be secured using polypropylene rope and a danforth style anchor. The curtain shall have the ability to be furled for deployment and for adjusting to the waterway’s bottom elevations.
- D. The floating siltation curtain shall be a Type II design to withstand moderate currents and wave action. The curtain material shall be a woven poly-geotextile fabric. All fabric seams shall be heat sealed and resistant to marine growth,

ultraviolet light, and mildew. The curtain shall use a marine quality polystyrene flotation fully encased in 22 oz PVC Fabric. Horizontal loads shall be carried by galvanized steel cable to anchors. The curtain shall be ballasted with a galvanized steel chain and anchor points provided at least every 50-feet. The curtain shall be secured using polypropylene rope and a danforth style anchor. The curtain shall have the ability to be furled for deployment. The curtain shall be pinned to the bottom of the waterway to prevent disturbance to anadromous fish.

- E. The Contractor shall plan and execute all operations, particularly those associated with installation of the cofferdam, dredging, placement of fill, and dewatering discharge, in such a manner as to prohibit silt or other foreign material to pass through the curtain system into the waterway. The water quality of waterway outside the area protected by the curtain system shall not be degraded due to construction operations.
- F. It is the intent of these Specifications to prevent the unnecessary migration of sedimentation or siltation within watercourses. In the event that sedimentation or siltation prevention measures used by the Contractor prove to be inadequate the Contractor shall be required to adjust their operations to the extent necessary to prevent any such sedimentation or siltation from occurring outside the curtain system. Any damage or degradation caused by inadequate controls must be restored by the Contractor at no additional cost to the Owner. The Contractor shall maintain the curtain system through the duration of construction. The Contractor shall have materials on hand to repair minor tears for both materials used in the curtain system.
- G. The curtain system shall be deployed in the waterway as shown on the construction drawings. Deployment of the floating turbidity curtain system shall be at least 5 feet from outermost edge of the cofferdam. Deployment of the floating siltation curtain shall be at least 5 feet from the edge of the dredging area. The angle of incidence with the curtain skirt and the direction of flow shall not exceed an angle of 45 degrees. The curtain system shall be installed per the requirements of the manufacturer. The curtain system shall be deployed furled and the method used shall prevent the disturbance of the waterway sediments.
- H. The Contractor shall submit, in accordance with Section 01300, the details of the proposed floating turbidity curtain, floating siltation curtain, anchoring system and their components, floating marker lights, and marine marker buoys.
- I. Sediment-laden water that is being pumped from the trenches or excavations for the construction of the outfalls and associated piping shall be pumped directly into waterway inside the limits of the floating turbidity curtain.
- J. The curtain system shall be manufactured by:
 - 1. Elastec/American Marine, Inc.

2. Parker System, Inc.
3. Indian Valley Industries, Inc
4. Or equivalent

2.5 SEDIMENT FILTER DEVICE

- A. Sediment filter device shall be manufactured to fit the opening of the catch basin or drop inlet. The sediment filter device shall have the following features:
 1. Two dump straps attached at the bottom to facilitate the emptying of the device and shall have lifting loops as an integral part of the system.
 2. Yellow restraint cord approximately halfway up the sack to keep the sides away from the catch basin walls. Yellow restraint cord is also a visual means of indicating when the sack should be emptied.
 3. Fabric shall consist of a woven polypropylene geotextile and be sewn by a double needle machine, using a high strength nylon thread.
 4. Sediment filter device shall have a certified average wide width per ASTM Standard D-4884 standard of 165 lbs/in.

PART 3 – EXECUTION

3.1 GENERAL

- A. The Contractor shall not discharge chemicals, fuels, lubricants, bitumen, raw sewage, and other harmful waste into or alongside any body of water or into natural or manmade channel.
- B. It is the intent of these Specifications to prevent the unnecessary occurrence of sedimentation or siltation of waterways and private properties. In the event the sedimentation or siltation prevention measures used by the Contractor prove to be inadequate as determined by the Owner and Engineer, the Contractor shall be required to adjust his operations to the extent necessary to prevent any such sedimentation or siltation from occurring.

3.2 RE-FLAGGING OF WETLAND BOUNDARY

- A. Re-flagging of the wetlands, in areas impacting the Project Area, shall occur prior to the start of clearing and grubbing operations or any earthwork operations according to the Order of Conditions and as directed by the City's Representative Engineer. Flagging shall consist of materials that will clearly demarcate wetland boundary and

persist until completion of construction.
coordinates can be obtained from the
prepared by WSP Sells, dated October 18, 2011.

The wetland flagging GPS
Topographic survey

3.3 TURBIDITY CURTAIN

- A. Turbidity curtain shall be constructed and installed as per manufacturer's recommendations. Anchor spacing will vary with current velocity and wind/wave action.

3.4 SILT FENCE AND STRAW BALES

- A. Silt fence and straw bales shall be placed to form temporary water stops, dams, diversions, dikes, berms and for other uses connected with water pollution control and as indicated in the Contract documents; bales shall be disposed of by the Contractor upon completion. Composting socks shall be installed per manufacturer's written installation procedures.
- B. Straw bales shall be inspected daily and maintained or replaced as required to maintain both their effectiveness and essentially their original condition. Underside of bales shall be kept in close contact with the earth below at all times, as required to prevent water from washing beneath bales.

3.5 PROTECTION OF CATCH BASINS

- A. The Contractor shall protect catch basins by installing sediment filter devices as specified in this Specification in every catch basin within and downstream of the project limits.
- B. The Contractor shall install the sediment filter device before any work begins and shall place the device so that it is flush with the material around the frame of the grate of the catch basin structure. The Contractor shall be responsible for maintenance and placement of the strap lift holes to ensure that they do not become a hazard for pedestrians.
- C. The Contractor shall maintain the sediment filter device and remove the collected debris as required by the Engineer. If any material is lost in the removal of the sediment filter device, then the Contractor shall be responsible for cleaning of the catch basin. The Contractor shall inspect the position of the device to ensure that the sediment filter device will work properly during any heavy rain or any storm greater than a 10 year flood.

3.5 EROSION CONTROL

- A. Existing natural drainage patterns and vegetative cover shall be preserved to the maximum possible extent.

- B. The Contractor shall use temporary vegetation, mulching, and paving to protect areas exposed during construction. He shall minimize the amount of bare earth exposed at any one time during construction, and he shall also minimize the length of time bare earth is exposed.
- C. Water that is being pumped from the trenches or excavations shall not be pumped directly into water courses or pipe conveyance systems. At a minimum, sedimentation control measures shall include portable sedimentation tanks, pumps, and piping, or other means acceptable to the Owner and Engineer to meet the water quality parameters specified in both the NPDES Dewatering Permits and these Specifications, whichever is more stringent.
- D. Spoil resulting from the trench excavation shall be leveled or removed to permit free entry of water from adjacent land surfaces without excessive erosion or harmful ponding.

PART 4 – COMPENSATION

Item 1568.1 – Sedimentation and Erosion Control

METHOD OF MEASUREMENT:

Measurement for payment for Sedimentation and Erosion Control will be on a percent of the Lump Sum bid calculated by dividing the elapsed time to date by the contractual construction time limit as approved by the Engineer.

BASIS OF PAYMENT/INCLUSIONS

Payment for Sedimentation and Erosion Control will be based on the bid for this item in the proposal. Under the Unit Price bid for this item, the Contractor shall furnish all labor, materials, tools, equipment and incidentals required to furnish, install, maintain, relocate, and remove all sedimentation and erosion control measures. Under the Unit Price bid for this item, the Contractor shall also furnish all labor, materials, tools, equipment and incidentals to prepare and submit all work plans and submittals; line all existing and new catch basins with sediment filter devices and remove prior to inclement weather; install, maintain and remove temporary vegetation for erosion control; removal and disposal of all silt and sediment collected from sedimentation and erosion control measures; and all other items of work not specifically included herein or elsewhere required to furnish, install, maintain, relocate, and remove sedimentation and erosion control devices as specified and required.

SPECIAL NOTES/EXCLUSIONS:

Erosion control, sediment, and containment measures for work related to the storm drain outfall on Memorial Drive including to but not limited to reflagging wetland area, installation and removal of turbidity curtain, installation of straw bales and silt fence along

embankment, and all other incidental sedimentation and erosion control measures related to work at the outfall shall not be paid for under this Bid Price Item and are paid for elsewhere.

END OF SECTION 01568

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SECTION 01570

MAINTENANCE AND PROTECTION OF TRAFFIC

1570.1	TRAFFIC AND PEDESTRIAN MANAGEMENT	LUMP SUM
1570.2	VARIABLE MESSAGE BOARDS	UNIT WEEK

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish all labor, equipment, and materials and perform all operations in connection with the maintenance and protection of vehicular, bicycle, and pedestrian traffic on all roads, state and local, directly or indirectly affected by the construction. The work of this section also includes maintaining access to all properties adjacent to the work.
- B. The Contractor is responsible for preparing and submitting a plan for traffic management to the Owner and Engineer, including updates as conditions warrant. The Contractor is responsible for design and implementation of revisions to the traffic management procedures during the course of the project at the requirements of the Engineer and at no additional cost to the Owner.
- C. The Contractor shall develop and implement a detailed Traffic Management and Control Plan and obtain approval from the City of Cambridge Traffic Department and Department of Public Works prior to proceeding with the work.
- D. Furnish, erect, set, reset, relocate, move, remove, and dismantle sufficient signs, temporary lighting, barrels, flashers, channelizing devices (concrete barriers), fencing, and other traffic control devices on a continuous basis as necessary to protect the work and the general public at all times during construction in accordance with Contractor's approved Traffic Management and Control Plans. The work of this Section shall also include temporary bridging for traffic across excavations.
- E. The design, application, and installation of all traffic control devices required by this section shall conform to the requirements of the Manual on Uniform Traffic Control Devices (MUTCD) published by U.S. DOT, latest edition; American Disabilities Act (ADA); Massachusetts Architectural Access

Board; and the Massachusetts Department of Transportation Highway Division (MassDOT), Standard Specifications for Highways and Bridges, latest edition.

- F. “Approved by the Owner” throughout this Section shall mean the approval of the Cambridge Department of Public Works and Traffic and Parking Department.
- G. Traffic control during construction also includes street sweeping and snow removal from sidewalks and streets within the work zone as described in section 3.1 D. Maintaining rubbish and recyclable removal is also required and described in Section 01560 - TEMPORARY ENVIRONMENTAL CONTROLS.
- H. The Contractor shall retain the services, at no additional cost to the Owner, a Professional Traffic Engineer licensed in the Commonwealth of Massachusetts to review the Contractor’s Traffic Management and Control Plan for all work within Memorial Drive and on Western Avenue from the intersection of Putnam Avenue to Memorial Drive. For all work zones within Memorial Drive, the Professional Traffic Engineer shall conduct weekly site visits or as otherwise required by the Owner or Engineer to review the implementation of the Traffic Management and Control Plan and advise the Contractor to make adjustments to work zones, traffic control layouts, and traffic signaling as required.
- I. Contractor shall hold Traffic Management kick-off meeting with City of Cambridge DPW, City of Cambridge Traffic Department, and Engineer to discuss and revise the Traffic Management Plans included in the Contract Documents prior to beginning any work on Memorial Drive and/or at the intersection of Western Avenue and Memorial Drive.

1.2 REFERENCES

- A. Reference is made herein to the Massachusetts Department of Transportation Highway Division, Standard Specifications for Highways and Bridges, latest edition. References made to particular sections or paragraphs in the Standard Specifications for Highways and Bridges shall include all related articles mentioned therein.
- B. Manual of Uniform Traffic Control Devices Part VI Standard and Guides for Traffic Controls for Streets and Highway Construction, Maintenance, Utility and Incident Management Operations, latest edition.

1.3 SUBMITTALS

- A. Submit the following in accordance with Section 01300 – SUBMITTALS:

1. Traffic Management and Control Plan: Before starting any work under this Contract, the Contractor shall prepare a plan that indicates construction equipment movement and the traffic routing proposed by the Contractor during the various stages and time periods of the work, and the location of temporary pedestrian, bicycle routes and construction facilities, temporary barricades, signs, drums, and other traffic control devices to be employed during each stage and time period of the work, to maintain traffic and access to abutting properties. Particular care shall be taken to establish and maintain methods and procedures that will not create unnecessary or unusual hazards to public safety. The Plan shall be submitted a minimum of four weeks prior to the start of construction for acceptance by the Engineer and approved by the Owner and the City prior to start of Work. The Plan shall be reviewed on a daily basis with the Engineer during construction. The Plan shall include procedures for the Contractor to coordinate daily with the Owner and City Departments (Department of Public Works, Traffic and Parking Department, Police, Fire, and Emergency Medical Services).
 2. Temporary Pedestrian Access Ramp Work Plan, Temporary Pedestrian Protection Work Plan and Temporary Pedestrian Detour Plan: Contractor shall provide a work plan detailing the location and layout of ramps and their protection, type of ramps and protection to be used with manufacturer's information, and duration the ramps and protection will be utilized. All pedestrian detours required shall be submitted for approval with these plans.
- B. Shop Drawings shall be submitted for review four weeks prior to start of construction. Thereafter, the Contractor shall submit to the Engineer updated Traffic Management and Control Plans a minimum of 10 working days prior to the start of construction at any new location or updates required in the work zone resulting from progress of Work throughout the duration of construction.
1. Submit complete shop drawings and work plans for staged construction and traffic movement including temporary vehicle, pedestrian, and bicycle as needed, certified by a Professional Engineer registered in the Commonwealth of Massachusetts.
 2. Show on the shop drawings all materials, dimensions, sizes, and methods of installation.
 3. Safety Signing for Construction Operations: The Contractor shall submit temporary pedestrian, bicycle, and traffic management sign placement and sign size sketches showing the proposed sign setups intended to be used to provide the necessary traffic control and

protection during the progress of work, plus the sign and legend size and layout. These sketches shall be submitted to the Engineer, Owner and City for review and approval before work begins.

4. When a detour or by-passing of vehicular traffic is anticipated, the Contractor shall submit for approval by the Engineer, Owner and City, a detour plan showing the proposed alternative routes and location, size, and type of signs and traffic controls to be used. The traffic routing through or around the Work and provisions for control of same shall be approved by the Engineer, Owner, and City.
5. The Contractor shall submit a Truck and Hauling Route Work Plan for all proposed truck routes prior to mobilizing. No trucking or hauling will be allowed without the approval of the City of Cambridge. No trucking or hauling will be allowed outside the proposed routes without the prior approval of the Engineer, Owner, and City. The Contractor is responsible for obtaining all permits and permissions. The Contractor is further responsible for obtaining approval for and coordinating parking restrictions required to facilitate trucking and hauling.

1.4 SPECIAL REQUIREMENTS

- A. The Contractor shall provide access for fire apparatus and other emergency vehicles through the work zones to abutting properties at all times.
- B. At the end of each workday, where trenches in areas of public travel are covered with steel plates, each edge of the plates shall be either beveled or protected by a bituminous concrete ramp as accepted by the Engineer. Temporary bituminous patching material may be used to construct the ramps. The cost of patching materials, and their maintenance and removal, will be considered incidental to the Traffic Management item with no separate payment elsewhere. Plates shall be pinned or welded together to eliminate movement, noise or vibration.
- C. Open excavations adjacent to the traveled way or shoulders shall not remain open through non-work hours unless steel plated for the passage of heavy vehicles or protected by concrete barricades or barriers and specifically authorized by the Owner, City and Engineer.
- D. Do not block more than one-side of the roadway at a time when making open cut or other street crossings unless otherwise approved.
- E. The Contractor shall be responsible for the costs in obtaining all permits to perform the Work.

- F. At least one serviceable driveway access to all residences and businesses within the project shall be maintained at all times.
- G. The Contractor shall provide temporary lighting to properly illuminate the work area and approaches in the event of nighttime work.
- H. The Contractor shall not allow unnecessary idling of trucks and/or equipment throughout the entire project area. The City of Cambridge prohibits idling of trucks and equipment for periods of time exceeding five (5) minutes when not in use.
- I. The Contractor shall notify the Cambridge Fire and Police Departments of any street closings.
- J. The Contractor shall comply with DCR Permit regulating traffic control at the intersection of Western Avenue and Memorial Drive.
- K. The Contractor shall coordinate their activities, throughout the duration of construction, with the operations of the A.J. Spears Funeral Home, located at 124 Western Avenue.

1.5 SEQUENCING AND SCHEDULING

- A. All streets within or adjacent to the contract limits, not specifically cited shall have their full roadway widths available for traffic or permitted parking at all times except for such restrictions as may be approved by the Owner, City and Engineer.
- B. Notify the Owner, City and Engineer at least 48 hours in advance (not including Saturday or Sunday or Holidays) prior to the access lane restriction of the roadway. Notification shall include the date of the restriction, the hours of the day the roadway access will be restricted, and the estimated completion date.
- C. The Owner, City and Engineer shall be notified of any re-routing of traffic 48 hours in advance (not including Saturday or Sunday or Holidays). Approval shall be obtained from the Owner, City and Engineer prior to any re-routing of traffic (except emergencies).
- D. The Contractor shall verify street sweeping schedules in the work zone. Delivery related parking restrictions will not be permitted on days where street sweeping is scheduled unless otherwise approved.
- E. Contractor shall coordinate work zones and traffic control layouts with concurrent City of Cambridge and MassDOT projects including not limited to the Magazine Beach Pedestrian Bridge Replacement, the Anderson

Memorial Bridge Rehabilitation Project, and the Western Avenue Bridge Rehabilitation Project.

1.6 HAULING AND TRUCK ROUTES

- A. The Contractor is advised that all roads and bridges within or adjacent to the project shall be subject to legal loads, heights of vehicles and vehicle type / use restrictions. The Contractor is responsible for understanding the restrictions and obtaining all necessary permits.
- B. The Contractor is advised that no agreements have been made by the Owner, the City of Cambridge, MassDOT, or with surrounding cities or towns to relieve the Contractor of liability for damage to local roads and bridges caused by the Contractor's operation. The Contractor shall contact appropriate officials of the surrounding cities, towns or agencies concerning hauling over city or town roads and bridges.

1.7 STORAGE OF MATERIALS, PARKING OF CONSTRUCTION EQUIPMENT AND WORKER PARKING

- A. No material shall be stored within the work area or on adjacent roadways or residential streets except that which is needed to complete the work for that day.
- B. Construction workers shall park their vehicles within the work zone during work hours, and remove them thereafter. Parking outside the work zone will be required if the vehicles obstruct traffic flow.
- C. The Contractor shall park construction equipment within the work zone and protect equipment with barriers or barricades. Parking outside the work zone will be required if the equipment obstructs traffic flow.

1.8 BARRICADES, WARNING SIGNS AND OTHER PROTECTIVE DEVICES

- A. Install, inspect, remove, maintain, and reset all temporary construction controls as frequently as required and in accordance with an approved construction staging sequence and traffic management plan.
- B. Regulatory and warning devices shall be subject to removal, replacement and repositioning as often as necessary, and as directed by the Owner and Engineer.
- C. Temporary pavement markings and devices shall be used as shown on the approved plans and as required by MUTCD and ADA standards for traffic control and pedestrian safety.

1.9 POLICE DETAILS SERVICE

- A. Uniformed City, Municipal, or State police officers shall be utilized to maintain safe traffic flow throughout the construction period. A Police Detail is to be present during all construction activity. Scheduling Police Details shall be the responsibility of the Contractor. To schedule a detail officer, call (617) 349-3350.
- B. The Cambridge Police Department requires 24-hour advance notice to obtain a Police Detail, except in emergencies and 4-hour advance notice to cancel a detail. Contractor shall use as many police details as needed to ensure the safety of pedestrians and traffic at all times.
- C. The Contractor shall coordinate all work with the police officers including but not limited to: locations of work, delivery of materials, equipment movement, required traffic management and schedules.
- D. The Contractor must submit all signed detail forms to the project managers or engineer, so that Public Works can pay all submitted and approved Police Detail invoices. Any invoices that are not approved will be the responsibility of the Contractor to pay.
- E. The City of Cambridge Police Department shall bill the City of Cambridge Department of Public Works or whatever department has oversight of the contract for the services of uniformed police officers provided by the Police Department.
- F. The Contractor will be required to reimburse Public Works or whatever department has oversight of the contract for Police Details, if the Contractor fails to show for the job or if the Contractor fails to cancel the detail with adequate advance notice.

1.10 PEDESTRIAN TRAFFIC

- A. Sidewalks shall be maintained at all times through the construction period. Temporary sidewalks, pedestrian detours and pedestrian and construction facilities shall be constructed as needed to maintain pedestrian traffic and business access. The Contractor shall anticipate that temporary pavement markings (paint or tape) will be required in order to comply with this provision.
- B. Pedestrian access shall be provided to abutting land uses and businesses at all times, as approved by the Owner, City and Engineer and in accordance with MUTCD and ADA requirements.
- C. Unobstructed walkways of 4-foot minimum width, unless otherwise approved by the Owner, City and Engineer shall be provided at all times.

- D. Temporary pedestrian walkways shall be separated from roadway and construction areas by barricades and fence as approved by the Owner, City and Engineer.
- E. The Contractor shall be notified by telephone of any location not providing adequate pedestrian access. The Contractor shall acknowledge notification of the call within one (1) hour by contacting the Project Engineer or the Public Works Dispatcher at (617) 349-4800.
- F. The Contractor shall respond to the work site within one and a half (1.5) hours of acknowledged notification with sufficient equipment and labor to perform the required work.
- G. The Contractor's failure to respond within the specified response time twice within the Contract time will result in a permanent deduction of \$250.00 from Contract payments due.
- H. The Contractor's failure to respond within the specified response time three times within the Contract time will result in an additional permanent deduction of \$400.00 from Contract payments due.
- I. The Contractor's failure to respond within the specified response time four or more times within the Contract time will result in an additional permanent deduction of \$500.00, per each additional occurrence, from Contract payments due.
- J. Continued failure to provide adequate pedestrian access may result in the City terminating the contract in accordance with Paragraph 18.3 of Section 800 (General Terms and Conditions of the Contract).

1.11 VEHICULAR CONTROL REQUIREMENTS

- A. The Contractor shall meet the following conditions, unless otherwise specifically approved by the Owner, City, and Engineer:
 - 1. All work shall be prosecuted with proper regard for the convenience of the public and in a manner to permit unimpeded traffic flow whenever possible. The interruption of traffic will not be permitted unless specifically allowed by the Owner, City and Engineer and in accordance with the requirements of the Owner and City and in conformance with MUTCD requirements.
 - 2. The Contractor shall be responsible for necessary coordination with the City departments affected by the project.

3. Traffic control devices and signs shall be removed, demounted or properly covered for those periods of the day not in use.
4. The Contractor shall coordinate the work with the schedules of City Rubbish and Recycling Collection trucks and delivery trucks to the adjacent stores and property owners so as not to impede their access, and cooperate with delivery personnel to facilitate deliveries to properties within the work zone.
5. No operations shall be conducted, including the loading or unloading of equipment or materials, on or near the traveled lanes or road shoulders without first erecting warning signs and channelizing devices. These precautions shall be maintained at all times while work, loading and unloading is in progress.
6. Construction signs and channelizing devices shall be used to separate traffic from the work areas and for traffic control. Placement, other than as shown in the plans or the MUTCD, will require prior approval.
7. Temporary signs and channelizing devices shall not be set up until there is adequate visibility or appropriate construction lighting. The Contractor shall schedule his work so that temporary signs and channelizing devices are removed and traffic is returned to its normal pattern before the end of the work period.
8. Work requiring overnight lane closures shall not begin until all materials required for the completion of each night's work are delivered or available to the project site, unless otherwise approved by the Owner, City and Engineer.
9. Accesses to buildings shall be maintained at all times.
10. Work operations shall not be performed on the roadway in such a manner that traffic is obstructed or endangered simultaneously from both sides of the roadway.
11. The Contractor shall keep all roadway areas open to traffic as clear as possible at all times. Materials shall not be stored on any roadway area or within 4-ft. of the traveled way. Material shall be delivered to the installation areas as they are needed to provide a continuous installation. Location of storage areas shall be subject to approval.
12. The Contractor shall remove all equipment and construction vehicles from the traveled way and shoulders open to traffic during non-work hours. Vehicles shall be parked no closer than 4-feet from the traveled way in pre-approved areas unless specifically permitted.

13. Each driver of any vehicle or piece of equipment used on this contract shall be furnished written instructions concerning the manner of operation for that vehicle or piece of equipment. Specifically, these instructions shall warn against stopping on the traveled portions of the roadway, against passing other vehicles, and against traveling in close proximity to other vehicles. A copy of these instructions shall be given to the Engineer.
14. Temporary signs and channelizing devices shall not be set up in inclement weather.
15. The Contractor shall furnish 60-inch x 30-inch approved signs reading "CONSTRUCTION VEHICLE - DO NOT FOLLOW" to be used on trucks hauling to the project, when such signs are deemed necessary by the City and/or Engineer. The color, type of sheeting and size of lettering shall conform to that of the permanent construction signs.
16. The Contractor shall furnish, install, and maintain 36-inch x 36-inch approved signs reading "ROUGH ROAD" in advance of all roadway areas which have been cold-planed.
17. The Contractor shall furnish, install and maintain additional temporary cones and barrels, as required by the Engineer, after Traffic Calming devices (horizontal and vertical deflections) have been constructed.
18. The Contractor will be responsible for snow removal within active work zones.

1.12 BICYCLE CONTROL REQUIREMENTS

- A. The Contractor shall meet the following conditions, unless otherwise specifically approved by the Owner, City, and Engineer:
 1. Bicycle traffic shall be accommodated on all public streets either within bicycle lanes where existing or in vehicular travel lanes.
 2. Where bicycle lanes are not present, provide a shared vehicle lane as wide as physically feasible.
 3. When travel lanes are restricted to less than 14-foot in width warning signage (W11-1/W16-1 combination - Bicycle warning symbol with SHARE THE ROAD plaque) shall be placed warning motor vehicle operators of the presence of bicycles in the roadway.

4. If the disruption occurs in a bicycle lanes over a short distance (approximately 500 feet or less), bicyclists should be routed to share a motor vehicle lane.
5. On projects where the disruption occurs over a longer distance (more than 500 feet), and on busy roadways, a temporary bicycle lane or wide outside lane (at least 14 foot wide) should be provided. If that is not feasible, provide access, including ramps if necessary, for bicyclists to have the option of using sidewalks, except within zones where sidewalk bicycle riding is prohibited by the City.
6. Steel plates:

When steel plates are used in the travel way warning signage (Warning Steel Plates 100 FT) shall be placed at least 100 feet in advance.

Steel plates shall be set so there is no vertical lip over 1/4 inch between the plate and adjacent pavement. This shall be accomplished in one of the following ways:

- a. Recessing the plate so that the top of the plate matches adjacent pavement (with no lip over 1/4 inch).
- b. Providing bituminous concrete lip painted reflective orange to provide a smooth transition slope up from existing pavement to top of plate.

Non-slip surface steel plates are preferred for use, and must be used where plates are in an intersection or within a crosswalk.

7. Raised castings: Where raised castings are present after cold planing and/or in anticipation of final paving, provide the following:
 - a. Advance warning signs saying: "Caution – Raised Castings Ahead."
 - b. Spray paint reflective fluorescent orange the raised portions of the castings.
8. Cold planing and pavement installation: Where cold planing or the installation of pavement in lifts results in vertical joints greater than 1/4 inch, provide temporary bituminous concrete lip painted reflective orange to provide a smooth transition slope between the pavement layers.
9. When the roadway or travel lanes narrow due to construction, advance warning signs should be placed at least 20 feet in advance.

10. Narrow cuts that are parallel with the direction of travel create an extreme hazard for cyclists, whose tires could get caught. These should never be made and left in an area where bicyclists will be traveling. If necessary, they should be blocked off and cyclists routed around the hazard. When performing advance pavement cutting for trenching or other roadway excavation, use only saw cutting (approximately 1/4 inch or narrower).
11. Debris should be swept to maintain a reasonably clear riding surface in the bicycle lanes or, where there are no bicycle lanes, the outer 5 or 6 feet of roadway. Promptly remove gravel, debris, litter, sand, stone, and other obstructions from bicycle lanes and travel lanes.
12. Advance construction signs shall not be placed in bicycle lanes and shall not otherwise obstruct bicyclists' path.
13. Temporary ramps for site access ramps. The creation of ramps in the roadway is not permitted unless being created in an area that is otherwise used by on-street parking.
14. Restore pavement markings for bike lanes within 2 weeks of paving.

PART 2 – PRODUCTS

2.1 MATERIAL

- A. All barricades, drums, cones and other channelizing devices shall meet the requirements for MassDOT Standard Specifications for Highways and Bridges Section 850 Traffic Control for Construction and Maintenance Operation (Latest Revision) and the Manual of Uniform Traffic Control Devices (Latest Revision).
- B. Traffic Control Materials
 1. Materials required for the work of this Section need not be new, but must be in first-class condition and acceptable to the Owner and Engineer. Any materials that in the judgment of the Owner are unsatisfactory in appearance or performance shall be removed and immediately replaced by acceptable units.
 2. Signs, portable barricades, and drums shall have “High Intensity Encapsulated Lens Reflective Sheeting” in accordance with Section M9.30.2 of the MassDOT Standard Specifications for Highways and Bridges and MUTCD requirements.

3. Signs shall be fabricated with “High Intensity Encapsulated Lens Reflective Sheeting”. Transparent red, blue, yellow or black opaque paint (ink) may be used over “High Intensity Encapsulated Lens Reflective Sheeting” in accordance with the provisions of subsection M9.30.2, “D.2 Surface”, of the MassDOT Standard Specifications for Highways and Bridges, where these colors are specified.
4. Safety signage for construction operations shall consist of furnishing, positioning, repositioning, inspecting, maintaining, and removing regulatory, warning, and guide signs and temporary bus stop signs and taxi stop signs and their supports as approved by the Owner, City and Engineer.
5. Replace all signs and posts, which are damaged or are missing from their location at no additional cost to the Owner.
6. Maintain all signs in a satisfactory manner including the removal of dirt or road film that cause a reduction in sign reflective efficiency.

C. Portable Barricades

1. Furnish, install, relocate, remove, re-install, and maintain portable barricades in accordance with MassDOT and MUTCD requirements or as directed by the Owner, City and Engineer.
2. Portable barricades shall conform with Standard Plate No. 40612 of the MassDOT (Metric Edition). Reflectorized sheeting shall conform to Section M9.30.2, of the MassDOT Standard Specifications for Highways and Bridges.
3. Eight-foot-long units of portable barricades shall be constructed, as needed.
4. Alternating 6 inches (152.4 mil) wide diagonal stripes shall be orange and white and shall slope downward at 45 a degree toward the end by which traffic is to pass. Barricades that block the passage of traffic or designate the end of the traveled way shall have alternating vertical orange and white stripes on the rails.
5. Barricades shall be maintained in good and serviceable condition throughout the duration of the Contract.
6. Temporary pedestrian and construction facilities shall be kept clean and freshly painted as required.

D. Signs, Covered

1. Cover any existing regulatory and warning signs as required by the Owner, City and Engineer.
2. Use a cover approved by the Owner, City and Engineer which shall be securely fastened to the existing sign and shall completely cover the legend of the existing sign. The cover shall remain in place as long as necessary at which time it shall be promptly removed.
3. Signs shall be covered without causing any damage to the existing sign.

E. Traffic Signals

1. Traffic lights shall remain operable at all times throughout the duration of the contract unless approved otherwise by the City.
2. It shall be the Contractor's responsibility to maintain the traffic signal system in continuous and good working order. The Contractor at his expense, shall repair any damage to the traffic signal system resulting from the Contractor's work.

F. Temporary Precast Concrete Barriers and Work Zone Protection

1. Temporary precast concrete barriers shall be furnished and installed as shown on the approved traffic management plans and where required to protect work zones and excavations which cannot be completed and backfilled or plated within a daily work period. Barriers shall be removed or relocated when no longer required and with the approval of the Owner, City and Engineer.
2. Precast concrete median barrier shall conform with Standard Plate No. 401.15.1 of the MassDOT, as well as be acceptable for temporary pedestrian and construction facilities and signage.
3. Temporary precast barrier for use for temporary pedestrian and construction facilities shall have three sleeves cast in the barrier to receive a post for panel and fence installations.
4. Temporary chain link fence, 4-feet high, shall be erected at work zones abutting pedestrian travel paths and around work zones hazardous to pedestrians in conjunction with precast barriers to form a "safety zone" 7 feet high, or as required by the Owner, City and Engineer. The top 2-feet shall be fixed with plywood panels painted as required by the Owner and Engineer. The barriers and fencing

shall be overlapped at the corners of the excavated area to provide a continuous protective screen.

G. Variable Message Boards

1. Variable message boards (as required) shall be for the exclusive use of the Owner. The Contractor shall bear all costs associated with relocation and maintenance of the variable message boards (VMB). Each VMB shall be battery operated, programmable via a hand-held controller and have a minimum display size of 1.3 yards by 2.66 yards (1.2m by 2.4m). The VMB shall be A-1 Roadlines ER200 or approved equal.

PART 3- EXECUTION

3.1 GENERAL

- A. Conduct the work in manner that interferes as little as possible with public travel, whether vehicular or pedestrian.
- B. Provide and maintain suitable and safe bridges, detours, or other temporary expedients for accommodation of public and private travel whenever it is necessary to cross, or obstruct roads, driveways, and walks, whether public or private.
 1. Give a minimum of 48 hours (not including Saturday, Sunday or Holidays) written notice to owners of private driveways before interfering with them.
- C. Provide temporary surfacing on shoulders when necessary.
- D. Provide snow removal and street sweeping within the work limits to maintain safe and efficient vehicular and pedestrian traffic flow, including accesses and sidewalks. Contractor shall plow snow out of the work zone in all areas where municipal snow removal is prevented by construction in the opinion of the Owner, City and Engineer. The Contractor shall also remove snow from all sidewalks in areas where construction related activities are occurring or have recently occurred. The Contractor shall sweep sidewalks, pedestrian walkways and detours, and streets within the work zone on a daily basis. In the event that the Contractors work zone restricts municipal street sweeping in the area, the Contractor shall sweep the restricted streets (including streets outside the work zone) to a point where municipal street sweeping can continue.

- E. Sufficient and adequate signs, flashers, channelizing devices, lights, arrow boards and other precautions necessary to protect the work and the public, as determined by the Engineer shall be used at all times during construction.
- F. Provide trench bituminous paving repairs on a daily basis, but at intervals no longer than weekly, unless required or allowed otherwise by the Owner, City and Engineer or applicable agency having jurisdiction.
- G. Pedestrian access shall be maintained at all times. Access shall be a minimum of 4-feet, clear of all obstructions and meet all American with Disability Act (ADA) requirements. If an existing pedestrian walkway is interrupted, temporary walkways with ramps shall be provided.
- H. Contractor shall post “No Parking” signs 48-hours in advance for residential permit parking locations and 24-hours in advance for metered, public, etc. If work does not take place that day, signs must be reposted. Standard Cambridge signs shall be used that provide information regarding proposed construction and parking restriction hours. Signs shall be placed at a minimum of 25-foot intervals.
- I. Variable message boards (VMB) shall be furnished and installed as specified by the Owner. The Contractor shall remove, replace and reposition variable message boards as requested by the Engineer. The variable message boards shall be available for immediate use throughout the duration of the project and be positioned at the direction of the City. The Contractor shall be responsible for the VMB maintenance throughout its use on the project and any unit found defective in any way shall be replaced immediately at the Contractor’s expense

3.2 DETOURS

- A. If approved by the Owner, City, and Engineer, construct and maintain detours around the work to maintain traffic over any construction work in a public street, road, or highway where traffic cannot be maintained on alignment of original roadbed or pavement.
- B. When detours are allowed, the Contractor shall provide all detour signs approved by the City and/or Engineer with directional arrows. Signs shall be placed at all streets and intersections to provide required direction to allow motorists to return to the street location beyond the detour. The Contractor must submit a written detour plan for the City and/or Engineer's approval prior to implementation of the detour.
- C. All detouring and signing shall meet the requirements of the applicable references specified in Parts 1 and 2 above.

- D. The Contractor shall provide Police details in the work areas. Contractor shall coordinate vehicle towing with the police.
- E. The Detour Plan shall be reviewed and approved by the Owner, City, and Engineer prior to establishing any detours.
- F. The Contractor is responsible for the notification of any parties affected by the detour, including, but not limited to Cambridge Fire Alarm, Cambridge Police, State Police, MBTA, DCR, Cambridge Traffic Department, and abutting property owners.

3.3 PROTECTION

- A. Signs and Channelizing Devices:
 - 1. Locate signs and channelizing devices with lights to protect public thoroughfares which are closed to traffic.
 - 2. Ensure that all open trenches and other excavations have signs, channelizing devices and lights to provide protection to the public.
 - a. Provide similar warning signs and lights for obstruction such as material piles and equipment.
 - b. Ensure that the material storage and conduct of the work on or alongside streets causes minimum obstruction and inconvenience to the traveling public.
 - 3. Install and maintain all signs, channelizing devices, lights, and other protective devices in conformity with applicable statutory requirements and as required by the municipalities or agencies having jurisdiction.
 - 4. Illuminate all channelizing devices with flashing lights.
 - 5. No traffic control devices shall be stored adjacent to the roadway.

PART 4 – COMPENSATION

Item 1570.1 - Traffic and Pedestrian Management

METHOD OF MEASUREMENT:

Measurement for payment for Traffic and Pedestrian Management will be on a percent of the Lump Sum bid calculated by dividing the elapsed time to date by the original Contractual construction time limit as approved by the Engineer.

BASIS OF PAYMENT / INCLUSIONS:

Payment for Traffic and Pedestrian Management shall be based on the lump sum price bid for this item in the proposal. Under the lump sum price for this item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required to provide, maintain, relocate, and remove Traffic and Pedestrian Management in areas directly or indirectly influenced by construction within the limits of work or outside the limits of work; along truck routes inside or outside the limits of work; as delineated in the approved Traffic and Pedestrian Management Plan, by the MUTCD, ADA, MA AAB, and MassDOT standards; and as further required by the Owner and Engineer. The work includes but is not limited to; fabrication of signage; furnishing and installing signage; mounting and securing signage; maintaining signage; protecting and storing signage not in use; relocating signage; removal of signage; The work further includes, but is not limited to; obtaining permits; coordination with the City Department of Public Works and Traffic and Parking Department; coordination with private property owners within the limits of work; preparing, submitting, reviewing, implementing, and revising traffic management and control plans; coordinating traffic management and control plans with adjacent construction projects; retaining services of Professional Traffic Engineer licensed in the Commonwealth of Massachusetts for reviewing Traffic Management and Control Plan, work zone layouts, and traffic signaling on Western Avenue and/or Memorial Drive; furnishing, installing, and maintaining traffic management devices based on approved traffic management and control plans including precast concrete and/or triplex barriers with fencing and plywood panels, reflectorized drums, lane delineators, portable barricades, temporary crosswalks, and cones; temporary pavement markings; removal of temporary and existing pavement markings; furnishing, installing, shimming, pinning, maintaining, and removing steel road plates; furnishing, installing, and removing cold patch pavement as necessary or as directed by the Engineer; ordering and coordinating police details; furnishing and installing temporary construction fencing; maintaining roadways and sidewalks inside or outside the limits of work; establishing and dismantling detours; covering existing traffic signs; obtaining, posting and maintaining "No Parking" signs; meeting with police details daily; coordinating police detail locations; and all incidental work, whether listed here or not, required to provide maintenance and protection of traffic and pedestrians.

SPECIAL NOTES ON EXCLUSIONS:

The following items are not included for payment under this item and are included for payment elsewhere; bituminous hot mix asphalt pavement; variable message boards; and Police Details. Police Details will be paid directly by the Owner. Signage damaged as a result of misuse or improper handling shall be replaced by the Contractor at no additional cost to the Owner.

Item 1570.2 - Variable Message Boards

METHOD OF MEASUREMENT:

Measurement for Payment for Variable Message Boards (VMBs) shall be based on the number of weeks each variable message board is provided, moved, removed and maintained, complete, as required by the Owner or Engineer. VMBs which are on site but not requested or approved by the Owner or Engineer shall be at the Contractor's expense, i.e. VMBs which

are brought on site earlier than directed, not removed in a timely manner when required, or which are not operational.

BASIS OF PAYMENT:

Payment for Variable Message Boards (VMBs) will be based on the unit price bid for this item in the proposal. Under the Unit Price for this item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required to provide, program, move, remove and maintain variable message boards in approved locations within or adjacent to the project area, complete, as required by the Owner or Engineer. The work further includes, but is not limited to the following; coordinating with the Owner and Engineer for variable message board locations; furnishing and setting-up variable message boards, power supply, programming equipment and appurtenances; maintaining message boards throughout project; relocating message boards to new locations as required by the Owner and Engineer; transportation and handling; and all incidental work required to furnish, place, program, maintain, relocate, and remove the VMBs.

END OF SECTION 01570

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SECTION 01600

PRODUCTS, MATERIALS AND EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Furnish and install products, equipment and materials as specified and indicated in accordance with the Contract Documents.
- B. Provide transportation, handling, storage, and protection of all products, materials and equipment in accordance with the Contract Documents.

1.2 DEFINITIONS

- A. The word "Products," as used herein, is defined to include purchased items for incorporation into the Work, regardless of whether specifically purchased for the project or taken from Contractor's stock of previously purchased products. The word "Materials," is defined as products which must be substantially cut, shaped, worked, mixed, finished, refined, or otherwise fabricated, processed, installed, or applied to form units of work. The word "Equipment" is defined as products with operational parts, regardless of whether motorized or manually operated, and particularly including products with service connections (wiring, piping, and other like items). Definitions in this paragraph are not intended to negate the meaning of other terms used in the Contract Documents, including "specialties," "systems," "structure," "finishes," "accessories," "furnishings," special construction," and similar terms, which are self-explanatory and have recognized meanings in the construction industry.
- B. Neither "Products" nor "Materials" nor "Equipment" includes machinery and equipment used for preparation, fabrication, conveying and erection of the Work.
- C. Spare Parts are defined as subassemblies or components of the Products installed in the Work.

1.3 QUALITY ASSURANCE

- A. Source Limitations: To the greatest extent possible for each unit of work, the Contractor shall provide products, materials, and equipment of a singular generic kind from a single source.
- B. Compatibility of Options: Where more than one choice is available as options for Contractor's selection of a product, material, or equipment, the

Contractor shall select an option which is compatible with other products, materials, or equipment. Compatibility is a basic general requirement of product, material and equipment selections.

1.4 PRODUCT DELIVERY AND STORAGE

- A. The Contractor shall deliver and store products, materials, and equipment for the Work in accordance with manufacturer's written recommendations and by methods and means that will prevent damage, deterioration, and loss including theft. Delivery schedules shall be controlled to minimize long-term storage of materials, products, and equipment at site and overcrowding of construction spaces. In particular, the Contractor shall ensure coordination to ensure minimum holding or storage times for flammable, hazardous, easily damaged, or sensitive products, materials, and equipment to deterioration, theft, and other sources of loss.

1.5 TRANSPORTATION AND HANDLING

- A. Products, materials and equipment shall be transported by methods to avoid damage and shall be delivered in undamaged condition in manufacturer's unopened containers and packaging.
- B. The Contractor shall provide equipment and personnel to handle products, materials, and equipment by methods to prevent soiling and damage.
- C. The Contractor shall provide additional protection during handling to prevent marring and otherwise damaging products, materials, equipment, packaging, and surrounding surfaces.

1.6 STORAGE AND PROTECTION

- A. Products, materials and equipment shall be stored in accordance with manufacturer's written instructions and with seals and labels intact and legible. Sensitive products, materials and equipment shall be stored in weather-tight climate controlled enclosures and temperature and humidity ranges shall be maintained within tolerances required by manufacturer's recommendations.
- B. For exterior storage of fabricated products, materials and equipment, the products, materials and equipment shall be placed on sloped supports above ground. Products, materials and equipment subject to deterioration shall be covered with impervious sheet covering and ventilation shall be provided to avoid condensation.
- C. Loose granular materials shall be stored on solid flat surfaces in a well-drained area and shall be prevented from mixing with foreign matter.

- D. Storage shall be arranged to provide access for maintenance and inspection. The Contractor shall periodically inspect to assure products, materials and equipment are undamaged and are maintained under required conditions.
- E. Storage of materials and equipment in resource areas shall not be permitted.

1.7 MAINTENANCE OF STORAGE

- A. Stored products, materials and equipment shall be periodically inspected. The Contractor shall maintain a log of inspections and shall make the log available on request.
- B. The Contractor shall comply with manufacturer's product, material and equipment storage requirements and recommendations.
- C. The Contractor shall maintain manufacturer-required environmental conditions continually.
- D. The Contractor shall ensure that surfaces of products, materials and equipment exposed to the elements are not adversely affected and that weathering of finishes and coatings does not occur.
- E. Products, materials and equipment shall be serviced on a regularly scheduled basis, and a log of services shall be maintained and submitted as a record document prior to acceptance by the Owner in accordance with the Contract Documents.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Do not use materials and equipment removed from existing premises, except as specifically required by the Contract Documents.
- B. Where similar Products (such as grease fittings, flexible couplings, etc.) are used on different pieces of equipment or in different areas within the Work, standardize the Products by providing all Products from the same Supplier.

2.2 SPARE PARTS

- A. Provide spare parts for Products as indicated and specified.
- B. The Contractor shall deliver to the Owner all spare parts except those requiring maintenance in storage, at least 30 days prior to scheduled starting of system. Spare parts that require maintenance in storage shall be held and

maintained by the Contractor until Substantial Completion and then a separate delivery of the remaining spare parts will occur. The spare parts that do not require maintenance in storage shall be packed so that they are protected from damage and the environment during storage.

- C. Tag spare parts and containers to clearly identify them. Cross reference all parts to the Tag ID numbers as indicated and as specified.
- D. All spare parts are to be identical and interchangeable with similar parts installed in the Work.
- E. The Contractor is to submit to the Owner at least 120 days prior to startup, all initial submittals of spare parts for review and approval.
 - 1. Early submittal is encouraged.
 - 2. The Contractor will have all spare parts submittals finalized, submitted and approved, and all spare parts shall be delivered to the Owner at least 30 days prior to scheduled starting of systems.

2.3 GENERAL MATERIAL AND EQUIPMENT REQUIREMENTS:

- A. The following requirements shall constitute the acceptable minimum standards for the equipment specified herein. Should these requirements conflict with the Supplier's recommendations or in any way be less stringent than the Supplier's requirements, they shall be superseded by the Supplier's requirements.
- B. Grease Fittings:
 - 1. Provide extension fittings and tubing on all grease fittings that are installed so that equipment can be lubricated from the operating level without the use of ladders, staging, or shutting down the equipment. Tubing shall be of corrosion resistant materials compatible with the material to which it is attached.

C. Concrete Inserts:

1. Use concrete inserts for hangers to completely support the maximum load that can be imposed by the hangers used in the inserts.
2. Provide inserts for hangers of a type which will permit adjustment of the hangers both horizontally (in one plane), and vertically, and locking of the hanger head or nut. Galvanize all inserts by the hot-dip process in conformity with ASTM Standard Specification for Zinc (Hot -Galvanized) Coatings on Products Fabricated from Rolled, Pressed, and Forged Steel Shapes, Plates, Bars and Strip, Designation A123-78, or ASTM Standard Specifications for Zinc Coating (Hot Dip) on Iron and Steel Hardware, Designation A153-80.

D. Sleeves:

1. Provided sleeves shall be of ample diameter to pass the pipe and its insulation, if any, and to permit expansion.
2. Provide sleeves that are flush at the walls and at the bottom of slabs. Sleeves must project one inch above the finished floor surface. Threaded nipples shall not be used as sleeves.

E. Protection against Electrolysis:

1. Where dissimilar metals are used in conjunction with each other, provide insulation between adjoining surfaces to eliminate direct contact and any resultant electrolysis. Provide bituminous insulation, heavy bituminous coatings, nonmetallic separators or washers, impregnated felt, or similar arrangement.

PART 3 – EXECUTION

3.1 GENERAL MATERIAL AND EQUIPMENT INSTALLATION REQUIREMENTS

- A. The following requirements shall constitute the acceptable minimum standards for installing the equipment specified herein. Should these requirements conflict with the Supplier's recommendations or in any way be less stringent than the Supplier's requirements, they shall be superseded by the Supplier's requirements.
1. Bolts, Anchor Bolts, and Nuts
 - a. Set anchor bolts and expansion bolts as indicated and as specified.

- b. If anchor bolts are set before the concrete has been placed, use templates.
- c. Where indicated, or specified, provide anchor bolts with square plates at least 4 in. by 4 in. by 3/8 in., or with square heads and washers set in the concrete forms with pipe sleeves, or both.
- d. If anchor or expansion bolts are set after the concrete has been placed, do all drilling and grouting or caulking without damaging the structure or finish by cracking, chipping, or spalling.

B. Equipment Foundations and Grouting

- 1. In setting pumps, motors, and other grouted equipment, make an allowance of at least one inch for grout under the equipment bases. Use steel shims to level and adjust the bases. Shims may be left embedded in the grout, in which case they shall be installed neatly and inconspicuous in the completed work. Use non-shrink grout.
- 2. Mix and place grout in accordance with the recommendations of the Supplier and as indicated and as specified. Place grout through the grout holes in the base, work outward and under the edges of the base, and across the rough top of the concrete foundation to a peripheral form to provide a chamfer around the top edge of the finished foundation.
- 3. After the grout has hardened, remove all forms, hoppers, and excess grout. Patch all exposed grout surfaces, give a burlap-rubbed finish, and coat with at least two coats as specified.

C. Sleeves and Openings

- 1. Provide all chases or openings for the installation of the Work, or cut the same in existing Work.
- 2. Provide all sleeves or forms at the Work, and set them as indicated and as specified, and in ample time to prevent delays.
- 3. Locate all chases, openings, and sleeves as specified and indicated. If the location is not specified or indicated, locate all openings to avoid interference with equipment and piping.
- 4. If openings and/or sleeves were not provided prior to concrete placements, the Contractor shall provide and set them afterwards at no additional cost to the Owner. Confine the cutting to the smallest

extent possible. In no case shall piers or structural members be cut without the written consent of the Owner.

5. Fit around, close up, repair, patch, and point around the work specified herein to the requirements of the Owner.
6. Perform all of this work by workmen using small hand tools. Do not use power tools except where, in the opinion of the Owner, the type of tool proposed can be used without damage to any work or structures and without interference with the operation of any facilities. The Owner's concurrence with the type of tools shall not in any way relieve or diminish the responsibility of the Contractor for such damage, or interference resulting from the use of such tools.
7. Do not cut or alter the work of any subcontractor or any other contractor, nor permit any subcontractor to cut or alter the work of any other contractor or subcontractor, except with the written consent of the contractor or subcontractor whose work is to be cut or altered, and with the written consent of the Owner. All cutting and patching or repairing made necessary by the Contractor or any subcontractors shall be done at no additional cost to the Owner.

PART 4 – COMPENSATION (Not Used)

END OF SECTION 01600

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SECTION 01630

RESTORATION OF GROUNDS AND CLEANING UP

PART 1 - GENERAL

1.1 REQUIREMENTS

- A. The Contractor on or before the completion of the work, except as otherwise expressly required or permitted in writing by the Owner, shall tear down and remove and legally dispose of all temporary structures built or used by him; shall remove all rubbish and debris of all kinds from all Contract structures and from any grounds which he shall have occupied within the limits of the project site; shall leave the site of the work in a satisfactorily neat and clean condition; shall remove from the land all abandoned materials and plant; and shall leave the spoil areas and the property which may have been affected by his operations in a neat and satisfactory condition. Also included is the restoration of all private grounds, including lawns, landscaped areas, driveway aprons and walkways damaged or disturbed in connection with the new work not elsewhere specified. Unless otherwise specified, all materials salvaged and not required to be reused shall be the property of the Contractor, and shall be legally disposed of off the site of the work.
- B. Included in the work under this Section is the restoration, including replacement of damaged and disturbed shrubs and trees, retaining walls, of all grounds and grassed and landscaped areas removed or disturbed or damaged during the construction of the new work, including pipe laterals within private property areas, and storage and field office areas.
- C. Also included in the work under this Section is the furnishing of all labor, materials, and equipment required to remove, store, and reset or replace bumper posts, stone walls of all types, flagstone walks, fences of all types, railings, signs and sign posts, signal posts, and such other miscellaneous objects damaged or disturbed during construction.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION (Not Used)

PART 4 – COMPENSATION (Not Used)

END OF SECTION 01630

RESTORATION OF GROUNDS
AND CLEANING UP
01630-1

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SECTION 01701

PROJECT CLOSEOUT

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section includes the requirements for project closeout including final clean up, closeout timetable, Owner's manual submittal, final submittals, maintenance and guarantee, and bonds.

1.2 FINAL CLEANUP

- A. The Contractor shall promptly remove from the vicinity of the completed work, all rubbish, unused materials, concrete forms, construction equipment, and temporary structures and facilities used during construction. Final acceptance of the Work by the Owner will be withheld until the Contractor has satisfactorily complied with the foregoing requirements for final cleanup of the project site.
- B. The Contractor shall cleanup and restore all areas affected by staging, trailer(s) placement and parking. Restoration includes regrading, re-establishing topsoil and reseeding.

1.3 CLOSEOUT TIMETABLE

- A. The Contractor shall establish dates for equipment testing, acceptance periods, and on-site instructional periods (as required under the Contract). Such dates shall be established as specified elsewhere in the Contract Documents.

1.4 OPERATION AND MAINTENANCE

- A. The Contractor's attention is directed to the condition that one percent (1%) of the applicable bid item price will be deducted from any monies due the Contractor as progress payments, if at the 75 percent construction completion point, the final O & M manuals complying with Section 01300 and the individual technical specification sections have not been submitted. The aforementioned amount will be retained by the Owner as the agreed, estimated value of the approved O & M manuals. Any such retention of money for failure to submit the approved O & M manuals on or before the 75 percent construction completion point shall be in addition to the retention of any payments due to the Contractor.

1.5 FINAL SUBMITTALS

- A. The Contractor, prior to requesting final payment, shall obtain and submit the following items to the Engineer for transmittal to the Owner:
 - 1. Written guarantees, where required.
 - 2. New permanent cylinders and key blanks for all locks.
 - 3. Maintenance stock items; spare parts; special tools.
 - 4. Completed as-built / record drawings.
 - 5. Certificates of inspection and acceptance by local governing agencies having jurisdiction.
 - 6. Releases from all parties who are entitled to claims against the subject project, property, or improvement pursuant to the provisions of law.

1.6 MAINTENANCE AND GUARANTEE

- A. The Contractor shall comply with the guarantee and warranty requirements contained in the General Conditions.
- B. Replacement of earth fill or backfill, where it has settled below the required finish elevations, shall be considered as a part of such required repair work, and any repair or resurfacing constructed by the Contractor which becomes necessary by reason of such settlement shall likewise be considered as a part of such required repair work unless the Contractor shall have obtained a statement in writing from the affected private owner or public agency releasing the Owner from further responsibility in connection with such repair or resurfacing.
- C. The Contractor shall make all repairs and replacements promptly upon receipt of written order from the Owner. If the Contractor fails to make such repairs or replacements promptly, the Owner reserves the right to do the Work and the Contractor and his surety shall be liable to the Owner for the cost thereof.

1.7 BOND

- A. The Contractor shall provide a bond to guarantee performance of the provisions contained in Paragraph "Maintenance and Guarantee" above, and of the General Conditions.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION (Not Used)

PART 4 – COMPENSATION (Not Used)

END OF SECTION 01701

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SECTION 01740

WARRANTIES AND BONDS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section specifies general administrative and procedural requirements for warranties and bonds required by the Contract Documents, including manufacturer's standard warranties on products and special warranties.

1.2 RELATED WORK

- A. Refer to General Conditions of the Contract for the general requirements relating to warranties and bonds.
- B. General closeout requirements are included in Section 01701 - PROJECT CLOSEOUT.
- C. Specific requirements for warranties for the Work and products and installations that are specified to be warranted are included in the individual Specification Sections.
- D. Certifications and other commitments and agreements for continuing services to Owner are specified elsewhere in the Contract Documents.

1.3 SUBMITTALS

- A. Submit written warranties to the Owner prior to the date fixed by the Engineer for Substantial Completion. If the Certificate of Substantial Completion designates a commencement date for warranties other than the date of Substantial Completion for the Work, or a designated portion of the Work, submit written warranties upon request of the Owner.
- B. When a designated portion of the Work is completed and occupied or used by the Owner, by separate agreement with the Contractor during the construction period, submit properly executed warranties to the Owner within fifteen days of completion of that designated portion of the Work.
- C. When a special warranty is required to be executed by the Contractor, or the Contractor and a subcontractor, supplier or manufacturer, prepare a written document that contains appropriate terms and identification, ready for execution by the required parties. Submit a draft to the Engineer for approval prior to final execution.

- D. Refer to individual Specification Sections for specific content requirements, and particular requirements for submittal of special warranties.
- E. At Final Completion, compile two copies of each required warranty and bond properly executed by the Contractor, or by a subcontractor, supplier, or manufacturer. Organize the warranty documents into an orderly sequence based on the table of contents of the Contract Specifications.
- F. Bind warranties and bonds in heavy-duty, commercial quality, durable 3-ring vinyl covered loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-in. by 11-in. paper.
- G. Table of Contents: Neatly typed. Identified each item with the number and title of the Specification Section in which the Work and Warranty and Bond requirement was specified, and the name of the product or work item.
- H. Provide heavy paper dividers with celluloid covered tabs for each separate warranty. Mark the tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product, and the name, address and telephone number of the installer, supplier, and manufacturer.
- I. Identify each binder on the front and the spine with the typed or printed title "WARRANTIES AND BONDS," the Project title or name, and the name, address, and telephone numbers of the Contractor and equipment supplier.
- J. When operating and maintenance manuals are required for warranted construction, provide additional copies of each required warranty, as necessary, for inclusion in each required manual.

1.4 WARRANTY REQUIREMENT

- A. Related Damages and Losses: When correcting warranted Work that has failed, remove and replace other Work that has been damaged as a result of such failure or that must be removed and replaced to provide access for correction of warranted Work.
- B. Reinstatement of Warranty: When Work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.
- C. Replacement Cost: Upon determination that Work covered by a warranty has failed, replace or rebuild the Work to an acceptable condition complying with requirements of Contract Documents. The Contractor is responsible for the cost of replacing or rebuilding defective Work regardless of whether the Owner has benefited from use of the Work through a portion of its anticipated useful service life.

- D. Owner's Recourse: Written warranties made to the Owner are in addition to implied warranties, and shall not limit the duties, obligations, rights and remedies otherwise available under the law, nor shall warranty periods be interpreted as limitations on time in which the Owner can enforce such other duties, obligations, rights or remedies.
- E. Rejection of Warranties: The Owner reserves the right to reject warranties and to limit selections to products with warranties not in conflict with requirements of the Contract Documents.
- F. The Owner reserves the right to refuse to accept Work for the Project where a special warranty, certification, or similar commitment is required on such Work or part of the Work, until evidence is presented that entities required to countersign such commitments are willing to do so.
- G. Disclaimers and Limitations: Manufacturer's disclaimers and limitations on product warranties do not relieve the Contractor of the warranty on the Work that incorporates the products, nor does it relieve suppliers, manufacturers, and subcontractors required to countersign special warranties with the Contractor.

1.5 DEFINITION

- A. Standard Product Warranties are pre-printed written warranties published by individual manufacturers for particular products and are specifically endorsed by the manufacturer to the Owner.
- B. Special Warranties are written warranties required by or incorporated in the Contract Documents, either to extend time limits provided by standard warranties or to provide greater rights for the Owner.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION (Not Used)

PART 4 – COMPENSATION (Not Used)

END OF SECTION 01740

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SECTION 02010

SUBSURFACE INVESTIGATION

2010.1

GEOTECHNICAL BORINGS

LUMP SUM

PART 1 – GENERAL

1.1 DESCRIPTION

- A. This section includes the basic requirements and expectations of the Contractor in all work pertaining to subsurface conditions.
- B. This section includes the requirements for obtaining geotechnical borings at proposed traffic signal mast arm locations. 3 (20' depth each) geotechnical borings are required at the intersection of Western Ave and Putnam Ave and 3 geotechnical boring (20' depth each) are required at the intersection of Western Ave and Howard St. Actual boring locations to be finalized during construction and coordinated with the Engineer.

1.2 GENERAL REQUIREMENTS

- A. The Contractor acknowledges that he has satisfied himself as to the nature and location of the Work; the general and local conditions, particularly those bearing upon groundwater table or similar physical conditions at the site; the characterization and conformation of subsurface materials to be encountered; and all other matters that can in any way affect the work or the cost thereof under this Contract. Any failure by the Contractor to acquaint himself with all available information concerning these conditions will not relieve him from responsibility for estimating properly the difficulty or cost of successfully performing the Work.
- B. Work under this item shall conform to the relevant portions of Section 190 of the 1995 "Commonwealth of Massachusetts Highway Department (MHD) Standard Specifications for Highways and Bridges" and the following:

No borings shall be performed without the presence of the Engineer or representative authorized by City of Cambridge.

1.3 SUBSURFACE DATA

- A. The findings of recent subsurface investigations are provided in the boring log information, laboratory grain size test results, and the analytical results of samples collected for waste characterization analyses are included in the Appendix to these Specifications.
- B. Such data is offered in good faith solely for the purpose of placing the Contractor in receipt of information available. The Contractor shall interpret such data according to his own judgment, and acknowledges that he is not relying upon the same as accurately describing the actual subsurface conditions or quantities of materials that may be encountered. The Contractor further acknowledges that he assumes all risk contingent upon the nature of the subsurface conditions to be actually encountered in performing the work covered by the Contract, even though such actual conditions may result in the Contractor performing more or less work than originally anticipated. In the event that quantities of waste soil/fill and related work as established in this Contract vary significantly from estimates provided, the unit bid prices will be the basis for compensation.
- C. Re-use of excavated soils on- or off-site is subject to local, state and federal regulations and as specified in Section 02080 – SOIL AND WASTE MANAGEMENT and 02095 – TRANSPORTATION AND DISPOSAL OF SOIL AND FILL.
- D. Since individual disposal facilities will have different permit conditions and specific pre-characterization data requirements, the Contractor shall use the information provided for waste characterization; however the Contractor shall be responsible for final waste characterization prior to transport and disposal. The Contractor is hereby made aware that for the purposes of disposal, final waste characterization testing is the responsibility of the Contractor, and costs for any additional characterization shall be incorporated into the Contractor's lump sum bid price for Soil Management.
- E. Additional subsurface investigation as may be warranted to satisfy a disposal facility's data requirements shall be the responsibility of the Contractor. Subsurface investigation activities shall not commence until a written work plan detailing the Contractor's approach for obtaining the data is approved by the Owner's Licensed Site Professional. The work plan must indicate the location and frequency of sampling; sampling parameters and sampling methodology. The Contractor shall allow a minimum of 14 days for review and comment.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION

- A. Geotechnical borings are required at proposed traffic signal locations. Contractor shall be responsible for obtaining geotechnical boring data as specified or as otherwise required by the Engineer.
- B. The borings shall be Hollow Stem Auger Borings. The depth of borings shall be 20 feet.
- C. If ledge, utilities or underground obstructions are encountered while boring at the proposed foundation location, the Contractor shall backfill the boring hole to its original condition and contact the Engineer so that an alternative foundation design or location can be determined.
- D. The contractor shall contact Dig-Safe (1-888-344-7233) 72 hours prior to performing any soil borings. The Contractor shall arrange any police details required due to the soil borings and provide necessary traffic management devices in conformance with the traffic management plans included in the Contract drawings.
- E. Boring logs shall be provided by the Contractor indicating soil encountered and depths of soil changes, blow counts and groundwater level if encountered. Split spoon samples shall be provided every 5 feet or change in strata. The cost of the soil borings shall be based on the number of days the soil boring truck rig is drilling onsite rounded to the half-day.

PART 4 – COMPENSATION

Item 2010.1 Geotechnical Borings

METHOD OF MEASUREMENT:

Measurement for payment for Geotechnical Borings shall be based on the Lump Sum Price bid in the proposal. Measurement for payment shall be based on the completion of obtaining the geotechnical borings and required testing data as specified.

BASIS OF PAYMENT/INCLUSIONS

Payment for Geotechnical Borings will be based on the bid for this item in the proposal. Under the Unit Price bid for this item, the Contractor shall furnish all labor, materials, tools, equipment and incidentals required to conduct geotechnical borings. Under the Unit Price bid for this item, the Contractor shall also furnish all labor, materials, tools, equipment and incidentals to prepare and conduct geotechnical borings, obtain soil

samples, furnish and install backfill per one of the approved methods; furnish, install and compact gravel road sub-base, obtain required testing data in the field and at a testing laboratory, submit boring logs and testing data; and all other items of work not specifically included herein or elsewhere required to conduct geotechnical borings as specified and required.

END OF SECTION 02010

SECTION 02015

GEOTECHNICAL INSTRUMENTATION AND MONITORING

2015.1 GEOTECHNICAL INSTRUMENTATION AND MONITORING DAY

PART 1 – GENERAL

1.1 SUMMARY

- A. Work in this Section shall include, but not be limited to, all materials, equipment, labor, and services required to install, protect, replace, monitor and report on geotechnical instrumentation specified herein.
- B. The work included in this section includes the following:
 1. Furnish, install, protect, replace, monitor and report on wall monitoring points on the top of the temporary excavation support walls (not including trench boxes), a minimum of one every 20 feet, to measure horizontal displacements of these points during the Work. Locations of the monitoring points shall be distributed uniformly around the excavation support wall at locations proposed by the Contractor and accepted by the Engineer.
 2. Furnish, install, protect, replace, monitor and report on utility monitoring points and ground surface and building deformation monitoring points as indicated and shown on the Contract Drawings. The Engineer will assist the Contractor in determining the final locations.
 3. The Contractor shall retain the services of Geotechnical Monitoring Consultant to install, monitor, maintain and report on geotechnical instrumentation that includes but is not limited to temporary excavation support wall monitoring points, utility, ground surface and building deformation monitoring points, crack gauges and vibrations. Monitoring frequency shall be daily during installation of the support of excavation, and once per week thereafter for all instruments located within 100 feet from the edge of the excavation, during all excavation, backfill and compaction, unless otherwise required by the Engineer or specified. Monitoring includes; crack gauges, temporary earth support monitoring points, surface, utility and building monitoring points.
 4. Vibration monitoring shall be performed continuously during all excavation, backfill, and compaction and installation of temporary

earth support. Two seismographs shall monitor vibrations at two separate locations; one adjacent to the work and one adjacent to the nearest private property. Vibration levels shall not exceed the criteria indicated herein.

5. Replace instrumentation damaged or made inaccessible by the construction operations at no additional cost to the Owner.

1.2 SUBMITTALS

- A. Submit the following in accordance with Section 01300 – SUBMITTALS.
 1. Shop drawings that indicate the instrumentation locations, sizes, material types, manufacturers' data and specifications, installation procedures, and other data. Provide description of work and materials.
 2. Contractor submittals shall be acceptable to the Engineer prior to undertaking the work. The Contractor shall forward submittals in advance considering that re-submittals may be required.
- B. The Geotechnical Monitoring Consultant shall submit initial baseline survey data on a plan indicating locations and elevations of all instrumentation monitoring points to the Engineer at least three days prior to beginning of the installation of the excavation support and excavation operations.
- C. The Geotechnical Monitoring Consultant shall submit subsequent survey data on all instrumentation monitoring points to the Engineer prior to the beginning of work the following day. A faster turnaround of data reporting may be required by the Engineer if threshold or limiting response values, as specified in this Section, are approached or exceeded. Data shall be tabulated or depicted graphically on plots and show incremental and cumulative movement since the start of excavation.
- D. A mitigation plan shall be submitted to the Engineer by the Contractor prior to any excavation and prior to the installation of the excavation support system. The mitigation plan shall detail the Contractor's course of action in the event threshold or limiting response values are met or exceeded. Such mitigation plan shall be revised as appropriate for each instance threshold and/or limiting values are reached.

1.3 QUALITY CONTROL

- A. Retain the services of Geotechnical Monitoring Consultant to monitor the geotechnical instrumentation, which includes and is not limited to excavation support system, building, utility and ground surface deformation monitoring points, crack gauges and vibrations. The consultant shall be a Geotechnical

Engineer registered in the Commonwealth of Massachusetts and shall have demonstrated at least five years experience and at least three projects of similar type, size, and complexity including installation and monitoring of surface settlement and lateral deformation points, crack gauges, and vibrations with seismographs. The Geotechnical Monitoring Consultant shall be approved by the Engineer and must be approved two weeks prior to mobilization for construction. The Geotechnical Monitoring Consultant shall adhere to all methods and standards described in this Specification.

- B. The Contractor shall provide sufficient notice to the Engineer to allow the Engineer to be present to observe the Work. Cooperate with the Engineer in all respects to facilitate any testing or observations.
- C. The Contractor may conduct additional testing or monitoring for its own information, at no additional cost to the Owner.
- D. The presence of the Engineer (including observations and review of test results) shall not relieve the Contractor of its sole responsibility to perform the work in accordance with the Contract Documents, nor shall they be construed to relieve the Contractor from full responsibility for the means and methods of construction and for safety on the construction site.
- E. Work not in conformance with the specified requirements shall be improved, or removed and replaced, at no additional cost to the Owner. All costs related to testing of nonconforming Work or materials shall be paid for by the Contractor, at no additional cost to the Owner.
- F. Measure and report all data on movements of all instrumentation monitoring points to the nearest 0.01 ft.

PART 2 – PRODUCTS

2.1 BUILDING AND GROUND SURFACE DEFORMATION MONITORING POINTS

- A. Deformation monitoring points shall consist of 3-inch long surveyors' "PK" nails, securely nailed in place, a #4 rebar 12 inches long driven flush into the ground surface or ½-inch diameter carriage bolts drilled 2 inches into the building surface and extending approximately 3 inches from the building face. Surface monitoring points may also consist of an observable point punch marked on the top horizontal surface of a manhole or catch basin rim. The steel surface within 3 inches of the point shall be cleaned by wire brush to permit easy identification of the exact point. The point shall be clearly identified using fluorescent spray paint adjacent to the point.

2.2 CRACK GAUGES

- A. Crack gauges on existing and new cracks developing during construction shall be monitored using a device such as the Avongard Calibrated Crack Monitor (Avongard Products, Waukegan, IL or approved equal) shall be bolted or epoxied to the surface. For uneven surfaces, such as stone, pairs of flat washers should be used, with the distance between the washers measured with a caliper.

2.3 VIBRATION MONITORING

- A. Construction vibrations shall be monitored at the approximate locations shown on the Drawings in terms of peak particle velocity using a seismograph with continuous recording capability. Capability to record vibrations at two locations simultaneously is required. The vibration sensors shall be capable of recording three orthogonal components of vibration.

2.4 TEMPORARY EXCAVATION SUPPORT WALL MONITORING POINTS

- A. Temporary excavation support wall monitoring points shall consist of an observable point punch marked on the top horizontal surface of the piles or sheeting. The surface within three inches of the point shall be cleaned by wire brush to permit easy identification of the exact point. The point shall be clearly identified using fluorescent spray paint adjacent to the point.

2.5 UTILITY MONITORING POINTS

- A. Utility monitoring points shall consist of an inner steel rod installed within casing placed near to the surface of the existing steam line, as shown on the Drawings. The exposed surface of the pipe shall be cleaned by high pressure air to assure that the inner rod rests directly on the pipe. The measurement rod shall be rounded at the top to assure that a surveyor's leveling rod can rest upon it to provide reproducible results. The rod shall be centered in the annular space between it and the casing to assure that the rod does not drag on the casing.

PART 3 – EXECUTION

3.1 GENERAL REQUIREMENTS

- A. Do not install any instruments until the Owner and the Engineer have been notified.

3.2 INSTALLATION

- A. Install excavation wall monitoring points at the locations proposed by the Contractor and accepted by the Engineer but not less than 20 feet on-center on all sides of the excavation. Surface, utility and building monitoring points shall be installed at the locations shown on the Drawings. Locations of existing building cracks shall be identified during the Pre-Construction Condition Survey. The base bid allows for a minimum of 65 existing monitoring locations.

3.3 MONITORING

- A. During and following the installation of the excavation support wall, the Geotechnical Monitoring Consultant shall be responsible for monitoring the horizontal position of individual components of the lateral earth support systems until the structures are installed and the trench backfilled to the original street surface grade.
- B. Immediately following installation of each element of the lateral support system, the Geotechnical Monitoring Consultant shall establish a baseline parallel to each side of the excavation from which offset (horizontal displacement) measurements shall be made to the pile.
- C. Offset (horizontal position) monitoring of the temporary lateral earth support systems shall be made at least once per week until the excavation is backfilled to within 2-ft of final grade, or as required by the Engineer. A minimum accuracy of 0.01 ft. shall be maintained.
- D. Obtain the first initial baseline readings on excavation wall, building, utility and surface monitoring points no later than seven days prior to the start of installation of the temporary excavation support or excavation operations. Obtain two sets of initial readings at least one day apart.
- E. Monitoring frequency may be increased as required by the Engineer for some or all of the monitoring points if the threshold or limiting response values are approached or exceeded during the Work, at no additional cost to the Owner.
- F. The Geotechnical Monitoring Consultant shall monitor all instrumentation specified. Instrumentation data obtained by the Geotechnical Monitoring Consultant shall be provided to the Engineer.
- G. After each set of readings is obtained, the data shall be sent to the Engineer, where the data will be reviewed and interpreted. The Contractor shall make its own interpretations for the data. The Contractor shall monitor and interpret data from additional instrumentation that it deems necessary to ensure the safety of its work. The Engineer is not responsible for the safety of the work based on its review of the instrumentation data.

Reporting Data:

1. A plan showing location and numbering system for monitoring points shall be submitted to the Engineer prior to start of temporary excavation support installation and excavation operations, along with results of two initial baseline surveys. Monitoring frequency shall be on a daily basis during installation of the excavation support system and once per week thereafter for all instruments located within 100 feet from the edge of the excavation unless otherwise required by the Engineer.
 2. Tables of results of surveys shall be submitted prior to the beginning of work the following day. The table of survey results shall include the initial measurement, the current measurement, and the amount of movement since start of excavation.
- H. Criteria for "threshold" and "limiting" movements of wall elements of temporary lateral support systems have been established as follows:
1. "Threshold" Horizontal Movement: No greater than 0.5 inch where buildings are present within 25 feet of the support of excavation system.
 2. "Limiting" Horizontal Movement: No greater than 1.0 inch where buildings are present within 25 feet of the support of excavation system.
- I. Criteria for "threshold" and "limiting" settlement of sidewalk, paved roadway areas adjacent to the temporary lateral support systems have been established as follows:
1. "Threshold" Settlement: No greater than 0.5 inches.
 2. "Limiting" Settlement: No greater than 1.0 inch.
- J. Criteria for "threshold" and "limiting" settlement of existing steam line adjacent to the temporary lateral support systems have been established as follows:
1. "Threshold" Settlement: No greater than 0.25 inches.
 2. "Limiting" Settlement: No greater than 0.50 inch.
- K. Criteria for "threshold" and "limiting" angular distortion (measure of building rotation due to vertical settlement) of adjacent buildings have been established as follows:

1. "Threshold" Angular Distortion: No greater than 1/1000 for wood, steel and brick buildings. No greater than 1/1200 for historical stone structures. Where the angular distortion is defined as the ratio of the differential elevation between any two building points over the horizontal distance between those points.
 2. "Limiting" Angular Distortion: No greater than 1/750 for wood, steel and brick buildings. No greater than 1/900 for historical stone structures. Where the angular distortion is defined as the ratio of the differential elevation between any two building points over the horizontal distance between those points.
- L. Criteria for "threshold" and "limiting" vibration acceptance measured from seismographs during demolition, construction of temporary excavation support, excavation and backfilling shall be as follows:
1. "Threshold" values in peak particle velocity (inches per second): for wood, steel and brick buildings shall be 0.6, and for historical stone structures 0.3 at frequencies of 50 Hz or less as measured from the ground surface within the area shown in the Contract Drawings.
 2. "Limiting" values in peak particle velocity (inches per second): for wood, steel and brick buildings shall be 0.8, and for historical stone structures 0.5 at frequencies of 50 Hz or less as measured from the ground surface within the area shown in the Contract Drawings.
- M. The Contractor shall immediately notify the Engineer and shall take immediate steps to control further movement by revising construction procedures, providing supplemental bracing or other measures (working extended hours as approved or temporarily terminating work in the area of movement if necessary) as required if any of the following occur:
1. Field measurements indicate that any of the "threshold" movement criteria are reached or exceeded.
 2. Field measurements or observations indicate that significant or sustained wall movements, beyond those reasonably expected, are occurring (total movement may be less than the "Limiting" movement criteria). Movements of adjacent structures, utilities or other facilities are detected.
- N. If "Limiting" movements are being approached or reached, the Owner may require the Contractor to temporarily suspend the work in the area where such movement is occurring and implement all necessary mitigation measures which are satisfactory to the Engineer, to arrest the movements, at no cost to the Owner.

- O. Installation of Work in the area where the Limiting Values had been reached shall not be permitted until the results of optical surveys indicate no increase in lateral movement of the earth support system and adjacent surface and building settlement for the one-week period immediately prior to the start of construction.
- P. These criteria are intended to establish a minimum basis for the Contractor's design and procedures and does not relieve the Contractor of its responsibility for preventing detrimental movements and damage to adjacent structures, utilities or other work.
- Q. The Contractor shall pay a penalty of \$1,000 for each scheduled day the Geotechnical Monitoring Consultant is not on site, \$1,000 for each day the data is not delivered to the Engineer at the specified time, and \$1,000 for each day the Contractor works in violation of any threshold or limiting values being reached or exceeded as determined by the Engineer.
- R. In the event the Contractor does not comply with the approved mitigation plan, or continues to work in violation of threshold or limiting values being reached or exceeded, the Contractor shall not be allowed to continue work until proper mitigation procedures and corrections have been made as required by the Owner and Engineer.
- S. The Contractor shall be responsible for repairing all property damage caused by construction activities.

3.4 PROTECTION OF INSTRUMENTATION

- A. Protect all instruments during the course of the Work. Any damage or loss of function caused by the Contractors operations, or by any other cause, to new or existing instrumentation devices, shall be immediately repaired or the equipment replaced at no additional cost to the Owner.

PART 4 – COMPENSATION

Item 2015.1 - Geotechnical Instrumentation and Monitoring

METHOD OF MEASUREMENT:

Measurement for payment for Geotechnical Instrumentation and Monitoring shall be based on the actual number of days when geotechnical instrumentation or monitoring activities are conducted on site, as determined in the field by the Engineer. Payment will not be made until all required submittals have been approved by the Engineer. Further, payment will be contingent upon the Contractor meeting the requirements in the specifications for monitoring, maintenance, and submission of reports. Payment may be withheld, at the Engineer's discretion, for late submission of reporting requirements. Costs for additional monitoring done for the Contractor's convenience shall not be compensated for.

BASIS OF PAYMENT/ INCLUSIONS:

Under the Unit Price for Geotechnical Instrumentation and Monitoring, the Contractor shall furnish all labor, materials, instrumentation, tools, equipment, and incidentals required to perform all geotechnical monitoring as specified in the Contract Specifications and also as required by the Engineer. Payment under this Item includes, but is not limited to; furnishing, installation and maintenance of earth support settlement and deformation monitoring points; monitoring earth support settlement and deformation monitoring points and submission of all data to the Engineer; furnishing, installation and maintenance of ground surface, building, and utility monitoring points; monitoring ground surface, building, and utility monitoring points and submission of all data to the Engineer; furnishing, installation, and maintenance of crack monitoring gauges; monitoring crack monitoring gauges and submission of all data to the Engineer; furnishing, installation and maintenance of seismographs; monitoring seismograph data and submission of all data to the Engineer; submission of shop drawings and submittals as required.

END OF SECTION 02015

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SECTION 02051

DEMOLITION, MODIFICATION, AND ABANDONMENT

2051.1	DISPOSAL OF CONSTRUCTION DEBRIS AS SOLID WASTE	TON
2051.2	DISPOSAL OF BITUMINOUS CONCRETE	TON
2051.3	DEMOLITION OR REMOVAL OF LAMP HOLE, MANHOLE, CATCH BASIN OR OTHER STRUCTURE	EACH
2051.4	ABANDON IN PLACE MANHOLE, CATCH BASIN OR OTHER STRUCTURE	EACH
2051.5	DEMOLITION OR REMOVAL OF PIPE GREATER THAN 15-INCH THROUGH 36-INCH PIPE DIAMETER	LINEAR FOOT
2051.6	DEMOLITION OR REMOVAL OF PIPE GREATER THAN 36-INCH THROUGH 48-INCH PIPE DIAMETER	LINEAR FOOT
2051.7	DEMOLITION OR REMOVAL OF PIPE 22-INCH x28-INCH OLD SEWER	LINEAR FOOT
2051.8	BULKHEAD FOR PIPE PLUG OR ABANDONMENT EQUAL TO OR GREATER THAN 30-INCH IN DIAMETER	EACH

PART 1 – GENERAL

1.1 SUMMARY

- A. The Contractor shall furnish all plant, labor, tools, equipment, materials, and supplies as required for utility and structure removal, demolition, modification, and/or abandonment as specified.
- B. The Work of this Section shall include the following significant items; all other activity shown on the Drawings; and work necessary and defined herein pertaining to the project area: demolition of roadway and sidewalk; removal of existing catch basins and manholes; abandonment of existing catch basin laterals; removal of existing pipe and selective demolition.

1.2 RELATED DOCUMENTS

- A. Section 02210 – EARTH EXCAVATION, BACKFILL, FILL AND GRADING
- B. Section 02590 – BRICK MASONRY
- C. Section 03315 – GROUT
- D. Section 02160 – TEMPORARY EXCAVATION SUPPORT SYSTEMS
- E. Section 02080 – SOIL AND WASTE MANAGEMENT
- F. Section 02095 – TRANSPORTATION AND DISPOSAL OF SOIL AND FILL

1.3 SUBMITTALS

- A. Submit the following in accordance with Section 01300 – SUBMITTALS:
 - 1. Removal and abandonment procedures that shall provide for safe conduct of the Work, careful removal and disposition of materials and equipment, protection of utilities, structures, property, or other features which are to remain undisturbed and coordination with existing utilities or owners responsible for those nearby elements to remain in service.
 - 2. A detailed work plan to include a list of items to be removed and/or abandoned, a sequence and schedule, and a list of salvageable materials and equipment.
 - 3. Proposed Dust-Control and Noise-Control Measures: Submit statement or drawing that indicates the measures proposed for use, proposed locations, and proposed time frame for their operation. Identify options if proposed measures are later determined to be inadequate.
- B. Schedule of Selective Demolition, Modification and Abandonment Activities
 - 1. The Schedule of Selective Demolition, Modification and Abandonment Activities shall be subject to approval by the Owner and Engineer.

Indicate the following:

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- a. Detailed sequence of selective demolition, modification and abandonment work, with starting and ending dates for each activity. Ensure the Owner's operations are uninterrupted.
 - b. Interruption of utility services.
 - c. Coordination for shutoff, capping, bulkheading and continuation of utility services.
 - d. Proposed materials, construction details, locations of temporary utilities, abandonment materials, and means of access.
 - e. Coordination of Owner's continuing use of portions of utilities, structures, property or other features and of Owner's partial occupancy of completed Work.
- C. Additional Submittals for Selective Demolition, Modification, and Abandonment Activities
1. Inventory: After selective demolition or modifications are complete, submit a list of items that have been removed and salvaged.
 2. Pre-demolition Photographs or Videotape: Show existing conditions of adjoining utility construction and site improvements that might be misconstrued as damage caused by selective demolition or modification operations. Submit before Work begins.
 3. Landfill Records: Indicate receipt and acceptance of all wastes by disposal facility licensed to accept the wastes to be disposed.
- D. Plugs and Bulkheads
1. For each permanent and temporary bulkhead and masonry and mechanical plug, the Contractor, at a minimum, shall submit the following, prepared by a Massachusetts Registered Professional Civil or Structural Engineer:
 - a. Design Loads
 - b. Restraining Mechanisms
 - c. Method of Installation
 - d. Results of Field Inspection after Installation
 - e. Decommissioning Method

2. If temporary pneumatic or hydro plugs are proposed, in addition, the Contractor shall submit the method and procedure of maintaining bladder pressure.

1.4 REPAIR OF DAMAGE

- A. Any damage to existing facilities to remain, as caused by the Contractor's operations shall be repaired at no additional cost to the Owner.
- B. Damaged items shall be repaired or replaced with new materials as required to restore damaged items or surfaces to a condition equal to and matching that existing prior to damage or start of work of this Contract.

1.5 PROTECTION OF EXISTING WORK

- A. Before beginning any cutting, trenching or demolition work, the Contractor shall carefully review the work sequence and examine the Drawings and Specifications to determine the extent of the Work. The Contractor shall take all necessary precautions to prevent damage to existing facilities, which are to remain in place, and be responsible for any damages to existing facilities, which are caused by the operations. Damages to such work shall be repaired or replaced to its existing condition at no additional cost to the Owner. The Contractor shall carefully coordinate the work of this Section with all other work and shall provide shoring, bracing, and supports, as required. The Contractor shall insure that structural elements are not overloaded or compromised and shall be responsible for increasing structural supports or adding new supports as may be required as a result of any cutting, removal, or demolition work performed under any part of this Contract. The Contractor shall remove all temporary protection when the work is complete.
- B. The Contractor shall carefully consider all bearing loads and capacities for placement of equipment and material on site. In the event of any questions as to whether an area to be loaded has adequate bearing capacity, the Contractor shall consult with the Owner prior to the placement of such equipment or material.

1.6 JOB CONDITIONS

- A. The Owner assumes no responsibility for actual condition of the facilities to be removed, abandoned or modified. The Contractor shall visit the site; inspect all facilities to get familiarized with all existing conditions and utilities.
- B. The Owner may occupy portions of the utilities, structures, properties or other facilities immediately adjacent to selective demolition area. Conduct
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selective demolition, modification and abandonment so Owner's operations will not be disrupted. Provide not less than 24 hours notice to Owner of activities that will affect Owner's operations.

- C. Owner assumes no responsibility for condition of the utilities, structures, properties or other facilities to be selectively demolished.
- D. If materials suspected of containing hazardous or asbestos materials are encountered, do not disturb; immediately notify Engineer.
- E. Storage or sale of removed items or materials on-site will not be permitted.
- F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition, modification and abandonment operations.

1.7 QUALITY ASSURANCE

- A. Comply with Section 01400 - QUALITY CONTROL
- B. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.
- C. Pre-Demolition, Modification, and Abandonment Conference: Conduct conference at Project site, which includes Owner and Engineer. Review methods and procedures related to selective demolition.
- D. Review and finalize selective demolition, modification and abandonment schedule and verify availability of materials, labor, equipment, and facilities needed to make progress and avoid delays.

1.8 WARRANTY

- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials so as not to void existing warranties.

PART 2 – PRODUCTS

2.1 MATERIALS

- A. Comply with material and installation requirements specified in individual Specification Sections.

2.2 MATERIALS OWNERSHIP

- A. Coordinate with Engineer and Owner, who will make final determination as to whether an item is to be salvaged or removed. Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, demolished materials shall become Contractor's property and shall be removed from Project site.

2.3 REPAIR MATERIALS

- A. Use repair materials identical to existing materials. If identical materials are unavailable or cannot be used for exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible. Use materials whose installed performance equals or surpasses that of existing materials.

PART 3 – EXECUTION

3.1 DEFINITIONS

- A. Remove: Detach items from existing construction and legally dispose of them off-site, unless indicated to be removed and salvaged or removed and reinstalled.
- B. Remove and Salvage: Detach items from existing construction and deliver them to Owner ready for reuse.
- C. Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.
- D. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

3.2 PREPARATION FOR WORK

- A. Verify that utilities have been disconnected and capped, shut-off, or bulk headed. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition, modification and abandonment required. Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged.
- B. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Engineer.

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- C. Engage a professional engineer to survey condition of structures to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective demolition operations.
- D. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.
- E. Dangerous Materials: Drain, purge, or otherwise remove, collect, and dispose of chemicals, gases, explosives, acids, flammables, or other dangerous materials before proceeding with selective demolition, modification, and abandonment operations.

3.3 SITE ACCESS, TEMPORARY FACILITIES AND PROTECTION

- A. Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used utilities, structures, properties or facilities.
- B. Do not close or obstruct streets, walks, walkways, or other adjacent occupied or used facilities without permission from Owner. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.
- C. Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction.
- D. Protect existing site improvements, appurtenances, and landscaping to remain.
- E. Erect a plainly visible fence around drip line of individual trees or around perimeter drip line of groups of trees to remain.
- F. Temporary Facilities: Provide temporary barricades and other protection required for demolition security and to prevent injury to people and damage to adjacent utilities, structures, properties and facilities to remain.
- G. Provide protection to ensure safe passage of people around the area.
- H. Temporary Shoring: Provide and maintain in accordance with Section 02160 - TEMPORARY EXCAVATION SUPPORT SYSTEMS.
- I. Strengthen or add new supports when required during progress of selective demolition.

- J. Existing landscaping materials, structures, pipes and appurtenances, which are not to be removed/abandoned shall be protected and maintained as required by the Engineer and as specified.

3.4 POLLUTION CONTROL

- A. Water sprinkling, temporary enclosures, and other suitable methods shall be used to limit dust and dirt rising and scattering in the area. Comply with government regulations pertaining to environmental protection. Water shall not be used when it creates hazardous or objectionable conditions such as ice, flooding, or pollution.
- B. Disposal: Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

3.5 CLEANING

- A. During and upon completion of work, the Contractor shall promptly remove unused tools and equipment, surplus materials, rubbish, debris, and dust and shall leave areas affected by work in a clean, approved condition.
- B. All areas shall be cleaned of dust, dirt, and debris caused by demolition, modification, or abandonment and adjacent areas returned to conditions existing prior to start of work.

3.6 UTILITY SERVICES

- A. Existing Utilities: Maintain services indicated to remain and protect them against damage during selective demolition, modification and abandonment operations.
- B. Do not interrupt existing utilities serving occupied or operating facilities unless authorized in writing by Owner and authorities having jurisdiction. Provide temporary services during interruptions to existing utilities, as acceptable to Owner and to authorities having jurisdiction.
- C. Provide at least 72 hours notice to Owner if shutdown of service is required during changeover.
- D. Utility Requirements: Locate, identify, disconnect, and seal or cap off indicated utilities serving areas to be selectively demolished or abandoned.
- E. If utility services are required to be removed, relocated, or abandoned, before proceeding with selective demolition provide temporary utilities that bypass area of selective demolition, relocation or abandonment, and that maintain continuity of service to other parts of building.

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3.7 DEMOLITION AND ABANDONMENT PROCEDURES

- A. Disposal of all materials shall be performed in compliance with applicable local, state, and federal codes and requirements. Provide labor, equipment, and materials to perform work as specified and indicated.
- B. The Contractor shall flush all pipe and structures to be removed or abandoned to remove solids and objectionable material prior to commencing demolition, modification, or abandonment.
- C. When existing pipe is removed, the Contractor shall plug all resulting abandoned connections whether or not shown. Where removed piping is exposed, the remaining piping shall be fitted with a removable cap or plug, or bulk headed. Where existing piping, to include catch basin laterals, is to be abandoned, the Contractor shall cut back the abandoned pipe for a distance of 5 feet from any connecting structures to remain. Pipes to be abandoned in structures to be abandoned may be capped, plugged or bulk headed from inside the structure. All holes at the existing structures shall be repaired. Abandoned pipe smaller than 15 inches diameter shall be capped or plugged at both ends prior to backfill. Abandoned pipe 15 inches diameter and larger shall be filled with Controlled Density Fill (CDF) prior to being capped, plugged, or bulk headed and backfilling unless otherwise noted. Each pipe reach to be abandoned with CDF shall be filled with CDF from the up gradient end of the pipe reach wherever possible. The CDF shall completely fill each pipe reach and flow out the other end. The Contractor can aid the flow of the CDF in the pipe by providing a temporary structure at the access point to build up head or by pumping the CDF or by providing vibration in the pipe reach or access point. Requirements for Controlled Density Fill are described in Section 02210 – EARTH EXCAVATION, BACKFILL, FILL AND GRADING.
- D. Where existing drainage structures such as catch basins, drain manholes, sewer manholes, and combined sewer manholes are to be abandoned in place, the Contractor shall remove the frames, grates, and covers and cut the structures down a minimum of 2 feet below final grade. The Contractor shall put a minimum of four, 2-inch diameter drainage holes in the invert of each structure and then backfill the structure with flowable fill or sand as specified and as approved by the Engineer. Backfill around the structure shall be in accordance with Section 02210 – EARTH EXCAVATION, BACKFILL, FILL AND GRADING.
- E. Permanent plugs shall be constructed of Class B concrete, brick or other material approved by the engineer unless otherwise indicated on the Contract Drawings.
- F. Fill excavations with solid fill resulting from earth removal operations and/or with select borrow material in accordance with Section 02210 – EARTH DEMOLITION, MODIFICATION, AND

EXCAVATION, BACKFILL, FILL AND GRADING. Final grade to be restored in kind unless otherwise noted.

- G. Exercise precautions for fire prevention. Make fire extinguishers approved for Class A, B and C fires available at all times in areas where performing demolition or abandonment work with burning torches. Do not burn demolition debris on site.

3.8 SELECTIVE DEMOLITION

- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Neatly cut openings, joints and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
2. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
3. Maintain adequate ventilation when using cutting torches.
4. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
5. Dispose of demolished items and materials promptly.
6. Return elements of construction and surfaces that are to remain to condition existing before selective demolition operations began.
7. Existing Facilities: Comply with Owner's requirements for using and protecting utilities, structures, properties and other facilities.

- B. Removed and Salvaged Items: Comply with the following:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.

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3. Store items in a secure area until delivery to Owner.
 4. Transport items to Owner's storage area designated by Owner.
 5. Protect items from damage during transport and storage.
- C. Removed and Reinstalled Items: Comply with the following:
1. Clean and repair items to functional condition adequate for intended reuse. Paint equipment to match new equipment.
 2. Pack or crate items after cleaning and repairing. Identify contents of containers.
 3. Protect items from damage during transport and storage.
 4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.
- D. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Engineer, items may be removed to a suitable, protected storage location during selective demolition, cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.9 REHABILITATION/MODIFICATION PROCEDURES

- A. Certain areas of existing piping, conduits, and the like will be affected by work necessary to complete modifications under this Contract. The Contractor shall be responsible to rehabilitate those areas affected by his construction activities.
- B. When new piping is installed in existing manholes, catch basins or other structures, the Contractor shall accurately position core-drilled openings in the concrete as shown or otherwise required. Openings shall be of sufficient size to permit a final alignment of pipelines and fittings without deflection of any part and to allow adequate space for satisfactory installation of a flexible connector to ensure watertightness around openings so formed.
- C. When new piping is to be connected to existing piping, the existing piping shall be cut square and ends properly prepared for the connection shown. Any damage to the lining and coating of the existing piping shall be repaired by the Contractor.

3.10 DISPOSAL OF REMOVED/DEMOLISHED MATERIALS

- A. The Contractor shall prepare and transport all demolition debris, materials, refuse, and abandoned equipment to an approved disposal site as part of the work under this section. All costs associated with the proper performance of this work shall be included in the appropriate Bid Items and at no additional cost to the Owner.
- B. Promptly dispose of demolished materials. Do not allow demolished materials to accumulate on-site. Demolition material shall be reused as fill to the extent possible. Removal of demolition debris, not utilized as fill, shall be conducted to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities which shall not be closed or obstructed without permission from the Owner. Alternate routes shall be provided around closed or obstructed traffic ways.
- C. Burning: Do not burn demolished materials.
- D. Disposal: Transport demolished materials off Owner's property and legally dispose of them. See Sections 02095 – TRANSPORTATION AND DISPOSAL OF SOIL AND FILL and 02080 – SOIL AND WASTE MANAGEMENT as they relate to the transportation and disposal of non-hazardous and hazardous solid waste.

3.11 REPAIR OF DAMAGE

- A. Any damage to existing facilities to remain, as caused by the Contractor's operations shall be repaired at no additional cost to the Owner. Damaged items shall be repaired or replaced with new materials as required to restore damaged items or surfaces to a condition equal to and matching that existing prior to damage or start of work of this Contract.
- B. Promptly repair damage to adjacent construction caused by selective demolition operations.
- C. Patching: Comply with Section 01045 - CUTTING AND PATCHING.
- D. Repairs: Where repairs to existing surfaces are required, patch to produce surfaces suitable for new materials.
- E. Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.

3.12 MASONRY PLUGS AND BULKHEADS

- A. Shall be designed by a Massachusetts Registered Professional Civil or Structural Engineer and shall be installed by a qualified mason having
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experience in the construction of temporary and permanent masonry plugs and bulkheads of the same general nature of those Specified and proposed.

PART 4 – COMPENSATION

Item 2051.1 - Disposal of Construction Debris as Solid Waste

METHOD OF MEASUREMENT:

Measurement for payment for Disposal of Construction Debris as Solid Waste shall be on the basis of Tons of waste actually disposed, as measured at the disposal facility by certified scale, and documented on the return manifest or certified weight slip. Solid Waste disposed of for which return manifests or certified weight slips have not been submitted will not be paid for.

BASIS OF PAYMENT / INCLUSIONS:

Payment for Disposal of Construction Debris as Solid Waste shall be based on the per ton price bid for this item in the proposal. Under the per ton price for this item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required to Dispose of Construction Debris as Solid Waste. The work includes, but is not limited to; handle, load, transport, stockpile, weigh and dispose at an appropriately permitted facility; all cobbles, rail, timber, brick, cement concrete, metals, granite curb, edging, inlets and corners, plastic, or other construction debris; and all fees, permits, taxes, sampling, testing and analysis required by the facility.

SPECIAL NOTES ON EXCLUSIONS:

The excavation and removal of the items listed above for disposal are not included herein but are included for payment elsewhere. This is a disposal item only. Soils are not included for payment herein but are included for payment in the appropriate soil disposal item. Soil weight excavated and disposed with Construction Debris due to poor segregation techniques shall be estimated by the Engineer and deducted from the total weight disposed. Disposal of bituminous concrete is not paid for herein but is included for payment elsewhere. Bituminous Concrete weight excavated and disposed with Construction Debris due to poor segregation techniques shall be estimated by the Engineer and deducted from the total weight disposed. Payment for the disposal of abandoned or relocated existing gas, telephone, electric, cable TV, telecommunications, fire alarm and traffic signal utilities shall NOT be paid herein or separately elsewhere and are considered “incidental” to the Contract, with costs to be carried in the Contractor’s base bid. Disposal of concrete and brick sidewalks, driveways, and pedestrian ramps removed and disposed of is not included herein but is carried under the unit price for the construction of the new sidewalks, driveways and pedestrian ramps.

Item 2051.2 - Disposal of Bituminous Concrete

METHOD OF MEASUREMENT:

Measurement for payment for Disposal of Bituminous Concrete shall be on the basis of Tons of bituminous concrete actually disposed, as measured at the disposal facility by certified

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scale, and documented on the return manifest or certified weight slip. Bituminous Concrete disposed of for which return manifests or certified weight slips have not been submitted will not be paid for.

BASIS OF PAYMENT / INCLUSIONS:

Payment for Disposal of Bituminous Concrete shall be based on the per ton price bid for this item in the proposal. Under the per ton price for this item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required to Dispose of Bituminous Concrete. The work includes, but is not limited to; handle, load, transport, stockpile, weigh and dispose at an appropriately permitted facility all bituminous concrete; and all fees, permits, taxes, sampling, testing and analysis required by the facility.

SPECIAL NOTES ON EXCLUSIONS:

The excavation and removal of bituminous concrete is not included herein. The excavation of bituminous concrete is considered incidental to the contract and is not included for separate payment unless otherwise specified. This is a disposal item only. Soils are not included for payment herein but are included for payment in the appropriate soil disposal item. Soil weight excavated and disposed with Bituminous Concrete Pavement due to poor segregation techniques shall be estimated by the Engineer and deducted from the total weight disposed. Disposal of construction debris as solid waste is not included for payment herein but is included for payment elsewhere.

Item 2051.3 - Demolition or Removal of Lamp Hole, Manhole, Catch Basin, or Other Structure

METHOD OF MEASUREMENT:

Measurement for payment for Demolition or Removal of Lamp Hole, Manhole, Catch Basin or Other Structure shall be on the basis of the number of individual lamp holes, manholes, catch basins or other structures demolished or removed complete as measured by the Engineer. Lamp holes, manholes, catch basins or other structures demolished or removed for the Contractor's convenience, not indicated to be removed or demolished, in the Contract, will be at the Contractor's expense and at no additional cost to the Owner.

BASIS OF PAYMENT / INCLUSIONS:

Payment for Demolition or Removal of Lamp Holes, Manholes, Catch Basins or Other Structures shall be based on the number of individual lamp holes, manholes, catch basins or other structures demolished or removed complete for this item in the proposal. Under the per each price for this item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required to Demolish or Remove a Lamp Hole, Manhole, Catch Basin or Other Structure. The work includes, but is not limited to: saw cutting existing bituminous and cement concrete; excavation; furnishing and placing backfill per one of the approved methods; furnish and install filter fabric as required; compaction and compaction testing; temporary excavation support furnished and installed complete; construction dewatering; disconnecting existing pipe, services and other connections; removal or demolition of the lamp hole, manhole, catch basin or other structure; masonry plugs in the disconnected pipe not specified for payment elsewhere; remove and stack or remove and dispose existing castings as required; salvage of materials specified; stockpile of salvaged materials and

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delivery of materials identified as to be salvaged to a location designated by the Owner.

SPECIAL NOTES ON EXCLUSIONS:

The following items are not included for payment under this item but are included for separate payment elsewhere; disposal of construction debris as solid waste; demolition and removal of pipes; lamp holes, manholes, catch basins or other structures abandoned in place, not fully demolished or removed. The demolition of existing, abandoned or relocated gas, electric, telephone, cable TV, fire alarm, traffic signal, or telecommunications structures and utilities are not included for payment herein or elsewhere but are considered incidental to the Contract and the Contractor shall carry costs in the base bid as necessary.

Item 2051.4 - Abandon In Place Manhole, Catch Basin, or Other Structure

METHOD OF MEASUREMENT:

Measurement for payment for Abandon in Place Manhole, Catch Basin or Other Structure shall be on the basis of the number of individual manholes, catch basins or other structures abandoned in place as specified herein and as measured by the Engineer.

BASIS OF PAYMENT / INCLUSIONS:

Payment for Abandon in Place of Manholes, Catch Basins or Other Structures shall be based on the per number of individual manholes, catch basins or other structures abandoned in place complete for this item in the proposal. Under the per each price for this item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required to Abandon in Place a Manhole, Catch Basin or Other Structure. The work includes, but is not limited to; saw cutting existing bituminous or cement concrete; excavation; furnishing and placing backfill per one of the approved methods; furnish and install filter fabric as required; compaction and compaction testing; temporary excavation support furnished and installed complete; construction dewatering; disconnecting existing pipe, services and other connections; remove and stack or remove and dispose existing castings as directed; cutting and demolition of the manhole, catch basin or other structure sections 2-ft below finished grade; masonry plugs in the disconnected pipe not specified for payment elsewhere; stockpile of salvaged materials and delivery of materials identified as to be salvaged to a location designated by the Owner; drill 2-in holes in invert of structure and furnish, install and compact Controlled Density Fill or Sand in the manhole, catch basin or structure to be abandoned.

SPECIAL NOTES ON EXCLUSIONS:

The following items are not included for payment under this item but are included for separate payment elsewhere; disposal of construction debris as solid waste and demolition and removal of pipes, manholes, catch basins or other structures. The abandonment-in-place of existing, abandoned or relocated gas, electric, telephone, cable TV, fire alarm, traffic signal, or telecommunications structures and utilities are not included for payment herein or elsewhere but are considered incidental to the Contract and the Contractor shall carry costs in the base bid as necessary.

Item 2051.5 - Demolition or Removal of Pipe Greater than 15-inch Through 36-inch Pipe Diameter

METHOD OF MEASUREMENT:

Measurement for payment for Demolition or Removal of Pipe Greater Than 15-inch Diameter Through 36-inch Diameter shall be based on the per linear feet of individual pipes, 15-inch through 36-inch diameter, demolished or removed complete as measured by the Engineer as measured from inside wall of structure or beginning of demolition to inside wall of structure or end of demolition. Pipe demolished or removed for the Contractor's convenience, not indicated to be removed or demolished in the Contract, will be at the Contractor's expense and at no additional cost to the Owner.

BASIS OF PAYMENT / INCLUSIONS:

Payment for Demolition or Removal of Pipe Greater Than 15-inch Diameter Through 36-inch Diameter shall be based on the instances that the pipe, greater than 15-inch through 36-inch diameter, is demolished or removed complete for this item in the proposal. Under the per unit price for this item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required to Demolish or Remove pipe greater than 15-inch diameter through 36-inch diameter. The work includes, but is not limited to; saw cutting; excavation; furnish and placing backfill per one of the approved methods; furnish and install filter fabric as required; compaction and compaction testing; temporary excavation support furnished and installed complete; construction dewatering; disconnecting existing pipe, services and other connections; verify function of all existing connections including those that are abandoned or those to be transferred to an active and functioning pipe; demolition and removal of the pipe; salvage of materials specified; stockpile of salvaged materials and delivery of materials identified as to be salvaged to a location designated by the Owner.

SPECIAL NOTES ON EXCLUSIONS:

The following items are not included for payment under this item but are included for separate payment elsewhere; disposal of construction debris as solid waste; masonry plugs or bulkheads in abandoned pipe; demolition and removal of 22-inch x 28-inch old sewer within the alignment of the proposed Storm Drain; and demolition and removal manholes, catch basins or other structures. The demolition of existing, abandoned or relocated gas, electric, telephone, cable TV, fire alarm, traffic signal, or telecommunications structures and utilities are not included for payment herein or elsewhere but are considered incidental to the Contract and the Contractor shall carry costs in the base bid as necessary.

Item 2051.6 - Demolition or Removal of Pipe Greater than 36-inch Through 48-inch Pipe Diameter

METHOD OF MEASUREMENT:

Measurement for payment for Demolition or Removal of Pipe Greater Than 36-inch Diameter Through 48-inch Diameter shall be based on the per linear feet of individual pipes, 36-inch through 48-inch diameter, demolished or removed complete as measured by the Engineer as measured from inside wall of structure or beginning of demolition to inside wall of structure or end of demolition. Pipe demolished or removed for the Contractor's convenience, not indicated to be removed or demolished in the Contract, will be at the

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Contractor's expense and at no additional cost to the Owner.

BASIS OF PAYMENT / INCLUSIONS:

Payment for Demolition or Removal of Pipe Greater Than 36-inch Diameter Through 48-inch Diameter shall be based on the instances that the pipe, greater than 36-inch through 48-inch diameter, is demolished or removed complete for this item in the proposal. Under the per unit price for this item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required to Demolish or Remove pipe greater than 36-inch diameter through 48-inch diameter. The work includes, but is not limited to; saw cutting; excavation; furnish and placing backfill per one of the approved methods; furnish and install filter fabric as required; compaction and compaction testing; temporary excavation support furnished and installed complete; construction dewatering; disconnecting existing pipe, services and other connections; verify function of all existing connections including those that are abandoned or those to be transferred to an active and functioning pipe; demolition and removal of the pipe; salvage of materials specified; stockpile of salvaged materials and delivery of materials identified as to be salvaged to a location designated by the Owner.

SPECIAL NOTES ON EXCLUSIONS:

The following items are not included for payment under this item but are included for separate payment elsewhere; disposal of construction debris as solid waste; masonry plugs or bulkheads in abandoned pipe; and demolition and removal of manholes, catch basins or other structures. The demolition of existing, abandoned or relocated gas, electric, telephone, cable TV, fire alarm, traffic signal, or telecommunications structures and utilities are not included for payment herein or elsewhere but are considered incidental to the Contract and the Contractor shall carry costs in the base bid as necessary.

Item 2051.7 - Demolition or Removal of Pipe -22-Inch x 28-Inch Old Sewer

METHOD OF MEASUREMENT:

Measurement for payment for Demolition or Removal of Pipe -22-Inch x 28-Inch Old Sewer shall be based on the per linear feet of individual pipes, 22-inch x 28-inch old sewer within the alignment of the proposed Storm Drain, demolished or removed complete as measured by the Engineer as measured from inside wall of structure or beginning of demolition to inside wall of structure or end of demolition. Pipe demolished or removed for the Contractor's convenience, not indicated to be removed or demolished in the Contract, will be at the Contractor's expense and at no additional cost to the Owner.

BASIS OF PAYMENT / INCLUSIONS:

Payment for Demolition of Removal of Pipe -22-Inch x 28-Inch Old Sewer shall be based on the instances that the 22-inch x 28-inch Old Sewer, is demolished or removed complete for this item in the proposal. Under the per unit price for this item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required to Demolish or Remove the 22-inch x 28-inch old sewer within the proposed storm drain alignment. The work includes, but is not limited to; saw cutting; excavation below grade of proposed storm drain to remove 22-inch x 28-inch sewer; furnish and placing backfill per one of the approved methods; furnish and install filter fabric as required; compaction and compaction testing; temporary excavation support furnished and installed complete; construction dewatering; disconnecting

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existing pipe, services and other connections; verify function of all existing connections including those that are abandoned or those to be transferred to an active and functioning pipe; demolition and removal of the pipe; salvage of materials specified; stockpile of salvaged materials and delivery of materials identified as to be salvaged to a location designated by the Owner.

SPECIAL NOTES ON EXCLUSIONS:

The following items are not included for payment under this item but are included for separate payment elsewhere; disposal of construction debris as solid waste; masonry plugs or bulkheads in abandoned pipe; demolition and removal of 22-inch x 28-inch pipes outside alignment of proposed storm drain; and demolition and removal of manholes, catch basins or other structures. The demolition of existing, abandoned or relocated gas, electric, telephone, cable TV, fire alarm, traffic signal, or telecommunications structures and utilities are not included for payment herein or elsewhere but are considered incidental.

Item 2051.8 – Bulkhead for Pipe Plug or Abandonment Equal to or Greater than 30-inch Diameter

METHOD OF MEASUREMENT:

Measurement for payment for Bulkhead for Pipe Plug or Abandonment Equal to or Greater than 30-inch Diameter shall be based on the per each masonry bulkhead installed within pipes greater than or equal to 30-inch diameter installed complete as measured by the Engineer. Pipe abandoned or plugged for the Contractor's convenience, not indicated to be removed or demolished in the Contract, will be at the Contractor's expense and at no additional cost to the Owner.

BASIS OF PAYMENT / INCLUSIONS:

Payment for Bulkhead for Pipe Plug or Abandonment Equal to or Greater than 30-inch Diameter, is installed complete for this item in the proposal. Under the per unit price for this item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required to install bulkhead within pipe equal to or greater than 30-inches in diameter for the purposed of a plug or an abandonment. The work includes, but is not limited to; furnish and placing masonry bricks and mortar of the approved method.

END OF SECTION 02051

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SECTION 02080

SOIL AND WASTE MANAGEMENT

2080.1	OHM - SOIL AND WASTE MANAGEMENT	LUMP SUM
2080.2	OHM - HANDLING ASBESTOS CONTAMINATED SOIL/FILL	CUBIC YARD
2080.3	OHM - HANDLE AND CHARACTERIZE UNKNOWN MATERIAL	CUBIC YARD

PART 1 – GENERAL

1.1 QUALIFICATIONS

- A. The Contractor shall be experienced and knowledgeable and have the trained and qualified personnel needed to conduct the work as specified herein.

1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.
- B. The following documents are available for review at the office of the Owner, 147 Hampshire St, Cambridge, MA 02139 and appended to the technical specifications in Appendices or the Attachment to the Special Conditions in Division 0.
 - 1. Memorandum – Oil and Hazardous Materials Findings and Soil Management Recommendations, Western Avenue Infrastructure Improvements Project, Cambridge, Massachusetts, dated June 30, 2011.
 - 2. Summary of Analytical data and boring logs, completed January 2010.
 - 3. City of Cambridge Asbestos Ordinance.

1.3 OBJECTIVE and OVERVIEW

- A. This Section includes furnishing all plant, labor, equipment, appliances, and materials, and performing all operations in connection with the

handling, treating, stockpiling, transporting, and disposal and/or reuse of soil and associated fill and waste material resulting from the construction operations as specified.

- B. This Section also includes requirements for handling spills of contaminated and/or hazardous materials.
- C. The objective of soil management practices is to handle all soil and fill excavated during this contract in accordance with applicable state, federal and local regulations and bylaws and to implement off-site soil management in a cost-effective manner. The Contractor shall reuse excavated soils on-site to the maximum extent possible and minimize the volume of material to be disposed off-site.
- D. This Section includes protocol for handling and management of waste materials, including, but not limited to, construction debris, municipal waste, boulders, soil, fill, ash, rubble, and empty or crushed drums and/or drum parts. The Contractor shall provide the services of an Environmental Professional qualified to coordinate all soil/fill-handling activities with the Owner or Engineer and/or their representative.
- E. In the course of the work, it may be necessary to excavate and handle potentially contaminated soil/fill. The soil/fill management practices specified herein apply to all soil/fill excavated during the course of this contract. To the extent possible, the Contractor shall reuse geotechnically suitable excavated material prior to using imported backfill to reduce the volume of material to be disposed off-site. Imported backfill shall be used only as accepted by the Engineer.
- F. All work shall be conducted in compliance with the following Contractor-prepared plans:
 - 1. Site-Specific Health and Safety Plan;
 - 2. Soil Management Plan;
 - 3. Equipment and Personnel Decontamination Plan;
 - 4. Dust, Vapor and Odor Control Plan;
 - 5. Air Monitoring and Quality Control Plan; and
 - 6. Spill and Discharge Control Plan.

1.4 DEFINITIONS

- A. **Area of Excavation:** For the purposes of reusing soil/fill on-site, the *area of excavation* is considered to be the approximate area in which the soil/fill was removed provided that area is consistent in soil strata, color, texture, geotechnical properties and has substantially similar visual and

olfactory characteristics as accepted by the Engineer. Soil/fill returned to the *area of excavation* shall be placed approximately in the same horizontal and vertical location from which it originated.

- B. Excavation: The removal of materials encountered to the elevation and width limits indicated in the Contract Drawings, Specifications, or as directed by the Engineer.
- C. Fill (Historic Fill): Fill, also known as historic fill or miscellaneous fill, is defined as a mixture of soil and other materials which have been located in the area through man-made processes primarily for the purpose of grading, backfilling or filling in low areas. Materials commonly associated with historic fill includes, but are not limited to; coal, glass, brick, ash, wood fragments and other similar granular materials. Historic fill shall not include boulders, ledge, consolidated rock, asphalt pieces, concrete, railroad timbers, rail, cobblestones or other abandoned building materials that would preclude the disposal of the urban fill as daily cover at a landfill.
- D. Hazardous Waste:
 - 1. Defined in 310 CMR 40.0006; or
 - 2. Defined in 40 CFR 261.3.
 - 3. A waste, or combination of wastes, that, because of its quantity, concentration, or physical, chemical, or infectious characteristics may:
 - a. Cause or significantly contribute to an increase in mortality or cause or significantly contribute to an increase in a serious irreversible or incapacitating reversible illness; or
 - b. Pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, disposed of, or otherwise managed.
- E. Peat: A substance of vegetable origin, consisting of roots and fibers, moss, etc., in various stages of decomposition, and found as a kind of turf or bog. Peat shall be considered natural soil when it is encountered in small amounts (layers 1-foot (304.8 mm) or less in thickness) and when it is impractical to separate the peat from the natural soil or urban fill strata. Otherwise, peat shall be considered a distinctive stratum.
- F. Sediment: All detrital and inorganic or organic matter situated on the bottom of lakes, ponds, streams, rivers, the ocean, or other surface water bodies.

G. Soil Classification Categories: Unless specifically stated otherwise terms used in this specification are as defined in the MCP, 310 CMR 40.0006. For purposes of this Section, sediments shall also be included as soil. The following definitions and soil classifications apply to these specifications:

1. (Class A-1) Background: Any soil or fill material which meets the regulatory definition of "background" as defined in 310 CMR 40.0006 may be reused as common fill/ordinary borrow provided it also meets the physical requirements as specified herein and as specified in Section 02210 - Earth Excavation, Backfill, Fill and Grading. Excess soil/fill that meets the definition of background, shall be transported under a Material Shipping Record (MSR).

Background soil may also be re-used off-site without restriction provided it is reused in an area where the excavated soils concentrations are equal to or less than the site-specific background determined at the off-site reuse location. The Contractor is responsible for determining the background levels in the area of excavation. The Contractor shall identify one or more disposal facilities/locations with background levels appropriate to receive the material to be disposed. It is the Contractor's responsibility to determine these background levels in advance so as to comply with 310 CMR 40.0032(3)(b) and so as not to delay or adversely affect construction operations.

2. (Class A-2) Impacted: Any soil or fill material which contains oil or hazardous materials (OHM) at concentrations greater than background levels but less than release notification thresholds established by 310 CMR 40.0300 and 40.1600. Impacted soil may be reused in the area of excavation or as fill provided it is reused in an area of equal or greater contamination and meets the physical requirements as specified herein and as specified in Section 02210 - Earth Excavation, Backfill, Fill and Grading. Class A-2 soils requiring off-site transportation and disposal/reuse shall be transported using a Material Shipping Record (MSR).
3. (Class B) Contaminated: Any soil or fill material which contains oil or hazardous materials at concentrations equal to or greater than a release notification threshold established by 310 CMR 40.0300 and 40.1600, except where the presence of the material is consistent with the regulatory definition of "background" as defined in 310 CMR 40.0006.

Any soils which contain either petroleum or chemical odor or visual indications of oil or hazardous materials as accepted by the Engineer

shall be handled as potentially contaminated soils. Soil which do not exhibit any evidence of contamination can be reused within the area of excavation without first performing laboratory analyses. Any excavated soil/fill material which is not reused within the area of excavation, must be characterized prior to reuse. After analytical results are available, soil/fill shall be handled in accordance with the type and degree of contamination (if any) present in the soil/fill. Soil/fill which may be contaminated shall be set aside by the Contractor for assessment by the Contractor's Environmental Professional. Soil/fill which is staged and characterized can be reused within the area of excavation or elsewhere on site provided the material has been tested and has equal or less contamination than the point where it is to be reused and it is not reused beneath a permanent structure such as a building foundation.

4. Class B soil which cannot be reused on site shall be reused off-site, recycled, or disposed of at a permitted facility unless it also meets the regulatory definition of hazardous waste as defined in 40 CFR part 261 or contains detectable asbestos. Subcategories of Class B are defined as follows:
 - a. Class B-1: Soil and Fill that meet all applicable criteria (i.e., Massachusetts Department of Environmental Protection (MassDEP) Policy # COMM 97-001 - Reuse and Disposal of Contaminated Soil at Massachusetts Landfills Policy, and/or facility-specific permit requirements) for reuse as daily cover, intermediate cover, or pre-cap contouring material at in-state unlined landfills. Note: per COMM 97-001, sediments may not be re-used as Class B-1.
 - b. Class B-2: Soil and Fill that meet all applicable criteria (i.e., COMM 97-001 and/or facility-specific permit requirements) for reuse as daily cover, intermediate cover, or pre-cap contouring material at in-state lined landfills.
 - c. Class B-3: Soil and Fill that meet all applicable criteria for in-state recycling at an asphalt batching plant and/or the specific licensing requirements for the proposed in-state recycling facility.
 - d. Class B-4: Soil and Fill that contain concentrations of contaminants that exceed in-state, lined, and unlined landfill reuse criteria as well as in-state recycling acceptance criteria, but meet the criteria for regional thermal treatment facilities or out-of-state recycling facilities, and are not classified as a RCRA Hazardous Waste.
 - e. Class B-5: Soil and Fill that contain concentrations of contaminants that require removal to regional disposal facilities and are not classified as RCRA Hazardous Waste.

- f. Class B-6: Soil and fill which does not meet one of the designations above due to excessive foreign materials and/or debris that are not classified as a hazardous waste.
- 5. (Class C) Hazardous Waste: A waste, or combination of wastes, that, because of its quantity, concentration, or physical, chemical, or infectious characteristics may cause or significantly contribute to an increase in mortality or cause or significantly contribute to an increase in a serious irreversible or incapacitating reversible illness; or pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, disposed of, or otherwise managed. Also included within the definition of hazardous waste is hazardous waste as defined 310 CMR 40.0006 and 40.CFR 261.3. Hazardous waste as defined in 40 CFR 261.3 is a solid waste that exhibits any of the characteristics of hazardous waste in excess of regulation levels presented in 40 CFR 261, subpart C and/or that is listed in 40 CFR 261, subpart D; that is a mixture of solid and hazardous waste; or that is derived from a listed waste. Subcategories of Class C shall be as follows:
 - a. Class C-1: Soils classified as hazardous waste that can be treated on-site to eliminate the toxicity characteristic (e.g., for lead).
 - b. Class C-2: Material determined to contain "listed" or "characteristic" hazardous waste constituents which cannot be treated on-site. This material must be transported to an out-of-state approved RCRA Subtitle C hazardous waste disposal or treatment facility under a Uniform Hazardous Waste Manifest.
- H. Special Waste: means any solid waste that is determined not to be a hazardous waste pursuant to 310 CMR 30.000 and that exists in such quantity or in such chemical or physical state, or any combination thereof, so that particular management controls are required to prevent an adverse impact from the collection, transport, transfer, storage, processing, treatment or disposal of the solid waste. Asbestos and PCB-contaminated soils/fill (at regulated concentrations) are examples of special waste categories.
- I. Soil (Natural Soils): Soil, otherwise known as natural soil, is defined as unconsolidated sand, gravel, silt and clay, and the organic material which has become part of the unconsolidated soil matrix.
- J. Over Excavation: Consists of removal of materials beyond indicated elevations and width limits indicated in the Contract Documents without direction of the Engineer. Over-excavation material handling,

transportation and disposal, backfilling and compaction shall be at the Contractor's expense. Over-excavations shall be backfilled and compacted as specified for excavations of the same class, unless otherwise directed by the Engineer.

- K. Unknown Materials: Any material, that is not readily identifiable as non-hazardous waste, and which has not been previously characterized or encountered during site investigation activities. The Unknown Material classification is to be used in the event that an unexpected, unusual material is encountered for which special handling procedures shall be required in order to handle the material safely. Such wastes include but are not limited to:
1. Unlabelled drums or containers containing material which is not readily identifiable as a non-hazardous substance.
 2. Any material which varies significantly from material previously observed on site and which cannot be readily identified as a non-hazardous.
 3. Waste material of unusual color or odor or material with indications of hazardous levels (e.g. exceeding OSHA permissible exposure limits) of contaminants as evidenced on an organic vapor monitor or other similar instrument.

The Owner reserves the right to apply generator knowledge to classify and profile the material as a previously encountered waste or as a known waste. In the event that a material is encountered which the Contractor is uncertain as to its nature, the Owner or their representative shall assess the material with the Contractor and direct the Contractor as to the nature of the material being known or unknown.

1.5 WORK INCLUDED

- A. Managing excavated soil and fill material.
- B. Characterization of soil, fill, and unknown material for disposal/reuse purposes; field screening and soil management/segregation; temporary storage/staging; and characterization (as may be necessary for unknown materials and/or for compliance with receiving facility requirements); and disposal and/or reuse of excavated soil and fill material.

All laboratory chemical analyses conducted shall utilize currently accepted U.S. EPA and applicable state agency analytical protocols and procedures.

- C. Management of contaminated groundwater: If groundwater potentially impacted by OHM, based on visual or olfactory evidence, is encountered in the course of the work, construction dewatering and discharge permits and groundwater treatment may be necessary depending upon the discharge method(s) and/or location(s) utilized by the Contractor. The Owner and Engineer shall be notified by the Contractor if groundwater potentially impacted by OHM is identified.
- D. All work at the site must be performed in accordance with all applicable federal, state, and local regulations, permits and licenses, including, but not limited to:
1. The applicable parts of the Code of Federal Regulation (CFR) Title 40: Protection of Environment, pertaining to the Comprehensive Environmental Response and Liability Act (CERCLA) and the Superfund Amendments and Reauthorization Act (SARA), RCRA, and the National Emission Standards for Hazardous Air Pollutants (NESHAPS) as regulated by the U.S. Environmental Protection Agency (U.S. EPA);
 2. State regulations specified in the Massachusetts Contingency Plan (MCP) (310 CMR 40.0000), and Massachusetts General Law 21E - Massachusetts Oil and Hazardous Materials Release Prevention and Response Act, and applicable Massachusetts Department of Environmental Protection (MassDEP) guidelines and policies;
 3. Department of Transportation (DOT) regulations 49 CFR, and state transportation licenses and permits;
 4. OSHA regulations (including, but not limited to, 29 CFR 1910.1000, 29 CFR 1926, and CFR 1910.120), 40-hour Occupational Safety and Health Administration (OSHA) training (plus 8-hour refresher training) and all other applicable state and federal regulations regarding health and safety requirements;
 5. NIOSH/OSHA/USCG/EPA: "Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities" October 1985, DHHS (NIOSH). Publ. No. 85-115;
 6. Department of Transportation training;
 7. U.S. Army Corps of Engineers Section 404 Programmatic General Permit, Commonwealth of Massachusetts;
 8. General Contractor's license;

9. National Pollutant Discharge Elimination System (NPDES) Notice of Intent (NOI) to discharge and permits;
 10. Regional and local Publicly Owned Treatment Works (POTW) pre-treatment and construction dewatering requirements and permits;
 11. NPDES General Permits;
 12. Excavation and/or grading permits;
 13. Special use permits;
 14. Special waste haulers certificate;
 15. Massachusetts Wetlands Protection Act and associated Order of Conditions; and
 16. The Contractor's Soil Management Plan (SMP) and Health and Safety Plan to protect the workers and the public.
- E. Implementation of the submitted HASP and other applicable monitoring and control plans includes establishing work zones (e.g., support zone, contamination reduction zone, exclusion zone), preparing a decontamination pad(s) and staging area(s), performing the appropriate environmental monitoring, training and medical monitoring of personnel, coordinating waste disposal and waste characterization as needed.
- F. The Contractor's Environmental Professional shall characterize all excavated soil and fill material prior to reuse or disposal. Characterization requirements may vary depending on the site selected to receive soil suitable for reuse or the disposal facility permits and policies. The Contractor is responsible for final waste characterization and shall determine if any additional waste characterization is required at no additional cost to the Owner.
- G. The Contractor shall develop, implement, maintain, supervise, and be responsible for all soil management practices during the course of this contract. The Contractor's Environmental Professional shall be present during all field screening, segregating, handling, and characterization of all soils excavated in the course of completing this contract to ensure that soil is managed in accordance with applicable laws, regulations, and this Section.

Soil management activities shall include and be conducted as specified herein:

1. Providing and constructing a secure soil staging area sized to adequately segregate soils in accordance with the conditions specified without impeding construction-related activities. The Contractor is to use existing information and obtain additional information as may be needed at no additional cost to the Owner to minimize the need for a staging area. If a staging area is required to characterize unknown or excess material for any reason, the Contractor is responsible for locating, selecting, preparing and securing the area.
2. Excavated soil that cannot be re-used on site shall either be loaded directly into containers for off-site reuse or disposal (provided the material is consistent in visual, olfactory and chemical characteristics as observed in previous investigations) or be staged at a location determined and secured by the Contractor pending sampling and analytical characterization by the Contractor's Environmental Professional. Since individual disposal facilities have different permit conditions and specific pre-characterization data requirements, the Contractor is responsible for final soil characterization prior to transport and disposal. The Contractor is hereby made aware that for the purposes of disposal, final soil characterization is the responsibility of the Contractor and costs for securing a staging area and conducting waste characterization shall be incorporated into the Contractor's bid price for construction.
3. The Contractor shall control and contain runoff of free liquids drained from stockpiled soil/fill. Free liquids shall be managed in accordance with applicable regulations.
4. Soil that has been chemically stabilized shall be confirmed through laboratory chemical analysis to be characteristically non-hazardous pursuant to RCRA prior to off-site shipment and disposal.
5. Soil/fill shall not be staged within 100 feet (30.5 meters) of a Reservoir or Area of Critical Environmental Concern. Soil/fill shall not be staged in the work area over night.
6. Excavating unknown, previously uncharacterized material which may be classified as RCRA hazardous waste and disposing of it at an approved facility and/or on-site treatment of these materials to render it non-hazardous prior to and disposing of it at an approved facility.
7. Removing characterized on-site materials for off-site re-use or disposal.

8. Demobilizing the site, including, but not limited to, removing and disposing of construction-related equipment and materials used for personnel and equipment decontamination and related waste such as personal protective equipment (PPE), decontamination water/solids, temporary covers, and washwater storage tanks; disconnection of temporary utilities; and final clean-up to pre-construction conditions.
 9. The Contractor shall manage unknown material separately and temporarily stage the material pending characterization.
- H. All incidental, Contractor-generated waste (such as Personal Protective Equipment, decontamination wash water, etc.) resulting from the services hereunder are the property and responsibility of the Contractor and are to be disposed of by the Contractor under a Uniform Hazardous Waste Manifest and/or by a Massachusetts Bureau of Waste Site Cleanup Bill of Lading, as appropriate.
- I. The Contractor is responsible for identifying potential hazards at the site and reviewing existing information. Copies of the report(s) are appended.

1.6 RELATED WORK

- A. Section 01025 – MEASUREMENT AND PAYMENT
- B. Section 01108 – HEALTH AND SAFETY PROCURES
- C. Section 01500 - TEMPORARY FACILITIES AND CONTROLS
- D. Section 02010 - SUBSURFACE INVESTIGATION
- E. Section 02080 – SOIL AND WASTE MANAGEMENT
- F. Section 02095 - TRANSPORTATION AND DISPOSAL OF SOIL AND FILL
- G. Section 02210 – EARTH EXCAVATION, BACKFILL, FILL AND GRADING
- H. Section 02140 – DEWATERING

1.7 EXISTING CONDITIONS.

- A. Limited chemical characterization of soil has been conducted, the results of which are presented in the reports and tables referenced in Paragraph 1.02

of this section. The Contractor is obligated to review existing environmental assessment reports and manage the soil and groundwater in accordance with applicable state and federal regulations.

1. 14 borings were advanced across the project area; soil samples were collected from six (6) borings (B-1, B102, B-105, B-106, B-111, and B-112) for laboratory chemical analysis. Visual assessment of subsurface soils indicates the presence of historic fill soils. The; thickness of fill was highly variable, ranging from two to sixteen feet.
2. OHM was reported above MCP Reportable Concentrations (RCS-1) in boring location: B-111 at the corner of Western Avenue and Franklin Street. The semi-volatile organic compounds (SVOCs) 2-methylnaphthalene and naphthalene and the volatile organic compounds (VOCs) 1,3, 5 trimethlybenzene and ethylbenzene were detected. Excavation in proximity to B-111 in anticipated to be conducted under a URAM that shall be prepared by the Owner's LSP; all soils deemed surplus that are excavated from this area shall be shipped under a Massachusetts Bill of Lading, pending laboratory chemical analytical confirmation. Further details are provided in the attached memoranda.
3. Other contaminants were also detected in one or more of the soil borings above laboratory reporting limits but at concentrations below RCS-1 limits. These analytes included arsenic, barium, cadmium, chromium, lead, mercury, naphthalene, petroleum hydrocarbons, and other VOCs and SVOCs.

1.8 SUBMITTALS

- A. The Contractor shall prepare a Work Plan that generally describes the work to be performed under Section 02080 Part 3 (Execution). The work plan shall include, but not be limited to detailing the submittal and implementation of the following:
 1. Site-Specific Health and Safety;
 2. Soil Management;
 3. Dust, Vapor, and Odor Control;
 4. Air Monitoring and Quality Control; and
 5. Spill and Discharge Control.

The Work Plan shall be submitted to the Owner and Engineer for review and acceptance at least two weeks prior to beginning any intrusive work at the site.

- B. The Contractor shall provide the qualifications of the Environmental Professional(s) to be assigned to this project. The Environmental Professional(s) shall be at a minimum certified, registered or licensed as an Environmental Professional or equivalent and hold a Bachelor of Science Degree in Environmental Science, Environmental Engineering, or Public Health or related degree and have sufficient experience in similar work to perform the responsibilities detailed herein.

- C. Soil Management: The Contractor shall prepare a Soil Management plan that outlines measures for soil and fill sampling, field screening, laboratory chemical analysis, treatment, and disposal/reuse. At a minimum, this plan shall address the following:
 - 1. Methods, procedures, and equipment used for treating, excavating, dewatering, characterizing, segregating, reusing/backfilling, loading, and transportation of contaminated soil/fill materials encountered during excavation operations;

 - 2. A list of all transporters and waste facilities, complete with license numbers, permit numbers, contact person, and address and telephone number that the Contractor utilizes for waste disposal. In addition, a copy of a memorandum of understanding between the Contractor and each disposal facility shall be attached. The memorandum of understanding shall detail that the disposal facility agrees to accept a specified quantity of waste as characterized in the contract specifications and detail what, if any, restrictions may apply. The Contractor shall provide copies of the permits held by each disposal facility which the Contractor plans to use to dispose of non-hazardous solid waste; and if necessary to dispose of hazardous waste (due to lead toxicity), PCB-impacted waste and asbestos-containing waste;

 - 3. A summary of the history of compliance actions for each disposal/recycling facility proposed to be used by the Contractor. The compliance history shall include a comprehensive list of any state or federal citations, notices of non-compliance, consent decrees or violations relative to the management of waste (including remediation waste) at the facility. The Owner reserves the right to reject any facility on the basis of poor compliance history;

4. Procedures for securing the staging area, controlling dust and soil/fill migration, preventing damage to uncontaminated areas via contaminant migration and for decontaminating vehicles and personnel exiting the staging area;
5. The means and methods for decontaminating all equipment and personnel, including provisions for installing an equipment decontamination pad if required or specified;
6. Methods and procedures for identifying stockpiled material (e.g., labeling, marking containers) and procedures for identification and tracking;
7. Methods, procedures, and equipment used for obtaining the necessary information needed to satisfy the off-site reuse/disposal facility requirements specified herein and/or by the facility;
8. Methods, procedures, and equipment proposed for assessing and handling Unknown Materials. The SMP shall indicate which laboratory(ies) the Contractor shall utilize for chemical analysis soil, groundwater and unknown materials:
 - a. An Unknown Materials information sheet shall be developed as part of the Contractor's SMP, upon which the Contractor shall record information such as container type, size, and condition; and, any identifying characteristics of the unknown material. The format of the information sheet shall be as accepted by the Owner and/or its representatives;
 - b. The Contractor's plan for notifying the Owner and Engineer in the event that an unknown material as defined in this specification is encountered. The plan shall include the phone numbers and names of the Owner's representative(s) that the Contractor will contact in such an event.
9. Provisions for separation of incompatible materials;
10. Protocol for over-packing drums (if encountered); and
11. Procedures for consolidating (i.e., bulking) compatible materials for disposal.

- D. Soil Management/Tracking Documentation: Prior to off-site disposal or reuse, the Contractor shall provide to the Engineer a letter from the disposal facility indicating that the facility has reviewed the available data relative to the soil/fill to be delivered and agrees that the soil/fill meets their acceptance criteria. The letter shall be signed by a duly authorized representative of the receiving facility.

Within the time constraints established in state and/or Federal laws and regulations, the Contractor shall submit to appropriate authority(ies), as applicable, Uniform Hazardous Waste Manifests and/or Bills of Lading for all soils and associated fill disposed or reused of off-site utilizing such documents. Copies of all manifests, Bills of Lading, and all other documents used to track and/or permit off-site transportation of soils shall be submitted to the Engineer within ten (10) days of shipment. The Contractor is responsible for preparation of all manifests, Bills of Lading, Material Shipping Records, and all other related documents completely, legibly, and accurately prior to submitting them to the Owner and/or its representative for generator and LSP signatures. (Bills of Lading shall be prepared electronically by the Owner's LSP; the Contractor shall be responsible for providing information necessary for completion of the BOL). The Contractor shall be responsible for paying for any and all fines associated with inaccurate, incorrect, or improperly completed manifests, Bills of Lading and all other related documents, including fines resulting from late or untimely submittals.

- E. Spill and Discharge Control (SDC): The SDC program shall provide contingency measures and reporting responsibilities for potential uncontrolled spills and discharges of contaminated and/or hazardous materials, including, but not limited to, leachate, decontamination water, sewage, and other on-site waste materials. In addition to the above listed items, the SDC program shall specifically contain: procedures for containing dry and liquid spills; absorbent material available on site; storage of spilled materials; governmental reporting (i.e., notification) procedures; decontamination procedures; discharges of sanitary or combined sewers into storm drains either by flow handling/bypassing or accidental or unintentional discharge; and procedures for protecting wetlands and surrounding public and private property.

The Spill and Discharge Plan shall indicate the location and quantity of the materials to be staged on site and the basis for the quantities (i.e. indicate the vessel which will be on site containing the greatest volume of oil or hazardous materials). No fuel or oil tanks or drums may be temporarily staged on site unless they are stored within a secondary containment system. Fuel deliveries shall be performed in a designated area which has either secondary spill containment or an impervious surface with absorbent berms located around the point of fuel delivery. The Spill and

Discharge Plan shall indicate the location of the fueling area and the nature of secondary containment which the Contractor intends on utilizing.

1. Notification Procedures: The Contractor shall prepare in advance of work activities a notification list, complete with phone numbers, addresses, and contact names for all parties to be notified in the event of a spill. This list shall include:
 - a. Owner's designated representatives;
 - b. Owner;
 - c. Fire Department;
 - d. Engineer; and
 - e. Massachusetts Department of Environmental Protection (as required per 310 CMR 40.0000).

The Owner shall be notified immediately of an uncontrolled spill or discharge. If human health or the environment are potentially threatened, the Contractor shall take immediate action to abate the conditions and notify emergency personnel.

2. Spill Incident Report(s): In the event of an uncontrolled spill or discharge, a written report detailing each uncontrolled spill or discharge shall include, at a minimum, the cause and resolution of incident, outside agencies involved, and date of occurrence. The report shall be submitted to the Owner within 48 hours of the incident. The Contractor shall document all spills on the as-built Drawings and submit the Drawings to the Owner at project completion. The Contractor shall be responsible for remediating any spills or releases of oil or hazardous materials as a result of the Contractor's activities. The site shall be remediated to pre-release conditions at no additional cost to the Owner.

- F. Dust, Vapor and Odor Control (DVOC): The DVOC program shall include measures to control objectionable dust, vapors, and odors originating from the site. The DVOC Plan shall describe procedures to minimize the creation of dust, and the control of objectionable vapors and odors originating from the site. At a minimum, the DVOC program shall include air monitoring as specified in paragraph 3.6.

PART 2 – PRODUCTS

2.1 DUST CONTROL

- A. Air monitoring shall include total dust testing using MIE, Inc. Miniram PDM-3 Dust Monitors, or like instruments.

2.2 SPILL CONTROL

- A. At a minimum, the Contractor shall maintain on-site absorbent pads, booms and absorbent materials in sufficient quantity to address a release of fuel oil, hydraulic oil or other OHM that the Contractor intends to use or store on site, including fuel oil and hydraulic oil that is used within earth moving equipment. The quantity of spill containment materials maintained on site shall be sufficient to respond to a catastrophic release from the vessel containing the greatest quantity of oil or hazardous material on-site.

2.3 EQUIPMENT DECONTAMINATION PAD

- A. The Contractor shall provide all materials and labor to complete an equipment decontamination pad. Liner materials and collection system shall be selected by the Contractor to perform as specified.

PART 3 – EXECUTION

3.1 GENERAL

- A. All work in this section will be performed in accordance with the Contractor's Work Plan, SMP and Site-Specific HASP.
- B. The primary concern of the Contractor in the excavating, handling, sampling, bulking, and on-site storage of soil/fill and/or drummed material (if encountered) will be to protect the health and safety of the site workers, the public, and the environment.
- C. The Contractor shall keep a copy of the Health and Safety Plan (HASP) on site during all operations and shall conduct daily health and safety meetings. Failure to keep a copy of the HASP on-site, or any other breach of the Contractor's Plan, may be cause for stopping work at the cost of the Contractor. Delays caused by the Contractor's failure to comply with the health and safety regulations or any health and safety plan shall not entitle the Contractor to recover any additional costs or time lost. The Contractor shall not be allowed to resume activities until corrective measures are accepted by the Engineer and/or their representative and implemented.

- D. Medical surveillance records, OSHA 40-hour training forms, accident forms, and all other documentation requirements of the Contractor's safety and health program for personnel working on the site (who are subject to exposure to potentially contaminated soil) shall be up-to-date and kept on file at the site. The Contractor shall provide documentation of employee status upon request of the Engineer and/or their representative.

3.2 SOIL/FILL MANAGEMENT

- A. Soil and fill material that is managed under a Utility-related Abatement Measure (URAM) Plan pursuant to the MCP, which is staged off-site, and which is not characteristically hazardous, may be re-used within fourteen (14) calendar days of excavation. Any material which is suitable for re-use as ordinary borrow, based on analytical results and could have been placed on site, but was not, due to Contractor delay (i.e. analytical results were not available within 10 days following excavation) will be disposed in accordance with the applicable regulations by the Contractor at no cost to the Owner.
- B. Soil and fill material that is managed under a Utility-related Abatement Measure (URAM) Plan pursuant to the MCP, which is staged off-site and which is determined at the staging area to be characteristically hazardous for lead may be treated (stabilized) within the "Area of Contamination" only and must be reused or disposed of within ninety (90) calendar days of excavation. No treatment may occur at the staging area if outside the "Area of Contamination."
- C. Class B and C excavated soils shall be completely covered with a minimum 10-mil thick layer of plastic tarp. Soils exhibiting evidence of potential contamination including but not limited to odors and/or staining shall be covered prior to characterization and off-site reuse or disposal. Stockpiled soils determined to be Class B or C, as described herein, shall be securely covered at the close of each day and continuously when not being added to or otherwise being handled by the Contractor. Stockpiles shall also be covered at times as directed by the Engineer.

3.3 SOIL/FILL CHARACTERIZATION

- A. Soil and fill material shall be classified based on the criteria established in the accepted SMP and these Specifications.
- B. Initial Characterization of Soil/Fill Material: A summary of existing conditions and investigation findings performed by the Engineer during design, including a summary of analytical results, is appended to this section.

- C. The Contractor shall review the information provided. The Contractor shall use the information appended and shall either perform independent sampling and characterization of soil/fill strata to be encountered during construction in advance of excavation such that excavated soil can be stabilized as required to render soils characteristically non-hazardous, segregated and directly transported to an appropriate facility or the Contractor shall make the necessary arrangements to secure a staging area(s) suitable for storing soil stockpiles pending analyses.
- D. Soil shall be preliminarily segregated based on the Soil Classification Categories detailed in Sub-section 1.4, except as indicated below.
1. Potential Asbestos Containing Material (PACM): Soil/Fill suspected of containing asbestos as evidence by the presence of suspect asbestos-containing building debris such as cementitious (transite) piping, vinyl floor tiling, roofing paper or paper-like insulation materials or any other suspect asbestos containing material observed in the soil/fill shall be segregated and stockpiled pending confirmatory analysis to determine appropriate disposal requirements. In the event that PACM is encountered the Contractor shall immediately halt work in that area and notify the Owner and Engineer who shall determine
 2. Unknown Material. If unknown material is encountered during excavation, the Contractor or the Contractor-hired Environmental Professional shall immediately contact the Engineer to discuss the nature and extent of the unknown material and to assess potential hazards and appropriate handling procedures. Prior to handling and removing the unknown material from the excavation area, the Contractor and Owner and/or its representatives, shall visually assess the material and its potential hazards. Drums shall be assessed to determine whether they are leaking, bulging (evidence of reactive waste), crushed, or empty. Crushed, empty, and/or skeletal parts of drums shall be handled as solid waste, as specified. The Contractor shall record any identification or markings on the drummed material(s). Discovery and management of unknown materials shall be documented as required in the SMP.
- E. Disposal Characterization: Waste characterization shall be the responsibility of the Contractor. The Contractor shall be responsible for determining the characterization requirements of each disposal facility in advance to facilitate timely disposal and to adequately estimate the disposal costs. The Contractor shall perform additional segregation based on disposal requirements. Disposal or reuse of the material shall depend on sampling and characterization analytical results.

Stockpiles within the staging area shall be sampled and characterized within a timely manner so as not to impede construction activities or preclude the reuse of soil/fill on site. If soil/fill cannot be reused on site due to the Contractor's delay in sampling material, the Contractor shall dispose of the soil/fill at no additional cost to the Owner including the cost of imported fill material used in its place.

3.4 STAGING AREAS

- A. Unless the staging area is comprised of an impervious surface material such as asphalt or concrete, the Contractor shall pre-characterize the surface soils (0-6") at the staging area(s) prior to staging any soils to document the existing conditions relative to contamination which may result from using the area to stage excess or unknown materials. A minimum of one composite surface soil sample, consisting of at least five grab samples, for every 2,500 square feet of staging area shall be collected by the Contractor prior to staging materials at the location. The samples will be submitted to a certified laboratory for analysis for:
1. RCRA 8 total metals;
 2. Volatile organic compounds (EPA Method 8260B);
 3. Semi-volatile organic compounds (EPA Method 8270);
 4. Total petroleum hydrocarbons (EPA Method 8100M or equivalent); and
 5. Polychlorinated biphenyls (PCBs) (EPA Method 8082).
- B. At the completion of the work, the Contractor shall replicate the pre-staging sampling and analysis protocol to assess impacts to the area from use as a staging area.
- C. Stockpiles located within the soil staging areas shall be placed on a 20-mil HDPE liner/filter fabric and bermed to minimize the effects of contamination release. Each soil category shall be staged in separate areas with berms constructed a minimum of 2 feet above the existing grade with common fill, hay bales, concrete barriers, or functionally equivalent berm material. Waste characterized as RCRA hazardous waste shall not be stored on site for a period greater than sixty (60) days. All other waste must be disposed off-site within ninety (90) days of excavation.
- D. As described above and herein, excavated materials shall be completely covered with a minimum 10-mil thickness polyethylene tarp and secured with tires, ropes, anchors or equivalent material. The covered system shall be capable of resisting actual wind gusts at the site, with a minimum wind capacity of 40 miles per hour. The stockpile covers shall be installed and secured at the end of each working day and at all times when earthwork is

not taking place on site. Stockpile covers shall be immediately recovered should wind forces expose any of the excavated materials. Stockpiles shall also be covered at times as directed by the Engineer.

- E. Stockpiles are to be segregated based on a review of pre-characterization data and visual and olfactory conditions and field screening results obtained during excavation. Similar material may be stockpiled together. Each stockpile must be clearly separated from adjacent stockpiles.
- F. Stockpiles shall be clearly designated by a sign post or marker which can be cross-referenced with samples collected from the pile for characterization purposes. The signs/markers are not to be moved, except by authorized personnel and not until the soil is ready to be either reused on site or loaded for off-site disposal.
- G. Unknown, potentially hazardous soils/debris and drummed materials encountered during the project shall be located in a separate bermed location. The Contractor's Soil Management Plan shall provide construction details of the dimensions and protective measures proposed for the staging area(s). The construction details and protective measures are subject to the acceptance of the Owner and/or its representatives. The Contractor shall select the area to facilitate handling of the material and to minimize interference with other ongoing construction activities. The Owner or Engineer must agree with the location prior to construction.

3.5 EQUIPMENT AND PERSONNEL DECONTAMINATION

- A. Equipment and personnel decontamination area(s), conforming with the Contractor's HASP and these Specifications, shall be constructed in such a manner to protect existing site surfaces, materials, and structures from contamination. Equipment decontamination areas shall be sized adequately to provide for the decontamination of the largest piece of equipment to be decontaminated. Filter fabric shall be placed over an impermeable liner to protect the liner from rips, punctures, or tears from traffic and heavy equipment.
- B. The Contractor shall establish a site-specific decontamination protocol and decontamination areas for personnel and equipment utilized at the subject site. Personnel and equipment decontamination shall be conducted in compliance with the HASP.
- C. The decontamination protocol shall include (i) the means, methods, and materials for the proposed decontamination procedures; (ii) the procedures employed to contain and store the wash or rinse liquids/sludges; (iii) procedures used to sample, analyze, and characterize the contaminated wash or rinse liquids/sludges; (iv) procedures to contain or clean

contaminated equipment and PPE; and (v) the procedures for handling and disposing of solid wastes generated from site decontamination activities. All sample analysis or sample compositing shall be completed by a certified laboratory. The Contractor shall be responsible for the cost of this analytical work. The Contractor shall submit a copy of the analytical results and laboratory certifications to the Owner for review prior to proceeding with disposal. The Contractor shall be responsible to properly manifest and dispose of all residual wastes generated from on-site activities in conformance with federal, state, and local environmental and transportation regulations. The Contractor shall be responsible for the manifests and procedures to be used to package and dispose of contaminated solid wastes, wash, or rinse liquids at an EPA or state-approved treatment or disposal facility. The Contractor shall be responsible for any releases from site or decontamination activities due to its work, and will remediate any release for which the Contractor is responsible to pre-existing conditions at the Contractor's expense.

- D. Provisions for collecting decontamination water will be incorporated into the maintenance of the decontamination pad and will include placing an impermeable liner over a sloped surface such that water is directed, if necessary, into an area for subsequent pumping to 55-gallon drums or other appropriate tankage. Following completion of the work, the wash water shall be characterized by the Contractor and disposed off-site, in accordance with federal, state, and local regulations.

3.6 ENVIRONMENTAL FIELD MONITORING/DUST CONTROL

- A. The Contractor shall hire an Environmental Professional to keep accurate documentation of all air monitoring, which will be made available to the Engineer or Owner upon request.
- B. During excavation and construction, the Contractor shall monitor the air quality at and surrounding the areas where construction activities involve soil handling such as excavation, re-location, staging, loading or grading of soil/waste materials. Air monitoring shall involve appropriate techniques capable of providing real-time indications of air contaminants to protect on-site personnel and the local population. If there are indications of contamination, the frequency of air monitoring shall be determined by the Contractor's Industrial Hygienist or competent environmental health professional. The Contractor's Site Health and Safety Officer and Superintendent shall be responsible for assuring that monitoring is conducted in an appropriate manner, and that work practices, engineering controls and/or Personal Protective Equipment are proper for the conditions.

- C. The air monitoring program is to be designed to protect public health and the environment from the potential generation of dust and contaminant release during work. At a minimum, the air monitoring shall include daily monitoring and documentation of one upwind, and two downwind conditions during periods of activity on the site and when there is a potential for dust being generated on the site. The air monitoring information including air monitoring in the vicinity of all site activities shall also be utilized for establishing levels of personal protection measures in the Contractor's Site Specific Health and Safety Plan. The Contractor shall submit his/her air quality monitoring program for review prior to commencement of site activities.
- D. Air monitoring shall be performed by the Contractor during all soil handling operations. In contaminated areas, detectors for organic contaminants and dust should be utilized to monitor on-site and off-site breathing zones and possible sources of potentially hazardous material (e.g. excavations, regrading, etc.). All personnel shall be made aware of the potential hazards and be informed of air monitoring information by the Contractor. Particular attention to air quality shall be made in the work area during earthwork activities to ensure that contaminants do not escape to the atmosphere and affect off-site population, on-site control, working conditions and personnel protection measures.
- E. Dust shall be controlled during excavation of soil/fill material to limit potential spread of contaminants and potential exposure of contaminants to workers and the public.
- F. Ambient dust levels at the site shall be monitored by the Contractor prior to construction. During construction, real-time dust monitoring shall be conducted during any soil/fill handling activities. The monitoring shall consist of total dust testing using MIE, Inc. Miniram PDM-3 Dust Monitors, or like instruments. The total dust criteria at the site shall conform to the requirements of the HASP. Should fugitive dust quantities exceed 20 percent of the ambient level, the Contractor shall perform additional measures to reduce the total dust concentrations.
- G. Nuisance dust levels shall be reduced by pre-wetting the surface soils and by establishing and maintaining clean access roads. The Contractor's Dust, Vapor, and Odor Control Plan shall describe the procedures and materials to minimize dust. At a minimum, the Contractor shall provide clean water, free from salt, oil, and other deleterious materials.

Areas of exposed earth to be excavated shall be lightly sprayed with water before excavation if there is potential for nuisance dust generation. Additional water spray may be utilized only when any indication of

excessive dust is observed. To the extent feasible, the Contractor shall minimize the use of water within the limits of excavation.

Access roads shall be sprayed with water on a regular basis to minimize the generation of dust.

- H. All containers temporarily storing waste material shall be covered at all times except as necessary to place waste material into the container. The Contractor shall monitor the covers daily to ensure the covers are in place and effectively eliminating the generation of dust and make appropriate notes in the site log.
- I. In the event that asbestos containing materials are encountered, dust control measures, which may include negative air containment, shall be instituted in accordance with all applicable local, state and federal laws and regulations.

3.7 VAPOR AND ODOR CONTROL

- A. The Contractor shall provide the materials and labor to control objectionable vapors and odor in accordance with the Contractor's Vapor and Odor Control Plan. The Contractor shall limit the exposure area and shall cover the exposure area with synthetic reusable covers, lime, foam suppressants, or other methods to reduce off-site odors to acceptable levels. The Contractor shall not use soil suitable for on-site reuse as cover to control vapor and odors.

3.8 BULKING

- A. Following characterization and compatibility testing of waste material, the Contractor shall place compatible materials into common containers to reduce transport and disposal costs. In addition, materials that are improperly contained shall be transferred into the appropriate containers. Drums and containers used during this project shall meet the appropriate DOT, OSHA, and U.S. EPA regulations for the materials contained. The Contractor shall describe the bulking procedures in the Soil and Fill Management Plan.

3.9 BACKFILLING AND COMPACTION

- A. Excavated areas shall be backfilled with appropriate backfill material (including excavated material suitable for reuse and, when necessary, imported off-site material). Imported backfill used in excavated areas shall have been analyzed and certified as free of contaminants and as specified in Section 02210 – EARTH EXCAVATION, BACKFILL, FILL, AND GRADING.

PART 4 – COMPENSATION

Item 2080.1 – OHM - Soil and Waste Management

METHOD OF MEASUREMENT:

Measurement for Payment shall be based on the following breakdown; A maximum of 3 percent of the lump sum will be paid upon the finished construction of the completed soil/fill staging area as specified and accepted by the Engineer. A maximum of 4 percent of the lump sum will be paid upon the submittal and acceptance of all related submittals, plans and shop drawings. A minimum of 3 percent of the lump sum will be paid at the complete removal and restoration of the staging area, as approved by the Engineer. The balance of the Lump Sum measurement for payment for will be on a percent of the Lump Sum bid remaining, calculated by dividing the elapsed time to date by the contractual construction time limit as approved by the Engineer. Deducts for work not performed as specified shall be applied.

BASIS OF PAYMENT / INCLUSIONS:

Payment for Soil and Waste Management shall be based on the lump sum price complete for this item in the proposal. The Contractor shall furnish all labor, materials, tools, equipment, and incidentals required for Soil and Waste Management. The work includes, but is not limited to; Environmental Professional; dewatering Professional; soil/fill sampling; analytical services; development and implementation of all submittals and plans specified including, but not limited to: Health and Safety Plan; Equipment and Personnel Decontamination Plan; Soil and Waste Management Plan; Dust, Vapor, and Odor Plan; Air Quality Control Plan; and a Spill and Discharge Control Plan; submittal of all required certifications; coordination with all parties affected and maintaining proper documentation necessary; disposal of wastes, such as construction-related waste and by-products, and Contractor-generated waste material, such as personal protective equipment, excess materials, debris, wash water, and any other waste materials not specifically addressed in other payment items; waste characterization sampling and analysis costs for the waste referenced above; construct and maintain a secure (enclosed with 8 foot high fencing and gate) soil/fill staging area for soil/fill stockpiling pending analytical testing, reuse, or disposal; all permits and administration fees; collecting and testing surface soil samples pre- and post- use of staging area; placement of polyethylene liner under piles; additional placement of bituminous or cement concrete as may be needed at the staging area; construction of segregated soil/fill bays; signage and lighting at the staging area; installation of sedimentation and erosion control at the staging area; construction of a truck wash down area; construction of a decontamination area with wheel wash; maintenance including placement of daily polyethylene covers over existing stockpiles; performing dust control; street sweeping; vehicle wheel-washing in the staging areas as needed to control airborne dust and sediment from spreading beyond the staging area or presenting a health risk to the workers or public; day to day security measures; maintenance of the soil/fill stockpiles to avoid migration; and maintenance of the sedimentation and erosion control measures; and removal, hauling, and disposal of all

items of which the staging area was constructed as well as the restoration of the site to pre-construction conditions.

EXCLUSIONS:

The following items are not included for payment under this item; transportation and disposal of soil and fill material; re-use of soil and fill material on site as backfill; handling unknown materials; sedimentation and erosion control for other uses besides soil management (at the staging area); and all work associated with a staging area for other uses beyond soil and waste management.

2080.2 – OHM - Handle Asbestos Contaminated Soil / Fill

METHOD OF MEASUREMENT:

Measurement for payment for Handling Asbestos Contaminated Soil/Fill shall be based on the actual in-place volume excavated, in cubic yards, as measured by the Engineer, within the horizontal and vertical trench pay limits indicated elsewhere in the Contract Documents.

BASIS OF PAYMENT / INCLUSIONS:

Payment for Handling Asbestos Contaminated Soil/Fill shall be based on the cubic yard price complete for this item in the proposal. The Contractor shall furnish all labor, materials, tools, equipment, and incidentals required for Handling Asbestos Contaminated Soil/Fill. The work includes, but is not limited to; segregate, handle, stage, test, and characterize all soil and fill material suspected of containing asbestos-containing materials; all controls necessary to maintain compliance with City of Cambridge ordinances relative to asbestos in soils; procuring all health and safety equipment; protecting the excavation from accidental entry; controlling windblown litter and the spread of airborne contaminants; all fees, permits, and taxes; and construct, maintain, and remove a secure asbestos contaminated fill staging area for stockpiling pending analytical testing, reuse, or disposal.

EXCLUSIONS:

The following items are not included for payment under this item: disposal of asbestos contaminated material; soil and waste management items covered under other bid items; and all work associated with a staging area for other uses beyond asbestos contaminated material staging.

2080.3 – OHM - Handle and Characterize Unknown Material

METHOD OF MEASUREMENT:

Measurement for payment for Handle and Characterize Unknown Material shall be based on the actual in-place volume excavated, in cubic yards, as measured by the Engineer, within the horizontal and vertical trench pay limits shown on the Contract Drawings.

BASIS OF PAYMENT / INCLUSIONS:

Payment for Handle and Characterize Unknown Material shall be based on the cubic yard price complete for this item in the proposal. The Contractor shall furnish all labor, materials, tools, equipment, and incidentals required for Handling and Characterizing Unknown Material. The work includes, but is not limited to; segregate, handle, stage, test and characterize any soil and fill material which is inconsistent with previous observations and is not readily identifiable as non-hazardous waste; procuring all health and safety equipment; protecting the excavation from accidental entry; controlling windblown litter and the spread of airborne contaminants; and all fees, permits, and taxes. The staging area for handling unknown materials shall be constructed only after suspected materials are encountered, and the Owner is notified. The staging area shall be sized based on field observations and estimates of potential material volume.

EXCLUSIONS:

The following items are not included for payment under this item; transportation and disposal of unknown material; soil and waste management items covered under other bid items; and all work associated with a staging area for other uses beyond staging unknown materials.

END OF SECTION 02080

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SECTION 02095

TRANSPORTATION AND DISPOSAL OF SOIL AND FILL

2095.1	OHM - DISPOSAL OF SOIL – DAILY COVER UNLINED LANDFILL (CLASS B-1)	TON
2095.2	OHM - DISPOSAL OF SOIL – DAILY COVER LINED LANDFILL (CLASS B-2)	TON
2095.3	OHM - DISPOSAL OF SOIL – NON-HAZARDOUS SOLID WASTE ASPHALT BATCHING IN-STATE (CLASS B-3)	TON
2095.4	OHM - DISPOSAL OF SOIL - NON-HAZARDOUS SOLID WASTE THERMAL TREATMENT (CLASS B-4)	TON
2095.5	OHM - DISPOSAL OF SOIL – NON-HAZARDOUS SOLID WASTE RECYCLING (CLASS B-5)	TON
2095.6	OHM - DISPOSAL OF SOIL – TREATMENT OF RCRA CHARACTERISTICALLY HAZARDOUS SOIL TO DE-CHARACTERIZE & DISPOSAL OF SOIL AS NON-HAZARDOUS WASTE (CLASS C-1)	TON
2095.7	OHM - DISPOSAL OF SOIL – RCRA HAZARDOUS WASTE (CLASS C-2)	TON
2095.8	OHM - DISPOSAL OF ASBESTOS WASTE	TON

PART 1 – GENERAL

1.1 DESCRIPTION

- A. Furnish all labor, materials, equipment, and incidentals required to transport waste material off site, and dispose, reuse or recycle excess soil or waste materials at a licensed facility approved by the Owner.
- B. All personnel involved in the transportation of waste from the site shall have the required Department of Transportation (DOT) and Occupational Safety and Health Administration (OSHA) training.

1.2 RELATED WORK

- A. Section 01108 – HEALTH AND SAFETY PROCEDURES

- B. Section 01500 – TEMPORARY FACILITIES AND CONTROLS
- C. Section 02010 – SUBSURFACE INVESTIGATION
- D. Section 02080 – SOIL AND WASTE MANAGEMENT
- E. Section 02210 – EARTH EXCAVATION, BACKFILL, FILL AND GRADING

1.3 SUBMITTALS

- A. Submit the following in accordance with Section 01300 – SUBMITTALS:
 - 1. A list of all transporters, destination/receiving sites and waste facilities, complete with license numbers and permit numbers (as appropriate), contact person, and address and telephone number that the Contractor utilizes for soil management and waste disposal. In addition, a copy of a memorandum of understanding between the contractor and each facility that will receive excess soil and/or waste material shall be attached to the Waste Management Plan. The memorandum of understanding shall detail the terms under which the facility agrees to accept a specified quantity of soil or waste and detail what if any restrictions may apply.
 - 2. Where appropriate the Contractor shall submit waste manifests for all waste disposed off site to the appropriate authority, agency, facility, or person within the time constraints specified by state and federal regulations. Copies of all waste manifests and Bill of Lading documentation including weigh slips and BOL summary sheets shall be provided to the Owner within 10 days. It is the responsibility of the Contractor to complete all waste manifests and bills of lading completely and accurately prior to submitting them to the Owner. For MassDEP Bills of Lading the Contractor shall provide the Owner's Licensed Site Professional (LSP) all information required for preparation of electronic Bills of Lading. The Contractor shall be responsible for preparation of Material Shipping Records. The Contractor shall be responsible for submitting to the Owner's LSP all information necessary for preparation of LSP opinion letters to disposal facilities and coordinating disposal documentation with all parties. The Owner's LSP and the Owner shall sign any MassDEP Bill of Lading forms where required only after the Contractor has provided the information required for preparation of electronic MassDEP forms. The Contractor shall reimburse the Owner for any and all fines associated with inaccurate, incorrect, or improperly completed waste manifests, including fines resulting from late or untimely submittals.

3. Disclose a summary of the history of compliance for each disposal/recycling facility proposed to be used by the Contractor. The compliance history shall include a comprehensive list of any state or federal citations, notices of non-compliance, consent decrees or violations relative to the management of waste (including remediation waste) at the facility. The Owner reserves the right to reject any facility on the basis of poor compliance history.
4. Prior to transporting any soils or fill material to a disposal facility the Contractor shall submit a letter from the disposal facility indicating that the facility has reviewed the available data and the generator's profile of the material and the facility agrees that it meets the facility's acceptance criteria.

PART 2 – PRODUCTS

2.1 GENERAL

- A. Provide completed Bills of Lading, Material Shipping Records, manifests, certificates of disposal, weight slips and all other documentation relative to disposal, reuse or recycling of soil and waste material.

PART 3 – EXECUTION

3.1 GENERAL

- A. The Contractor shall reuse, recycle or dispose of all excess soil and wastes resulting from excavation activities in accordance with federal, state and local regulations and these specifications. Transport shall be by a permitted and licensed waste transporter. The Contractor shall be responsible for supplying the proper manifests to be approved and signed by a representative of the Owner.
- B. Prior to disposal, it shall be the responsibility of the Contractor to maintain segregated waste stockpiles in conformance with all applicable federal, state, and local waste disposal regulations and as specified in Section 02080 - SOIL AND WASTE MANAGEMENT.
- C. The Contractor shall be responsible for preparing and keeping in proper order all waste manifests, and shall designate one person who shall be made available to sign all transportation documentation. The Contractor shall be responsible for obtaining the generator's signature and all other signatures required for the proper completion of the manifests. The Contractor shall allow a minimum of five working days from the date of the submittal for any

documents requiring the signature of the Owner and/or the LSP. The manifests shall document the handling of the waste from the time it is generated until the time it is properly disposed.

- D. The Contractor shall be responsible for obtaining all federal, state, and local permits and variances to allow transport of materials on public roadways.
- E. The Contractor shall be responsible to inform the Owner if hazardous waste disposal will not be performed within 60 days of hazardous waste characterization. This notification shall take place a minimum of 30 days prior to the 60-day deadline. No hazardous waste stockpiled at the site shall remain on site more than 60 days after it is characterized.
- F. The Contractor shall obtain certificates of disposal for all disposed waste.
- G. Transportation of solid wastes shall be in compliance with any relevant federal, state and local special waste requirements, and such as to assure that waste material is not released during transit.

3.2 SOLID WASTES

- A. Transporters of solid wastes that include, but are not limited to, contaminated soil/fill (including oil-contaminated soil/fill), construction and demolition debris, non-hazardous laboratory wastes, bottles, tires, metal parts, asbestos cement, tree stumps, brush, and grass cuttings will utilize truck or dumpsters specifically designed to ensure that material, dust, or liquid is not released in transit. No truck shall be allowed to exit the site until all free liquids are drained from soil/fill being transported off-site. Material shall be covered at all times. The vehicle in which the waste is transported shall be driven directly to the intended destination without any stops or detours in between, except those necessary in response to road conditions, vehicle service needs, or emergencies. Discharge or release of material during transport shall be immediately reported to the Owner. Transporters shall clean up any discharge that occurs in transit, at the Contractor's expense.
- B. The disposal site shall be permitted by the state in which the facility is located to receive and dispose of solid waste, and shall be approved for use by the Owner. The Contractor shall provide copies of the disposal facility's operating permit.
- C. Manifesting of solid waste shall be required and shall include vehicle identification; date of loading and disposal; tonnage, as measured at the disposal site; and signature of the Owner and/or its representative, transporter, and disposal facility's representative. Transportation of the wastes shall be accompanied by the appropriate manifests such as a Massachusetts DEP Bill of Lading, as required in the Code of Massachusetts

Regulations (CMR) 310 CMR 40.0030, a Waste Material Shipping Record or by a Uniform Hazardous Waste Manifest. The original shall be returned to the Owner, and/or their representative, within ten (10) working days of disposal.

- D. All solid waste shall be disposed in accordance with all applicable federal, state and local laws and regulations, as well as all other state laws through which the waste material is being transported.
- E. Transport of soils in which asbestos containing materials have come to be located shall be transported and disposed of in accordance with Section 02082 and all applicable local, state and federal laws and regulations.

3.3 HAZARDOUS WASTES

- A. Transporters of hazardous wastes shall be in conformance with Code of Federal Regulations (CFR) 40 CFR, Part 171, all other federal laws and regulations, 310 CMR 30.400, and all other state laws through whose boundaries the waste material is being transported. The transporter shall provide copies of its EPA identification number, Massachusetts transporter's license, and proof of driver training in transporting hazardous waste.
- B. The disposal site shall be in conformance with 40 CFR, Part 264 and relevant laws of the state in which the facility is located. The Contractor shall provide copies of the disposal facility's EPA and state treatment and disposal permit.
- C. Manifesting of hazardous wastes shall be in conformance with 40 CFR, Part 264, Subpart E and 310 CMR 30.405.

3.4 DUST CONTROL

- A. Dust control measures shall be implemented during loading and transport of waste material from the site in accordance with the contractor's Dust Control Plan, as specified in Section 02080 – SOIL AND WASTE MANAGEMENT.

PART 4 – COMPENSATION

4.1 GENERAL

- A. Measurement and Payment for Transportation and Disposal of Soil and Fill items shall be as listed below. Payment for lump sum items and unit price items shall constitute full payment for all fees, labor, materials and equipment required to perform the work; all supervision; all overhead items

including but not limited to bonds, insurance, labor burden, profit, protections and cautions are also included. Payment for unit price items shall be as detailed below and as measured by the Engineer. The Contractor shall be made aware that for Transportation and Disposal of Soil and Fill unit price items, the actual quantities encountered may vary significantly from the estimated quantities presented in the Bid Schedule. The estimated quantities presented have been established for bid comparison purposes only and do not represent a warranty of work. In the event of quantity changes, the unit bid price shall be the basis for compensation or credit.

- B. The following unit price payment items are for transporting and disposing excess soils and fill material encountered during the course of this contract. Management of soil/fill shall be in accordance with applicable regulations and technical specifications. The costs associated with disposing excess soil and fill other than allowed for in the following payment items shall be incorporated into the contractor's lump sum bid price for soil and fill management. A minimum unit bid cost has been established for each unit price bid item. The Contractor is required to review the minimum unit bid price and increase it within the bid table as the Contractor sees fit. The Contractor is not obligated to accept the minimum unit price indicated but shall not be able to reduce it. The minimum unit price established may be below actual market cost and is provided to avoid unbalanced bidding. The Contractor is required to review the minimum unit price presented and develop a competitive unit price for inclusion in the bid table. Any bids received which do not present a unit price entered by the Contractor within the bid table or present a unit price below the minimum unit price established, shall be rejected as non-responsive.
- C. The quantity of any pay item expressed as tons shall be subject to verification by the Engineer by calculation of the in-place weight using the horizontal and vertical trench pay limits defined in the Contract Drawings, a bulking factor applicable to the soil type, and in place density tests supplied from a certified soil testing lab, hired by the Contractor. Should the quantity presented by the Contractor on the certified weight slips, be significantly more (i.e. greater than 10%) than that as determined through the Engineer's calculations, the Contractor shall be compensated for the lesser tonnage. The Contractor shall receive no additional compensation for material removed outside of the approved pay limits. The Owner, and/or their representative, shall have the right to perform independent weighing of trucks. No payments will be made in cases of incomplete documentation of disposal. Payment will be at the unit price established set in the FORMS FOR GENERAL BID.
- D. The quantity of any pay item expressed as cubic yards shall be as measured by the Engineer, per the horizontal and vertical trench pay widths established in the Drawings, and confirmed through field engineering surveys performed by the Contractor. The Contractor shall receive no additional compensation

for material removed outside of the approved pay limits. Payment will be at the unit price established set in the FORMS FOR GENERAL BID.

- E. Preference is to be given to the most cost effective option of either reusing excavated material on-site as fill or disposal off-site.

2095.1 – OHM - Disposal of Soil – Daily Cover Unlined Landfill (Class B-1)

METHOD OF MEASUREMENT:

Measurement for Payment for OHM - Disposal of Soil – Daily Cover Unlined Landfill (Class B-1) shall be on the basis of tons of waste actually disposed, as measured at the disposal facility by certified scale, and documented on the return manifest or certified weight slip and accompanied by the appropriate MassDEP Bill of Lading form. Measurement shall be verified as described above and the lesser tonnage, as further described above, paid for. Material excavated outside of the pay limits indicated elsewhere in the Contract Documents or as required by the Engineer shall be done at the Contractor's expense, at no additional cost to the Owner.

It is the intent, that if the analytical characteristics of the material meet the criteria for this classification, but not that of lower levels of contamination, that the disposal be paid for at the unit price bid for this item regardless of whether the Contractor chooses to dispose of as one of the higher unit price options.

BASIS OF PAYMENT / INCLUSIONS:

Payment for OHM - Disposal of Soil – Daily Cover Unlined Landfill (Class B-1) shall be based on the per ton price complete for this item in the proposal. Under the per ton price for this item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required for OHM - Disposal of Soil – Daily Cover Unlined Landfill (Class B-1). The work includes, but is not limited to; handle, load, transport, and dispose at an appropriately permitted, solid waste facility, all soil/fill which is unsuitable for on-site reuse and is defined as a non-hazardous solid waste suitable for reuse as daily cover at an unlined Massachusetts Landfill (as defined in MassDEP Policy #COMM-97-001); placing, grading and compacting the material at the disposal site as specified; and all fees, permits, and taxes.

EXCLUSIONS:

The following items are not included for payment under this item; transportation and disposal of soil and fill material which can be disposed of at the A-1 or A-2 levels; reuse of soil and fill material on site as backfill; furnishing and installing replacement imported backfill; staging; disposal of bituminous concrete; and disposal of construction debris.

2095.2 – OHM - Disposal of Soil – Daily Cover Lined Landfill (Class B-2)

METHOD OF MEASUREMENT:

Measurement for Payment for OHM - Disposal of Soil – Daily Cover Lined Landfill (Class B-2) shall be on the basis of tons of waste actually disposed, as measured at the disposal facility by certified scale, and documented on the return manifest or certified weight slip and

accompanied by the appropriate MassDEP Bill of Lading form. Measurement shall be verified as described above and the lesser tonnage, as further described above, paid for. Material excavated outside of the pay limits indicated elsewhere in the Contract Documents or as required by the Engineer shall be done at the Contractor's expense, at no additional cost to the Owner.

It is the intent, that if the analytical characteristics of the material meet the criteria for this classification, but not that of lower levels of contamination, that the disposal be paid for at the unit price bid for this item regardless of whether the Contractor chooses to dispose of as one of the higher unit price options.

BASIS OF PAYMENT / INCLUSIONS:

Payment for OHM - Disposal of Soil – Daily Cover Lined Landfill (Class B-2) shall be based on the per ton price complete for this item in the proposal. Under the per ton price for this item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required for OHM - Disposal of Soil – Daily Cover Lined Landfill (Class B-2). The work includes, but is not limited to; handle, load, transport, and dispose at an appropriately permitted, solid waste facility, all soil/fill which is unsuitable for on-site reuse or disposal at one of the lesser unit price options and is defined as a non-hazardous solid waste suitable for reuse as daily cover at a lined Massachusetts Landfill (as defined in MassDEP Policy #COMM-97-001); placing, grading and compacting the material at the disposal facility as specified; and all fees, permits, and taxes.

EXCLUSIONS:

The following items are not included for payment under this item; transportation and disposal of soil and fill material which can be disposed of at the A-1, A-2 or B-1 levels; reuse of soil and fill material on site as backfill; furnishing and installing replacement imported backfill; staging; disposal of bituminous concrete; and disposal of construction debris.

2095.3 – OHM - Disposal of Soil – Non-Hazardous Solid Waste Asphalt Batching In-State (Class B-3)

METHOD OF MEASUREMENT:

Measurement for Payment for OHM - Disposal of Soil – Non-Hazardous Solid Waste Asphalt Batching In-State (Class B-3) shall be on the basis of tons of waste actually disposed, as measured at the disposal facility by certified scale, and documented on the return manifest or certified weight slip and accompanied by the appropriate MassDEP Bill of Lading form. Measurement shall be verified as described above and the lesser tonnage, as further described above, paid for. Material excavated outside of the pay limits indicated elsewhere in the Contract Documents or as required by the Engineer shall be done at the Contractor's expense, at no additional cost to the Owner.

It is the intent, that if the analytical characteristics of the material meet the criteria for this classification, but not that of lower levels of contamination, that the disposal be paid for at

the unit price bid for this item regardless of whether the Contractor chooses to dispose of as one of the higher unit price options.

BASIS OF PAYMENT / INCLUSIONS:

Payment for OHM - Disposal of Soil – Non-Hazardous Solid Waste Asphalt Batching In-State (Class B-3) shall be based on the per ton price complete for this item in the proposal. Under the per ton price for this item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required for OHM - Disposal of Soil – Non-Hazardous Solid Waste Asphalt Batching In-State (Class B-3). The work includes, but is not limited to; handle, load, transport, and dispose at an appropriately permitted, asphalt batching plant, all soil/fill which is suitable for recycling at an asphalt batching plant (as defined in MassDEP Policy WSC-94-400) and which is unsuitable for on-site reuse or off-site reuse or as daily cover at a Massachusetts Landfill; and all fees, permits, and taxes.

EXCLUSIONS:

The following items are not included for payment under this item; transportation and disposal of soil and fill material which can be disposed of at the A-1, A-2, B-1, or B-2 levels; reuse of soil and fill material on site as backfill; furnishing and installing replacement imported backfill; staging; disposal of bituminous concrete; and disposal of construction debris.

2095.4 – OHM - Disposal of Soil – Non-Hazardous Solid Waste Thermal Treatment (Class B-4)

METHOD OF MEASUREMENT:

Measurement for Payment for OHM - Disposal of Soil – Non-Hazardous Solid Waste Thermal Treatment (Class B-4) shall be on the basis of tons of waste actually disposed, as measured at the disposal facility by certified scale, and documented on the return manifest or certified weight slip and accompanied by the appropriate MassDEP Bill of Lading form. Measurement shall be verified as described above and the lesser tonnage, as further described above, paid for. Material excavated outside of the pay limits indicated elsewhere in the Contract Documents or as required by the Engineer shall be done at the Contractor's expense, at no additional cost to the Owner.

It is the intent, that if the analytical characteristics of the material meet the criteria for this classification, but not that of lower levels of contamination, that the disposal be paid for at the unit price bid for this item regardless of whether the Contractor chooses to dispose of as one of the higher unit price options.

BASIS OF PAYMENT / INCLUSIONS:

Payment for OHM - Disposal of Soil – Non-Hazardous Solid Waste Thermal Treatment (Class B-4) shall be based on the per ton price complete for this item in the proposal. Under the per ton price for this item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required for OHM - Disposal of Soil – Non-Hazardous Solid Waste Thermal Treatment (Class B-4). The work includes, but is not limited to; handle, load, transport, and dispose soil/fill which is unsuitable for in-state recycling, on-site reuse,

off-site reuse or as daily cover at a Massachusetts Landfill, at an appropriately permitted out-of-state, recycling or thermal treatment facility; and all fees, permits, and taxes.

EXCLUSIONS:

The following items are not included for payment under this item; transportation and disposal of soil and fill material which can be disposed of at the A-1, A-2, B-1, B-2, or B-3 levels; reuse of soil and fill material on site as backfill; furnishing and installing replacement imported backfill; staging; disposal of bituminous concrete; and disposal of construction debris.

2095.5 – OHM - Disposal of Soil – Non-Hazardous Solid Waste Recycling (Class B-5)

METHOD OF MEASUREMENT:

Measurement for Payment for OHM - Disposal of Soil – Non-Hazardous Solid Waste Recycling (Class B-5) shall be on the basis of tons of waste actually disposed, as measured at the disposal facility by certified scale, and documented on the return manifest or certified weight slip and accompanied by the appropriate MassDEP Bill of Lading form. Measurement shall be verified as described above and the lesser tonnage, as further described above, paid for. Material excavated outside of the pay limits indicated elsewhere in the Contract Documents or as required by the Engineer shall be done at the Contractor's expense, at no additional cost to the Owner.

It is the intent, that if the analytical characteristics of the material meet the criteria for this classification, but not that of lower levels of contamination, that the disposal be paid for at the unit price bid for this item regardless of whether the Contractor chooses to dispose of as one of the higher unit price options.

BASIS OF PAYMENT / INCLUSIONS:

Payment for OHM - Disposal of Soil – Non-Hazardous Solid Waste Recycling (Class B-5) shall be based on the per ton price complete for this item in the proposal. Under the per ton price for this item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required for OHM - Disposal of Soil – Non-Hazardous Solid Waste Recycling (Class B-5). The work includes, but is not limited to; handle, load, transport, and dispose at an appropriately permitted, solid waste facility, all soil/fill (including embedded debris or foreign objects), which is not hazardous waste but is unsuitable for other non-hazardous recycling and disposal options listed above; and all fees, permits, and taxes.

EXCLUSIONS:

The following items are not included for payment under this item; transportation and disposal of soil and fill material which can be disposed of at the A-1, A-2, B-1, B-2, B-3, or B-4 levels; reuse of soil and fill material on site as backfill; furnishing and installing replacement imported backfill; staging; disposal of bituminous concrete; and disposal of construction debris.

2095.6 – OHM - Disposal of Soil – Treatment of RCRA Characteristically Hazardous Soil to De-Characterize and Dispose of Soil as Non-Hazardous Waste (Class C-1)

METHOD OF MEASUREMENT:

Measurement for Payment for OHM - Disposal of Soil – Treatment of RCRA Characteristically Hazardous Soil to De-Characterize and Dispose of as Non-Hazardous (Class C-1) shall be on the basis of tons of waste actually treated and disposed, as measured at the disposal facility by certified scale, and documented on the return manifest or certified weight slip and accompanied by the appropriate MassDEP BWSC Bill of Lading form. Measurement shall be verified as described above and the lesser tonnage, as further described above, paid for. Material excavated outside of the pay limits indicated elsewhere in the Contract Documents or as required by the Engineer shall be done at the Contractor's expense, at no additional cost to the Owner.

BASIS OF PAYMENT / INCLUSIONS:

Payment for OHM - Disposal of Soil – Treatment of RCRA Characteristically Hazardous Soil to De-Characterize and Dispose of as Non-Hazardous (Class C-1) shall be based on the per ton price complete for this item in the proposal. Under the per ton price for this item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required for OHM - Disposal of Soil – Treat and Dispose of Toxic Lead Soil RCRA Hazardous Waste (Class C-1). The work includes, but is not limited to: treat on-site all soil/fill determined through testing to be characteristically hazardous waste due to lead toxicity to render the material characteristically non-hazardous; handle, load, transport, and dispose at an appropriately permitted facility, all soil/fill determined through testing to be hazardous waste due to lead toxicity which has been treated on-site and subsequently determined through laboratory testing to be characteristically non-hazardous; and all fees, permits, and taxes.

EXCLUSIONS:

The following items are not included for payment under this item; transportation and disposal of soil and fill material which can be disposed of at the A-1, A-2, B-1, B-2, B-3, B-4, or B-5 levels; reuse of soil and fill material on site as backfill; furnishing and installing replacement imported backfill; staging; disposal of bituminous concrete; and disposal of construction debris.

2095.7 – OHM - Disposal of RCRA Hazardous Waste (Class C-2)

METHOD OF MEASUREMENT:

Measurement for Payment for OHM - Disposal of RCRA Hazardous Waste (Class C-2) shall be on the basis of tons of waste actually disposed, as measured at the disposal facility by certified scale, and documented on the return manifest or certified weight slip and accompanied by the appropriate MassDEP BWSC Bill of Lading form. Measurement shall be verified as described above and the lesser tonnage, as further described above, paid for. Material excavated outside of the pay limits indicated elsewhere in the Contract Documents or as required by the Engineer shall be done at the Contractor's expense, at no additional cost to the Owner.

BASIS OF PAYMENT / INCLUSIONS:

Payment for OHM - Disposal of RCRA Hazardous Waste (Class C-2) shall be based on the per ton price complete for this item in the proposal. Under the per ton price for this item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required for OHM - Disposal of RCRA Hazardous Waste (Class C-2). The work includes, but is not limited to; handle, load, transport and dispose at an approved RCRA-permitted hazardous waste facility all soil and fill determined through testing to be hazardous waste; and all fees, permits, and taxes.

EXCLUSIONS:

The following items are not included for payment under this item; transportation and disposal of soil and fill material which can be disposed of at the A-1, A-2, B-1, B-2, B-3, B-4, B-5 or C-1 levels; reuse of soil and fill material on site as backfill; furnishing and installing replacement imported backfill; staging; disposal of bituminous concrete; and disposal of construction debris.

2095.8 - OHM - Disposal of Asbestos Waste

METHOD OF MEASUREMENT:

Measurement for Payment for OHM - Disposal of Asbestos Waste shall be on the basis of tons of waste actually disposed, as measured at the disposal facility by certified scale, and documented on the return manifest or certified weight slip and accompanied by the appropriate MassDEP BWSC Bill of Lading form. Measurement shall be verified as described above and the lesser tonnage, as further described above, paid for. Material excavated outside of the pay limits indicated elsewhere in the Contract Documents or as required by the Engineer shall be done at the Contractor's expense, at no additional cost to the Owner.

BASIS OF PAYMENT / INCLUSIONS:

Payment for OHM - Disposal of Asbestos Waste shall be based on the per ton price complete for this item in the proposal. Under the per ton price for this item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required for OHM - Disposal of Asbestos Waste. The work includes, but is not limited to; handle, load, haul, and dispose all soil and fill material defined as asbestos-containing waste; procuring all health and safety items; compliance with local ordinances and preparing appropriate waste manifests; and all fees, permits, and taxes.

EXCLUSIONS:

The following items are not included for payment under this item; transportation and disposal of soil and fill material which does not meet the definition of soil of this classification; reuse of soil and fill material on site as backfill; furnishing and installing replacement imported backfill; staging; disposal of bituminous concrete; disposal of construction debris; segregate, handle, stage, test, and characterize all soil and fill material suspected of containing asbestos-containing materials; protecting the excavation from accidental entry; and controlling windblown litter and the spread of airborne contaminants.

END OF SECTION 02095

TRANSPORTATION AND
DISPOSAL OF SOIL AND FILL
02095-12

SECTION 02140

DEWATERING

2140.1 TREATMENT OF CONSTRUCTION DEWATERING DAY

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This section includes the following:
 - 1. Design, furnish, operate, maintain, and remove temporary dewatering systems to control groundwater and surface water to maintain stable, undisturbed subgrades, and allow work to be performed under dry and stable conditions: and comply with permit and other regulatory requirements. Work to be done as part of dewatering includes, but is not limited to:
 - a. Lower the groundwater level within excavations to at least 12 inches below the bottom of the excavation.
 - b. Lower hydrostatic pressure.
 - c. Prevent surface water from entering the excavation during construction.
 - d. Limit settlement of utilities and adjacent structures.
 - e. Implement erosion and sedimentation control measures for disposing of discharge water.
 - f. Provide treatment system to treat all water removed from excavations, except water that is re-infiltrated to the ground on site in a manner that does not result in negative on- or off-site impacts.
 - g. Provide an Environmental Site Professional/Dewatering Specialist/Field Representative (hereinafter referred to as the Dewatering Professional) who will be responsible for

dewatering, reinfiltration, treatment and discharge of dewatering flows as specified and in compliance with all applicable permits and regulations.

- h. Common dewatering methods include, but are not limited to, sump pumping, deep wells, well points, vacuum well points or any combinations thereof.
2. The Contractor shall be aware of groundwater under drains that may exist under all existing sanitary, storm, or combined piping. The Contractor shall identify such drains, bypass pump and dewater in accordance with the dewatering permits, and relocate and reconnect under drains upon completion of the work in the area.
3. Water removed from excavations shall be reinfiltrated to the ground if feasible. If reinfiltration is not feasible, treated water shall be directly or indirectly discharged to a surface water in accordance with a National Pollutant Discharge Elimination System (NPDES) permit issued by the U.S. Environmental Protection Agency (EPA). If neither reinfiltration nor surface water discharge is feasible, treated water shall be discharged to the Massachusetts Water Resources Authority (MWRA) or local sewer system in accordance with the appropriate permit and regulations. In no case shall dewatering flows be directly or indirectly released to surface waters or storm drains prior to settling and appropriate additional treatment.

1.3 SUBMITTALS

- A. Shop Drawing: Submit the following in accordance with Section 01300 – SUBMITTALS:
 1. Qualification of the both the Contractor's dewatering specialist or firm's qualifications (installation) and the Dewatering Professional (all other responsibilities) a minimum of four (4) weeks prior to execution of any dewatering. The submittal shall include, but not be limited to:
 - a. Qualifications of specialist or firm's Registered Professional Engineer as specified below.
 - b. Qualifications of the Dewatering Professional who shall oversee the installation, operation and maintenance of the dewatering system.
 2. Submit a dewatering plan including design calculations at least four (4) weeks prior to start of any dewatering operation. The review will be only for the information of the Owner and third parties for an

overall understanding of the project relating to access, maintenance of existing facilities and proper utilization of the site. The Contractor shall remain responsible for the adequacy and safety of the means, methods and sequencing of construction. The plan shall include the following items as a minimum:

- a. Dewatering plan and details stamped and signed by a Massachusetts Registered Professional Engineer that conform to the requirements of the dewatering permit(s), the Wetlands Protection Act Order of Conditions, and all other applicable regulations and permits including, but not limited to, requirements for equipment, monitoring, sampling and reporting.
 - b. Certificate of Design: Found attached to these documents.
 - c. A list of equipment including, but not limited to, pumps, prime movers, and standby equipment.
 - d. A description of the proposed method of dewatering; water reinfiltration; containment; treatment and discharge; and installation, monitoring, maintenance, and system removal procedures.
 - e. A groundwater monitoring plan shall be developed by the Professional Engineer retained by the Contractor and that designs the dewatering system. The monitoring plan shall address groundwater control within the excavations and address settlements of utilities and adjacent structure.
 - f. A description of erosion/sedimentation control measures.
 - g. List of all applicable laws, regulations, rules, and codes to which dewatering design conforms.
3. Data for the required discharge reports shall be collected by the Contractor's Dewatering Professional. It shall consist of periodic sampling and analysis of system influents, midfluent and/or effluents and discharge quantities and other requirements of the relevant permits. The Contractor's Dewatering Professional shall also coordinate analysis of samples at an appropriately certified analytical laboratory and shall comply with all permit reporting requirements.
 4. A modified dewatering plan within 24 hours, if open pumping from sumps and ditches results in boils, loss of fines or softening of the ground.

1.4 QUALITY ASSURANCE

- A. Employ the services of a Dewatering Professional and a Massachusetts Registered Professional Engineer in firms having the following qualifications:
1. The Massachusetts Registered Professional Civil Engineer shall have completed the design of at least five (5) successful dewatering projects of equal size and complexity and with equal systems within the last five (5) years consisting of deep wells, well points, vacuum well points, and sump pumping for heavy Civil projects of similar size, type, and complexity in urban areas with soldier pile and lagging, timber sheeting support and secant pile support of excavation systems.
 2. The dewatering systems installer supervisor shall have a minimum of 5 years experience in installation of well points, deep wells, recharge systems, or equal systems.
 3. The Dewatering Professional responsible for day to day operation of the system shall have the following minimum qualifications:
 - a. Completion of at least 5 successful dewatering projects of equal size and complexity with equal systems within the last five (5) years consisting of system operation and troubleshooting, collection of readings, maintenance of logs and other required documents, collection of samples, coordination of analysis of samples, and compliance with reporting requirements during pumping for heavy Civil projects of similar size, type, and complexity in urban areas.
 - b. Valid certification from DEP to operate the proposed treatment system.
- B. If subgrade soils are disturbed or become unstable due to dewatering operation or an inadequate dewatering system, notify the Engineer, stabilize the subgrade, and modify system to perform as specified at no additional cost to the Owner.
- C. Notify the Engineer immediately if any settlement or movement is detected on any adjacent structures. If the settlement or movement is deemed by the Engineer to be related to the dewatering, take actions to protect the adjacent structures and submit a modified dewatering plan to the Engineer within 24 hours. Implement the modified plan and repair any damage incurred to the adjacent structures at no additional cost to the Owner.

- D. If oil and/or other hazardous materials are encountered after dewatering begins, immediately notify the Engineer.

PART 2 – PRODUCTS

2.1 MATERIALS

- A. Provide groundwater monitoring wells in accordance with the submitted dewatering plan or as specified.
- B. Provide casings, well screens, piping, fittings, pumps, power and other items required for dewatering system.
- C. Provide sand and gravel filter around the well screen. Wrapping geotextile fabric directly around the well screen shall not be allowed.
- D. When deep wells, well points, or vacuum well points are used, provide pumping units capable of maintaining high vacuum and handling large volumes of air and water at the same time.
- E. Provide and store auxiliary dewatering equipment, consisting of pumps and hoses on the site in the event of breakdown, at least one (1) pump for every five (5) used.
- F. Provide dewatering equipment, including an appropriately sized settling tank, and maintain erosion/sedimentation control devices as indicated or specified and in accordance with the dewatering plan.
- G. Provide temporary pipes, hoses, flumes, or channels for the transport of discharge water to the discharge location.
- H. Provide cement grout having a water cement ratio of 1 to 1 by volume.

PART 3 – EXECUTION

3.1 GENERAL

- A. Execution of any earth excavation, installing earth retention systems, and dewatering shall not commence until the related submittals have been reviewed by the Engineer with all Engineer's comments satisfactorily addressed, the geotechnical instrumentation has been installed, and the Dewatering Professional is on site and has begun the duties specified herein.
- B. Furnish, install, operate, and maintain dewatering, reinfiltration, treatment and discharge systems as indicated or specified and in accordance with the

dewatering plan. As no dewatering flows shall be discharged to surface waters either directly or indirectly without appropriate settling, at a minimum, the Contractor shall provide a settling tank with a capacity of 10,000 gallons, so that if pumping rates exceed discharge rates, sufficient storage capacity is available. Delays due to insufficient storage capacity will be at no additional cost to the Owner. The Contractor is responsible to evaluate available data and determine the necessary storage capacity so as not to impede construction activities.

- C. Carry out dewatering program in such a manner as to prevent undermining or disturbing foundations of existing structures or of work ongoing or previously completed.
- D. Do not excavate until the dewatering system is operational.
- E. Unless otherwise specified, continue dewatering uninterrupted until all structures, pipes, and appurtenances below groundwater level have been completed such that they will not be floated or otherwise damaged by an increase in groundwater elevation.
- F. Discontinue open pumping from sumps and ditches, if such pumping is resulting in boils, loss of fines, softening of the ground, or instability of the slopes. Modify dewatering plan and submit to the Engineer at no additional cost to the Owner.
- G. Where subgrade materials are disturbed or become unstable due to dewatering operations, remove and replace the materials in accordance with Section 02210 – EARTH EXCAVATION, BACKFILL, FILL, AND GRADING at no additional cost to the Owner.

3.2 DEWATERING DISCHARGE

- A. Water to be infiltrated need not be treated. Contractor shall provide infiltration that complies with relevant local, state and federal regulations.
- B. Transport pumped or drained water to discharge location in compliance with applicable permits and without interference to other work; damage to or contamination of pavement, other surfaces, or property; erosion; or siltation.
- C. Provide separately controlled pumping lines.
- D. Immediately notify the Engineer if groundwater is encountered that is suspected to be contaminated with substances other than those for which the treatment system has been designed. Do not pump water found to be contaminated with oil or other hazardous material to the discharge locations.

3.3 COMPLIANCE WITH DEWATERING AND RELATED PERMITS AND REGULATIONS

- A. Discharging groundwater and allowing for natural infiltration may not be a viable option for controlling groundwater in the project area. Should dewatering activities be required where the Contractor needs to discharge groundwater to a location other than the point of origin, then the Contractor shall be prepared to store, treat and discharge the water in accordance with applicable permits and regulations. Periodic sampling, as may be required to demonstrate treatment effectiveness and compliance with pretreatment standards specified in any local, state, or federal discharge permit required shall be the responsibility of the Contractor and its Dewatering Professional. Water that cannot be infiltrated is anticipated to be discharged to the existing City of Cambridge Storm Drain system which discharges to the Charles River. The Contractor shall be responsible for seeking coverage under the appropriate EPA/NPDES permit. At a minimum, the Contractor shall be prepared to comply with the following periodic testing requirements: of the effluent for Total Toxic Organics (TTO) (VOA), TTO (ABN Extractables), petroleum hydrocarbons (MADEP EPH), pH, total metals, and total suspended solids (TSS); and with standard NPDES permit conditions including periodic testing of the treatment system influent, midfluent and effluent for benzene, toluene, ethylbenzene, xylenes, TPH, metals, and TSS. The Dewatering Plan shall include a description of procedures and information related to the collection of readings, maintenance of logs and other required documents. At a minimum, the dewatering plan shall describe compliance with relevant provisions of the EPA/NPDES Stormwater General Permit for Construction Activities, EPA/DEP NPDES Permit and Plan Approval for Construction Site Dewatering, and the Cambridge Conservation Commission Order of Conditions.
- B. The Contractor, through its Dewatering Professional:
1. Shall furnish all labor, equipment and materials necessary to obtain accurate representative samples of the groundwater and for analysis for the set of analytical parameters specified above and as required by local, state and federal permits and regulations.
 2. Shall coordinate sampling activities with the Engineer. The engineer reserves the right to sample treated and untreated dewatering flows at any time.
 3. Shall take readings from the treatment system in accordance with the dewatering plan.
 4. Shall collect an initial sample of untreated and treated groundwater at the beginning of dewatering activities within the construction area.

5. Shall prepare and keep in proper order all records required by regulatory authorities and permits.
6. Shall maintain logs and other records in accordance with the Specifications, regulatory agency and permit requirements, and the Dewatering Plan.
7. Shall coordinate analysis of samples by an appropriately certified analytical laboratory in accordance with the Specifications, regulatory agency and permit requirements, and the Dewatering Plan, and ensure that laboratory detection limits meet permit requirements.
8. Shall comply with reporting requirements in a timely manner and in the format required by the relevant permit. Reporting in compliance with permit requirements includes, but is not limited to, notification to the appropriate regulators and the Owner and Engineer prior to discharge; submittal of laboratory analytical reports for each sampling event; submittal of reports for each reporting period during which no discharge occurs; notification of non-compliant discharges; notification of termination of discharge; and response to permit-related questions posed by regulators or the Owner and Engineer.
 - a. Water will be discharged under a National Pollutant Discharge Elimination System (NPDES) permit. The Contractor shall submit notifications and reports to both the Environmental Protection Agency (EPA) and the appropriate regional office of the Massachusetts Department of Environmental Protection (DEP). Comply with pre-discharge notification, discharge reporting, notification of no discharge, and termination of discharge notification requirements; and respond to inquiries or correspondence from EPA or DEP regarding permit issues.
 - b. If water will be discharged under a local permit, submit notifications and reports as required in the permit.
 - c. For monthly or less frequent reporting deadlines, provide the Engineer with copies of all reports fourteen (14) days prior to the reporting deadline, and submit reports to the appropriate agency(ies) at the same. Provide copies of other dewatering documents to the Engineer immediately.
9. Install and maintain erosion/sedimentation control devices at the point of discharge as indicated or specified and in accordance with the dewatering plan.

10. The Contractor shall obtain all federal, state, county, and local permits and variances to allow transport of materials on public roadways, should such transport be necessary.
11. The Contractor shall dispose of all wastes resulting from construction dewatering activities in accordance with local, federal and state regulations.
12. The Contractor is solely responsible for the implementation of the permit requirements, and is solely responsible for any punitive action resulting from any violation of the permit. The actual permit issued by EPA/DEP shall become part of this Contract by either addendum or by change order. If the actual permit is included by change order, no additional costs for implementing the permit will be considered by the Owner, when the actual permit is issued.

3.4 REMOVAL

- A. Do not remove dewatering system without written approval from the Engineer.
- B. Backfill and compact sumps or ditches with crushed stone wrapped with geotextile fabric in accordance with Section 02210 – EARTH EXCAVATION, BACKFILL, FILL AND GRADING.
- C. All dewatering wells shall be abandoned upon completion of the work, and completely backfilled with cement grout.

PART 4 – COMPENSATION

2140.1 - Treatment of Construction Dewatering

METHOD OF MEASUREMENT:

Measurement for payment for Treatment of Construction Dewatering will be on a per day basis for treatment of dewatering, as measured by the Engineer. The Contractor shall be paid per day that the dewatering treatment system(s) is onsite and operational, as defined by this Section, as required by the applicable dewatering permits, and as required by the Owner or Engineer. The Contractor shall not be compensated when the dewatering treatment system is onsite when not required by the Engineer or not required by the applicable dewatering permits. A dewatering treatment system shall include a settling tank, granular activated carbon (GAC) unit, filters, meters, hose connections, hoses and other treatment apparatus.

BASIS OF PAYMENT / INCLUSIONS:

Payment for Treatment of Construction Dewatering will be based on the unit price bid for this item in the proposal. Under the unit price bid for this item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required for treatment of construction

dewatering complete, as required and as required by the Engineer. The work includes but is not limited to mobilization and demobilization of the complete system(s); design of the system(s); furnishing and installing treatment system(s); maintenance of the treatment system(s); “breakdown”, transportation and set-up of the treatment system(s) between on-site areas requiring treatment; sampling; reporting; maintenance of all logs and other documentation required; laboratory testing; coordination with permitting agencies and the Owner and Engineer; compliance with all permit requirements; removal, transportation, stockpiling, testing and disposal of all collected sediment; Dewatering Professional services; Dewatering Specialist services and all incidental work not included for payment elsewhere.

EXCLUSIONS

The Contractor shall not be compensated for construction dewatering under this item; including but not limited to re-infiltrated construction dewatering; providing, installing and maintaining pumps and hoses; installation and maintenance of well points, deep wells and pump filters and screens; temporary power sources and all incidental work. Construction dewatering shall be covered in the Contractor’s base bid, at no additional cost to the Owner. This is a Treatment Item only.

END OF SECTION 02140

SECTION 02160

TEMPORARY EXCAVATION SUPPORT SYSTEMS

PART 1 – GENERAL

1.1 SUMMARY

A. This section includes the following:

1. Design, furnish and install temporary excavation support systems as required to maintain lateral support, prevent loss of ground, limit soil movements to the allowable limits indicated, and protect from damage existing and proposed improvements including, but not limited to, pipelines, utilities, structures, roadways, and other facilities.

The location, configuration, design, construction and maintenance of the excavation support walls and internal bracing shall be the sole responsibility of the Contractor.

2. The temporary excavation support system to be used on this project may include singular or multiple stages comprised of internally braced timber or steel sheeting, soldier piles and timber lagging or trench box. Temporary excavation support system is, at a minimum, required at excavation locations within 25 feet of building walls. Within 25 feet of existing building walls, the soldier piles and timber or steel sheeting shall be drilled or hydraulically pushed in place. At excavation locations along the alignment outside 25 feet of existing building walls, other approved methods of excavation support system installation may be determined as acceptable after submittals by the Contractor have been submitted and reviewed, for informational purposes only, by the Engineer.
3. Wherever the word "sheeting" is used in this section or on the Contract Drawings, it shall be in reference to steel soldier piles and timber lagging or steel and timber sheeting support systems.
4. Construction of the temporary excavation support system shall not disturb the existing structures or the completed proposed structures. The Contractor, at no additional cost to the Owner, shall repair damage to such structures.
5. The Contractor shall bear the entire cost and responsibility of correcting any failure, damages, subsidence, upheaval or cave-ins as a result of improper installation, maintenance or design of the temporary excavation support systems. The Contractor shall pay for

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all claims, costs and damages that arise as a result of the work performed at no additional cost to the Owner.

6. Monitoring movement of the lateral support systems by optical survey techniques is required by an independent geotechnical monitoring consultant until installation and backfilling is complete. Additional survey monitoring of the lateral support system may be required if movement (lateral or vertical) is measured following backfilling to the existing grade.
7. If, in the Engineers judgment, the performance of the excavation support system is unacceptable, the Owner may instruct the Contractor to stop work and implement remedial measures to arrest further movements or restore groundwater levels to pre-construction levels. The Contractor shall take immediate steps to implement the remedial measures designed by the Contractor and reviewed by the Engineer. The costs for these measures shall be at no additional cost to the Owner.
8. Temporary excavation support systems shall be designed and installed in accordance with OSHA excavation safety standards.

1.2 SUBMITTALS

A. Shop Drawings: Submit the following in accordance with Section 01300 – SUBMITTALS.

1. Submit the following qualifications three weeks prior to the construction:
 - a. Qualifications of Contractor's temporary excavation support system designer as specified below.
 - b. Qualifications of Contractor's temporary excavation support system installer as specified below.
2. Submit a temporary excavation support plan stamped and signed by a Registered Professional Civil Engineer at least two weeks prior to start of the construction. Submit design calculations for review that will be only for the information of the Owner and third parties for an overall understanding of the project relating to access, maintenance of existing facilities and proper utilization of the site. The Contractor shall remain responsible for the adequacy and safety of the means, methods and sequencing of construction. The plan shall include the following items as a minimum:
 - a. Drilled or hydraulically pushed in place excavation support system, details, location, layout, depths, extent of different

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types of support relative to existing features and the permanent structures to be constructed, and methods and sequence of installation and removal.

- b. Certificate of Design
 - c. Requirements of dewatering during the construction.
 - d. Minimum lateral distance from the edge of the excavation support system for use for vehicles, construction equipment, and stockpiled construction and excavated materials.
 - e. List of equipment used for installing the excavation support systems.
3. Submit a Construction Contingency Plan specifying the methods and procedures to maintain excavation support system stability if the allowable movement of the adjacent ground and adjacent structures is exceeded.
 4. For excavation support systems left in place, submit the following as-built information prior to backfilling and covering the excavation support systems:
 - a. Survey locations of the temporary excavation support systems, including coordinates of the ends and points of change in direction.
 - b. Type of the temporary excavation support system.
 - c. Elevations of top and bottom of the excavation support systems left in place.
 5. Estimates of the lateral and vertical displacements of the excavation lateral support systems under applied loads at critical stages.

1.3 QUALITY ASSURANCE

- A. Provide in accordance with Section 01400 – QUALITY CONTROL and as specified.
- B. Conform to the requirements of the OSHA Standards and Interpretations: "Part 1926 Subpart P - Excavation, Trenching, and Shoring", and all other applicable laws, regulations, rules, and codes.
- C. All welding shall be performed in accordance with AWS D1.1.
- D. Prepare design, including calculations and drawings, under a Professional

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Civil Engineer registered in the Commonwealth of Massachusetts and having the following qualifications:

1. Not less than five years experience in the design of soldier pile and lagging and steel or timber sheeting temporary excavation support systems of at least 10 feet deep in urban areas of comparable type, size, and complexity as this project.
2. Completed not less than five successful soldier pile and lagging and steel or timber sheeting temporary excavation support system projects of comparable type, size, and complexity as this project within the last five years.

E. Temporary Excavation Support System Installer's Qualifications:

1. Not less than five years experience in the installation of soldier pile and lagging and steel or timber sheeting temporary excavation support systems of at least 10 feet deep in urban areas of comparable type, size, and complexity as this project.
2. Completed not less than five successful soldier pile and lagging and steel or timber sheeting temporary excavation support system projects of comparable type, size, and complexity as this project within the last five years.

F. Install all temporary excavation support systems under the supervision of a supervisor having the following qualifications:

1. Not less than five years experience in installation of soldier pile and lagging and steel or timber sheeting temporary excavation support systems of at least 10 feet deep in urban areas of comparable type, size, and complexity as this project.
2. Completed at least five successful soldier pile and lagging and steel or timber sheeting temporary excavation support system projects of comparable type, size, and complexity as this project within the last five years.

1.4 DESIGN CRITERIA

A. Design of temporary excavation support systems shall meet the following minimum requirements:

1. Support systems shall be designed for earth pressures, hydrostatic pressure, equipment, traffic, temporary stockpiles, construction loads, and other surcharge loads.
2. Design internal bracing to provide sufficient reaction to maintain

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stability.

3. Limit movement of ground adjacent to the excavation support system to not more than 1-inch.
4. Design the embedment depth below bottom of excavation to minimize lateral and vertical earth movements and provide bottom stability. Toe of braced temporary excavation support systems shall not be less than 5 feet below the bottom of the excavation.
5. Design temporary excavation support system shall withstand an additional 3 feet of excavation below proposed bottom of excavation without redesign except for the addition of lagging and/or bracing.
6. Maximum width of pipe trench excavation shall be as indicated on the Drawings.
7. Permanent structure walls shall not be directly cast against excavation support walls.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Provide in accordance with Section 01600 – PRODUCTS, MATERIALS AND EQUIPMENT and as specified.
- B. Store sheeting and bracing materials to prevent sagging, which would produce permanent deformation. Keep concentrated loads, which occur, during stacking or lifting below the level, which would produce permanent deformation of the material.

1.6 PROJECT/SITE CONDITIONS

- A. Subsurface investigation data are available as referenced in Section 02010 – SUBSURFACE INVESTIGATION. The geotechnical data is made available to the Contractor for informational purposes only and shall not be interpreted as a warranty of subsurface conditions whether interpreted from written text, boring logs, or other data.
- B. Prior to submitting a bid, the Contractor shall review and understand the information contained in the geotechnical data and all Contract Documents.
- C. The Contractor shall draw his own conclusions regarding site conditions based upon site visit(s) and from available sources, for which the Owner and its Consultants assume no responsibility. The Contractor shall assume that subsurface conditions between subsurface explorations could differ from conditions shown in the records of the explorations.
- D. The Contractor shall notify the Engineer immediately if obstructions are

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determined to conflict with the location of the excavation support system. Cobbles and boulders within dense well-bonded soils or other competent naturally deposited soils will not be considered obstructions.

- E. The Contractor shall protect adjacent structures above ground and buried from damage associated with lateral support of excavation operations and other operations. Damage due to lateral excavation support operations or other Contractor activities shall be repaired immediately by the Contractor at his own expense.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Structural Steel

1. All soldier piles, Wales, rakers, struts, wedges, plates, waterstop and accessory steel shapes shall conform to ASTM A36.
2. Steel Sheet Piling: ASTM A 328/A 328M, ASTM A 572/A 572M, or ASTM A 690/A 690M; with continuous interlocks.

B. Timber Lagging Left-in-Place

1. Structural grade having a nominal thickness of 3 inches and a minimum allowable working stress of 1100 psi.

C. Timber Sheeting Left-in-Place

1. Structural grade having a nominal thickness of 4 inches and a minimum allowable working stress of 1100 psi.

D. Other Materials

1. Tamping tools adapted for backfilling voids after removal of the excavation support system.
2. Provide specific trench box sizes for each pipe and utility excavation with structural capacity of retaining soil types as described in OSHA's 29 CFR Part 1926 Subpart P.

PART 3 – EXECUTION

3.1 GENERAL

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- A. Installation of the temporary excavation support system shall not commence until the Engineer has reviewed the related earth excavation and dewatering submittals with all Engineers' comments satisfactorily addressed.
- B. Install excavation support system in accordance with the Contractor's temporary excavation support plan.
- C. Carry out program of temporary excavation support in such a manner as to prevent undermining or disturbing foundations of existing structures of work ongoing or previously completed.
- D. Perform preparatory work to discover, protect, maintain and restore, or remove utilities, foundations or other facilities located in close proximity of the proposed excavation lateral support system.
- E. Conduct pre-excavation as necessary to remove obstructions and identify exiting utilities along the alignment of the excavation lateral support system which will interfere with installation in accordance with Section 02210 – EARTH EXCAVATION, BACKFILL, FILL AND GRADING.
- F. The Contractor shall provide fully equipped rig(s) and appropriate tools in full-time operation at the site during the work, and shall mobilize additional equipment, if necessary, to complete the work on schedule.
- G. Excavation shall not proceed more than 2 ft below the bracing level, anywhere within the excavation support limits, until the entire level of bracing is completely installed, including prestressing.
- H. Notify utility owners if existing utilities interfere with the temporary excavation support system. Modify the existing utility with the utility owner's permission or have the utility owner make the modifications at no additional cost to Owner.

3.2 SOLDIER PILES AND TIMBER LAGGING

- A. Install steel soldier piles before starting excavation. Install soldier piles by drilling or hydraulically pushing to the design tip elevation. Drilled methods shall prevent loss of ground around the hole. Each soldier pile shall be installed in its drilled hole within 2 hours after drilling is completed to the required depth.
- B. The Contractor shall have equipment on-site able to advance the drilled hole, for installation of the soldier piles, through sand below the water table, through concrete, and through large boulders and other obstructions which may be encountered.
- C. Space soldier piles at intervals indicated on the Shop Drawings. Accurately align exposed faces of flanges to vary not more than 2 inches from a

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horizontal line and not more than 1:120 out of vertical alignment.

- D. Within the same day of seating the soldier piles in the drilled holes, encase the piles with MHD (1995) M4.08.0 – Controlled Density Fill, Type 1E from the tip elevations to the currently existing ground surface. Crushed stone or other granular materials are not acceptable.
- E. Prior to completion of the final backfilling operations, soldier piles shall be cut off five feet below the final ground surface.
- F. Install wood lagging within flanges of soldier piles as excavation proceeds. Trim excavation as required to install lagging. As installation progresses, backpack the voids between the excavation face with sand and on-site soils to establish a tight contact. Pack louver openings between lagging with hay or other porous material to allow free drainage of groundwater without loss of retained soil or backpacking. In no case shall the louvered openings be allowed to exceed 1-inch.
- G. Beginning at the top of the soldier piles, the maximum permissible height of unlagged face of excavation shall not exceed 2-feet in all soil types encountered at the site. If water is flowing from the face of the excavation, or if soil to be retained moves toward the excavation, the maximum height of unlagged face shall not exceed 8-inches.
- H. If unstable ground is encountered, take suitable measures (grouting behind the lagging or other approved method) to retain the material in place and prevent loss of ground or movements, which may cause damage to adjacent structures or utilities.

3.3 INSTALLATION – STEEL OR TIMBER SHEETING

- A. Length Markings: Before installation is started each steel or timber section shall be marked so that the depth of the tip can be readily determined. This shall be accomplished by a method that is approved by the Engineer.
- B. Sheeting shall be installed by means of excavating or hydraulically pushing each sheet piling to the required design depth. The Contractor shall take all precautions against excessive vibrations in all areas. The Contractor shall be solely responsible for any damages caused directly or indirectly to structures, sewer and other utilities, and shall repair any such damage occurring due to his operations to the requirements of the Owner.
- C. All sheeting shall be protected from damage during installation.
- D. All sheeting shall be driven or hydraulically pushed to its full depth ahead of the excavation so as to avoid the loss of material from behind the sheeting; where voids occur outside of the sheeting, they shall be filled immediately with structural fill and thoroughly compacted.

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- E. Requirements for the sheeting include the following:
1. Install sheeting in the plumb position.
 2. Install sheeting such that the piling is in direct contact with the material to be retained.
 3. Install sheeting to the depths indicated on approved Shop Drawings.
 4. Methods and equipment used in pushing, setting, cutting and splicing shall conform to approved Shop Drawings.
 5. Use templates or other temporary alignment facilities to maintain piles plumb and on line.
 6. Control vibrations and noise associated with installation.
 7. Pre-excavate as necessary to remove existing structures along alignment of the sheeting.
 8. Sheeting shall be positioned within 3 inches of the design plan location along its length from top down to bottom of excavation grade. Design plan locations are to be established by the Contractor's Professional Engineer and submitted to the Engineer for review.
- F. The Contractor shall provide all inspection equipment to determine whether the sheeting has been started in their planned location, are vertical, and are within the allowable tolerance for position after installation.

3.4 INTERNAL LATERAL WALL BRACING (WALES AND STRUTS)

- A. Use wales and struts as necessary to provide support of the excavation lateral support walls as required. Include web stiffeners, plates, brackets, or angles as required to prevent rotation, crippling or buckling of connections and points of bearing between structural steel members. Allow for eccentricities due to fabrication and assembly. Consider effects of temperature changes.
- B. Install and maintain all support members in continuous tight contact with each other and with the wall being supported.
- C. Coordinate locations of all bracing and components thereof for temporary lateral excavation support with locations of permanent structures.
- D. Control rate of excavation and installation of support members to minimize movement of adjacent ground surface.

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- E. Excavation shall proceed in accordance with the detailed sequence submitted by the Contractor and reviewed by the Engineer. It shall be the responsibility of the Contractor to schedule and sequence the work accordingly.

3.5 REMOVAL OF EXCAVATION SUPPORT SYSTEM

- A. Except as otherwise noted on the Drawings or specified herein, leave in place the excavation lateral support system outside the limits of the permanent structure with the exception of the top 5 ft. of excavation support wall below final grades.

PART 4 – COMPENSATION (Not Used)

END OF SECTION 02160

SECTION 02210

EARTH EXCAVATION, BACKFILL, FILL AND GRADING

2210.1	TEST PITS	CUBIC YARD
2210.2	CONTROL DENSITY FILL FOR BACKFILL	CUBIC YARD
2210.3	OVEREXCAVATION OF ORGANIC SILT AND PEAT	CUBIC YARD
2210.4	UNCLASSIFIED EXCAVATION	CUBIC YARD
2210.5	IMPORTED GRAVEL SUB-BASE	CUBIC YARD
2210.6	CRUSHED STONE CYCLE TRACK BASE	CUBIC YARD
2210.7	FINE GRADING AND COMPACTING SUBGRADE AREAS	SQUARE YARD

PART 1 – GENERAL

1.1 SUMMARY

A. This section includes the following:

1. The Work shall consist of excavation of all materials removed within the limits of the Contract in accordance with the Specifications and in close conformity with the lines, grades, thickness and cross sections shown on the plans or established by the Engineer.
2. The Contractor shall comply with all applicable laws, rules, ordinances, and general regulations of the Federal Government, the Commonwealth of Massachusetts, the City of Cambridge, the Cambridge Department of Public Works, MassDEP, EPA, OSHA, and other regulatory agencies having jurisdiction over the Work.
3. Provide materials for backfilling excavations as indicated and specified.
4. Overexcavate Organic Silt and Peat deposits where encountered at proposed sewer and drain subgrade alignment to the top of the stiff clay deposit between approximate Sta. 0+00 to Sta. 2+00 and Sta. 14+00 to Sta. 17+00 and as required by the Engineer. Overexcavated unsuitable soil to be replaced with compacted

structural fill. See Contract Drawings for approximate limits of overexcavation.

5. Grade surfaces to meet finished grades indicated. Grade roadway and site as to maintain them in a level unrutted condition and to eliminate puddling of surface and subsurface water.
6. See Item 32751.41 for requirements for Sand Based Structural Soil.

1.2 SUBMITTALS

A. Shop Drawings: Submit the following in accordance with Section 01300 – SUBMITTALS:

1. Submit an Excavation, Backfilling, Grading and Compaction plan at least two weeks prior to start of any earth moving activities. The review will be only for the information of the Owner and third parties for an overall understanding of the project relating to access, maintenance of existing facilities and proper utilization of the site. The Contractor shall remain responsible for the adequacy and safety of the means, methods and sequencing of construction. The plan shall include, but not be limited to the following items:
 - a. Detailed sequence of work.
 - b. General description of construction methods.
 - c. Numbers, types, and sizes of equipment proposed to perform excavation, backfilling, grading and compaction.
 - d. Details of dust control measures.
 - e. Proposed locations of stockpiled excavation and/or backfill materials.
 - f. Proposed surplus excavated material off-site disposal areas and required permits.
 - g. Erosion and sedimentation control measures, which will prevent erosion and sedimentation during the earth moving and soil stockpile activities.
 - h. Proposed sequence of operations for pervious pavement areas, including methods of protecting subgrades from fouling and sedimentation.

2. Backfill Materials: Submit a 20 lb. sample, grain size analysis and moisture density curve performed in accordance with ASTM D422 and compaction test results (ASTM D1557 Procedure C) for each proposed source of backfill, imported material and on-site material to be reused, for review by the Engineer at least, one week prior to use of the material. The grain size analysis shall indicate that the backfill material conforms to the gradation requirements specified.
 - a. In addition, a certification statement and analytical results shall accompany each physical sample of earth materials to be imported onto the site, including but not limited to crushed stone, loam, bedding sand, gravel sub-base, common fill and structural backfill. At a minimum the certification shall state the point of origin and that the material is free of contaminants. The certification shall include representative sample analysis from each point of origin of backfill to be used on the site. The sample(s) shall be analyzed by a certified laboratory for total metals (EPA priority pollutant metals), volatile organic compounds (EPA Method 8260), semi-volatile organic compounds (EPA Method 8270), petroleum hydrocarbons (EPA Method 8100), and Total PCBs and pesticides (EPA Method 8081 and 8082). On-site soils defined as suitable for reuse in this Section and in Section 02080 – SOIL AND WASTE MANAGEMENT can be used as backfill without providing the certification required above.
 - b. All sampling of soils for chemical testing shall be performed by a person experienced in sample collection and shall be either: 1) a Licensed Site Professional registered in the Commonwealth of Massachusetts; 2) a Professional Engineer registered in the Commonwealth of Massachusetts; 3) a professional Geologist registered in the Commonwealth of Massachusetts; 4) a certified groundwater/environmental professional; or 5) an authorized representative of the one of the persons listed above. Samples of each material shall be submitted to a chemical analytical laboratory, certified by the Massachusetts Department of Environmental Protection.
 - c. Submit additional samples and geotechnical and analytical test data and certifications for every 1000 cubic yards (every 200 cubic yards for moisture density curves) of material imported or reused on-site or anytime consistency of material changes in the opinion of the Engineer. Submit associated chemical laboratory data on the imported materials throughout the course of the Work, if requested by the

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Engineer, to evaluate the consistency of the source or process, at no additional cost to the Owner.

- d. Controlled Density Fill Mix Design: Prior to beginning the work the Contractor shall submit for review, controlled density fill mix designs which shall show the proportions and gradations of all materials proposed for each class and type of controlled density fill specified herein.
 - e. Filter Fabric: Submit shop drawings and product data sheets.
- 3. Separation Geotextile: submit manufacturer's information.
 - 4. During Construction, submit written confirmation of fill lift thickness, in-place soil moisture content, and percentage of compaction to the Engineer before placing the next lift or constructing foundations.
 - 5. Submit Qualifications of the Contractor's Independent Testing Laboratory as specified in Paragraph 1.5.K, three weeks prior to the execution of any earth excavation, backfilling, filling, or compaction process.

1.3 DEFINITIONS

- A. Acceptable Material: Material which does not contain organic silt or organic clay; peat; vegetation; wood or roots; stones or rock fragments over 6-inch in diameter; porous biodegradable matter; loose or soft fill; excavated pavement; or refuse. Stones or rock fragments shall not exceed 40 percent by weight of the backfill material. Clay or silt content shall not exceed 25 percent by weight of the backfill material.
- B. Unacceptable Materials: Materials that do not comply with the requirements for the acceptable material or which cannot be compacted to the specified or indicated density.
- C. Percentage of compaction is defined as the ratio of the field dry density, as determined by ASTM D1556 or ASTM D2922 to the maximum dry density determined by ASTM D1557 Procedure C, multiplied by 100.
- D. Proof Roll: Compaction with a minimum of four passes of a vibratory steel drum roller. Vibratory plate compactors shall be used in small areas where a vibratory steel drum roller cannot be used.

1.4 REGULATIONS

- A. The Contractor shall be solely responsible for making all excavations in a safe manner. All excavation, trenching, and related sheeting, bracing, etc. shall comply with the requirements of OSHA excavation safety standards (29 CFR Part 1926 Subpart P) and State requirements. Where conflict between OSHA and State regulations exists, the more stringent requirements shall apply.
- B. Comply with all applicable laws, rules, ordinances, and general regulations of the Federal Government, the Commonwealth of Massachusetts, the City of Cambridge, the Cambridge DPW, DEP, EPA, OSHA, and other regulatory agencies having jurisdiction over the Work.

1.5 QUALITY ASSURANCE

- A. Dewatering and Groundwater Control: Provide and maintain as specified in Section 02140 - DEWATERING.
- B. Excavations shall be performed in the dry, and kept free from standing water, snow and ice during construction.
- C. Temporary Excavation Support Systems: Provide and maintain as specified in Section 02160 – TEMPORARY EXCAVATION SUPPORT SYSTEMS
- D. Do not excavate or fill until the Engineer has reviewed all the required submittals.
- E. Formulate excavation, backfilling, and filling schedule and procedures to eliminate possibility of undermining or disturbing foundations of partially and completed structures, pipelines and embankments or existing structures and pipelines.
- F. Cut pavement and all surface materials to the top of the existing fill material with a saw to prevent damage to remaining pavement without extra compensation. Surface materials may include concrete slabs, cobblestones, rails and other miscellaneous materials. Where pavement is removed in large pieces, dispose of pieces before proceeding with excavation.
- G. Dig test pits considered separate to the normal excavation as required to locate underground utilities, obstructions or water table.
- H. If material for foundation support is found to be unacceptable, as defined in these Specifications, at or below the grade to which excavation would normally be carried in accordance with the drawings and/or specifications,

remove such material to the required width and depth as required by the Engineer and replace it with crushed stone.

- I. During progress of work, conduct earth-moving operations and maintain work site so as to minimize the creation and dispersion of dust.
- J. Bedding and backfill material shall not be placed in water. Water shall not be allowed to rise upon or flow over the bedding and backfill material.
- K. Employ an independent testing laboratory to perform particle size and gradation analyses, in accordance with ASTM D422, as well as compaction testing. The independent testing laboratory shall have the following qualifications:
 - 1. Be accredited by the American Associates of State Highway and Transportation Officials (AASHTO) Accreditation Program;
 - 2. Have three years experience in sampling, testing and analysis of soil and aggregates, and monitoring field compaction operations;
 - 3. Able to provide three references from previous work.

1.6 AVAILABLE INFORMATION

- A. Prior to submitting his bid, the Contractor shall review and understand all available information possible. Test boring logs prepared by the Engineer, are included in the Contract Documents and are made available to the Contractor for informational purposes only and shall not be interpreted as a warranty of the subsurface conditions. Laboratory soil tests were performed on samples collected in the test borings. Lab test data is included in the Documents. The subsurface data represent conditions only at the sampling locations at the times the explorations were conducted.
- B. Neither the Owner nor Engineer shall be liable for any error or discrepancy in the subsurface information provided, nor for the Contractor's use or interpretation of the information. Additional test borings, test pits or other exploratory operations may be made by the Contractor with the written approval of the Owner, at no additional cost to the Owner.

1.7 MATERIAL TESTING

- A. Moisture Density - One per source, except for crushed stone. Repeat the moisture density test for every 200 cubic yard of material used, and whenever visual inspection indicates a change in material gradation as required shall be as determined by the Engineer.

- B. Gradation Analysis - A minimum of one per source, for each moisture density test, for every 100 cubic yards of material used, and whenever visual inspection indicates a change in material gradation. For on-site fill soil, the Engineer shall determine frequency of tests required.
- C. Construction Tolerances: Construct finished surfaces to plus or minus 0.5 inches of the elevations indicated. Provide the Engineer with adequate survey information to verify compliance with above tolerances.

1.8 FIELD TESTING

- A. Field Testing and Inspections: By Contractor's independent testing laboratory, acceptable to the Engineer, at Contractor's expense as specified. Location of tests shall be mutually acceptable to testing laboratory and the Engineer or as required by the Engineer. In the event compacted material does not meet specified in-place density, recompact material and retest this area until specified results are obtained at no additional cost to the Owner.
- B. Methods of Field Testing: In-Place Density: ASTM D1556, ASTM D2167, or ASTM D2922; In-Place Moisture Content: ASTM D3017, ASTM D4944, or ASTM D4959; Material Testing Frequency: The following testing frequencies are minimum required for all structural and non-structural fill materials.
- C. Field In-Place Density and Moisture Content - Crushed stone shall be compacted as specified and indicated. For other backfill and fill materials, minimum test frequency shall be as follows, and no less than two tests per lift:
 - 1. Trenches under structures, foundation preparation, or roadways subbase: Every 30 liner ft. per lift.
 - 2. Trenches in areas without structures or roadways: Every 50 lin. ft. per lift
 - 3. Under Structure: Every 300 sq. ft. per lift.
 - 4. Around Structures: Every 100 sq. ft. per lift.

PART 2 – PRODUCTS

2.1 SAND BORROW

- A. Sand borrow shall consist of clean, inert, hard, durable grains of quartz or other hard durable rock free from clay and loam or other deleterious or

organic material. Sand borrow shall be used as pipe bedding for all pipe with the exception of Reinforced Concrete Pipe, placed between 6 inches below pipe invert to 6 inches above pipe crown. The sand borrow shall conform to Massachusetts Highway Department (MHD) Specification Designation, M1.04.1, and the following gradation:

Sieve Size	Percent Passing by Weight
1/2-inch (12.7mm)	100
3/8-inch (9.525mm)	85-100
No. 4	60-100
No. 16	35-80
No. 50	10-55
No. 200	2-10

2.2 COMMON FILL AND ON-SITE MATERIAL GEOTECHNICALLY SUITABLE FOR REUSE ON-SITE AS BACKFILL:

- A. Common fill and on-site material geotechnically suitable for reuse on-site as backfill shall consist of sand and gravel consisting of hard durable particles, and free from trash, ice and snow, tree stumps, roots and other organic matter. Common fill and on-site material geotechnically suitable for reuse on-site as backfill shall be used from the top of the sand borrow or crushed stone and below the gravel subbase layer.

Common fill and on-site material geotechnically suitable for reuse on-site as backfill shall conform to the following gradation requirements:

Sieve Size	Percent Finer by Weight
6-inch (152.4mm)	100
No. 4	30-80
No. 40	30-50
No. 200	0-25

2.3 CRUSHED STONE

- A. Crushed stone shall consist of durable crushed rock or durable crushed gravel stone, free from ice and snow, sand, clay, loam, or other deleterious or organic material. Crushed stone shall be used as Reinforced Concrete Pipe bedding between 6 inches below pipe invert to 6 inches above pipe crown; initial 12 inches of backfill under structures; as a working mat; as a filter around perforated drain pipe; and as foundation material for roadway curb.

Where indicated or specified, crushed stone shall be wrapped in filter fabric, placed in maximum 6-inch thick layers, loose measure, and compacted with

a minimum of four passes of a vibratory plate or roller compactor. The crushed stone shall be uniformly blended and shall conform to the following requirements.

Sieve Size	Percent Passing by Weight
1-inch (25.4 mm)	100
3/4-inch (19.05 mm)	90-100
5/8-inch (15.875 mm)	---
1/2-inch (12.7 mm)	10-50
3/8-inch (9.5 mm)	0-20
No. 4	0-5
No. 8	---

2.4 CONTROLLED DENSITY FILL (CDF)

- A. Controlled density fill shall consist of a cementitious hard excavatable mixture of aggregate, Portland Cement, and air entraining admixtures. The material shall be of the type specified in Massachusetts Highway Department 1995 Standard Specifications for Highway and Bridges, as amended, Type 2E. Controlled density fill shall be used as trench backfill material around structures (not including manholes and catch basins) between the top of the crushed stone layer and the top of the structure. Controlled density fill shall also be used to fill abandoned utilities and around the excavation support systems as required by the Engineer.

2.5 STRUCTURAL FILL

- A. Structural fill shall consist of gravel and sand consisting of hard durable particles, and free from trash, ice and snow, tree stumps, roots and other organic and deleterious or organic matter. Structural fill shall be used for replacement of soft organic soils below pipe inverts and below structures; and as a new subgrade in full-depth roadway areas. Structural fill shall conform to the following gradation requirements.

Sieve Size	Percent Passing by Weight
3-inch (76.2 mm)	100
No. 4	40-70
No. 40	10-30
No. 200	0-8

2.6 FILTER FABRIC

- A. Filter Fabric used, as a drainage medium and separation layer shall consist of a nonwoven fabric made from polypropylene or polyethylene filaments or yarns. The fabric shall be inert to organic chemicals commonly encountered in the soil. The fabric shall conform to the following recommended property tests:

Property	Unit	Test Method	Minimum Value
Weight	oz/sy	ASTM D-3776	4.5
Grab Strength	Lbs	ASTM D-4632	120
Grab Elongation	percent	ASTM D-4632	55
Trapezoid Tear Strength	Lbs	ASTM D-4533	50
Mullen Burst Strength	Psi	ASTM D-3786	210
Puncture Strength	Lbs	ASTM D-4833	70

Edges and ends of filter fabric shall overlap a minimum of two feet.

2.7 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. The gravel subbase shall be used in areas of sidewalk and full depth roadway construction, and in the upper one foot of trench backfill material immediately below pavements and graded in accordance with Massachusetts Department of Transportation Highway Division (MassDOT) specification section M1.03.1 as indicated below:

Sieve Size	Percent Passing by Weight
3-inch	100
1-1/2-inch	70-100
3/4-inch	50-85
No. 4	30-60
No. 200	0-10

- B. The Contractor is encouraged to consider the reclamation of existing asphalt and concrete roadway materials for use as roadway subbase in lieu of, or supplementary to, gravel borrow. Due to proposed roadway elevation changes and site constraints, it is anticipated that processing of existing materials into suitable subbase materials will occur off-site. Reclaimed

concrete and/or asphalt used as roadway subbase shall be in conformance with the requirements of MassDOT Standard Specification Section M1.09.0.

2.8 CRUSHED STONE CYCLE TRACK BASE

- A. Crushed Stone Cycle Track Base to be used beneath pervious asphalt surfaces shall conform to the requirements of MassDOT Standard Specifications Section M2.01.0 with the following gradation:

Sieve Size	Percent Passing by Weight
3/4-inch	100
1/2-inch	90-100
3/8-inch	70-90
No. 4	20-40
No. 8	10-20
No. 40	0-8
No. 200	0-3

2.9 SEPARATION GEOTEXTILE

- A. Separation geotextile shall be a nonwoven needlepunched geotextile made of 100% polypropylene staple filaments. The geotextile shall satisfy the requirements of AASHTO M-288-06 for Class 2 applications and meets the following values:

PROPERTY	ASTM TEST METHOD	Min. Property Requirements
Tensile Strength	D-4632	160 lbs
Elongation @ Break	D-4632	50%
Mullen Burst	D-3786	305 psi
Puncture Strength	D-4833	90 lbs
CBR Puncture	D-6241	310 lbs
Trapezoidal Tear	D-4533	60 lbs
Apparent Opening Size	D-4751	US No. 30 Max.
Permittivity	D-4491	.02 Sec-1
UV Resistance @ 500 Hours	D-4355	50%

PART 3 – EXECUTION

3.1 GENERAL

- A. Do not excavate or fill until the Engineer has reviewed all the required submittals.

3.2 SITE MAINTENANCE

- A. Roadway and Site Leveling: Grade roadway and site as to maintain them in a level unrutted condition and to eliminate puddling of surface and subsurface water.

3.3 SUBGRADE PREPARATION AND PROTECTION (NON-PERVIOUS PAVEMENT)

- A. Proof roll the subgrade prior to backfilling and filling operation, or placing crushed stone or sand borrow.
- B. Proof roll the pipe trench foundation subgrade prior to backfilling and filling operation.
- C. Over excavate all organic soil at subgrade to the top of the stiff clay deposit and replace with compacted structural fill material.
- D. Fine grading and compacting subgrade in full-depth roadway areas shall be performed in accordance with Section 170 of the MassDOT Standard Specifications. In roadway areas where Structural Fill is to be used, the plane of the base upon which the Structural Fill is to be placed shall be compacted and graded until the surface is smooth. A tolerance of 1 inch above or below the proposed grade will be allowed, provided that this 1 inch above or below grade is not maintained for a distance longer than 50 feet and that the required crown is maintained.

3.4 SUBGRADE PREPARATION AND PROTECTION (PERVIOUS PAVEMENTS)

- A. The Contractor shall adhere to the following requirements when placing and compacting backfill materials below the pervious asphalt cycle track and the adjacent concrete curbside buffer.
- B. Subgrade shall be level and shall not be compacted or subjected to excessive construction equipment traffic prior to placement of sand-based structural soil and geotextile. All fine grading shall be done by hand. If erosion causes fine material to be deposited on the subgrade, this material shall be removed with light equipment and the subgrade scarified to a depth of 6 inches.

- C. Contractor shall maintain a minimum of 6-inches of existing material, or temporary fill, over subgrade until just prior to placement of separation geotextile or sand-based structural soil (beneath cycle track).
- D. Placement of sand-based structural soil shall be performed immediately after Engineer's approval of subgrade preparation.

3.5 **COMPACTION EQUIPMENT**

- A. The compaction equipment shall be selected by the Contractor, and shall be capable of consistently achieving the specified compaction requirements. The selected compaction equipment shall meet the following minimum requirements:
 - 1. Manually operated vibratory plate compactors weighing no less than 200 pounds with vibration frequency no less than 1600 cycles per minute.
 - 2. Vibratory steel drum roller weighing at least 12,000 pounds.
 - 3. Water jetting and puddling will not be allowed.

3.6 **COMPACTION REQUIREMENTS**

- A. The degree of compaction is expressed as a percentage of the maximum dry density at optimum moisture content as determined by ASTM Test D1557, Procedure C. The compaction requirements are as follows:

Area	ASTM Density Degree of Compaction
Natural subgrade (non-pervious pavement)	Proof roll
Natural subgrade (pervious pavement)	Do not compact
Crushed stone	As specified herein
Sand Borrow	As specified herein
Crushed Stone Cycle Track Base	95%
Gravel subbase	95%* *65% below lawn areas
General backfill with CDF adjacent to structures	As specified herein
Trench backfill (on-site fill)	
- below pavements	95%
- below landscaped areas	90%

Area	ASTM Density Degree of Compaction
Sand Based Structural Soil	See Item 32751.41
Other areas	90%

- B. Moisture Control: Fill that is too wet for proper compaction shall be desiccated, harrowed, or otherwise dried to a proper moisture content to allow compaction to the required density. If fill cannot be dried within 24 hours of placement, it shall be removed and replaced with drier fill at no additional cost to the Owner.
- C. Fill that is too dry for proper compaction shall receive water uniformly applied over the surface of the loose layer. Sufficient water shall be added to allow compaction to the required density.
- D. Unfavorable Conditions: In no case shall fill be placed in standing water, over organic silt or peat or material that is frozen. No fill material shall be placed, spread or rolled during unfavorable weather conditions. When work is interrupted by heavy rains, fill operations shall not be resumed until the moisture content and the density of the previously placed fill are as specified.
- E. In freezing weather, a layer of fill shall not be left in an uncompacted state at the close of the day's operations. Prior to terminating work for the day, the final layer of compacted fill shall be rolled with a smooth wheeled roller to eliminate ridges of soil left by compaction equipment.
- F. Compaction Control: In-place density tests shall be made at the Contractor's expense in accordance with ASTM D1556, D2922 or D2167 as the work progresses, to determine the degree of compaction being attained by the Contractor. Any corrective work required as a result of such tests, such as additional compaction, or a decrease in the thickness of layers, shall be performed by the Contractor at no additional expense to the Owner.
- G. The Engineer's duties do not include supervision or direction of the actual work by the Contractor, his employees or agents. Neither the presence of the Engineer nor any observation and testing performed by him shall excuse the Contractor from defects discovered in his work at that time or subsequent to the testing.
- H. Placement: All fill shall be placed in horizontal layers. Fill shall not be placed following the natural contours of the ground. Fill shall be placed starting in the lowest areas working up to finish grades in horizontal layers in the manner specified herein. Each layer of fill should be benched into the existing slope in order to avoid the formation of a shear plane.

EARTH EXCAVATION,
BACKFILL, FILL, AND GRADING
02210-14

- I. Surfaces: After backfilling trenches and excavations, the Contractor shall maintain the surfaces of backfill area in good condition so as to present a smooth surface at all times level with adjacent surfaces. The Contractor shall repair any subsequent settling over backfilled area immediately, in a manner satisfactory to the Engineer, and such maintenance shall be provided by the Contractor for the life of this Contract, at no additional expense to the Owner.
- J. The finished subgrade of the fills and filled excavations upon which topsoil or sand based structural soil is to be placed, or pavements are to be constructed, shall not be disturbed by traffic of other operations and shall be maintained in a satisfactory condition until the finished courses are placed. The storage or stockpiling of materials on finished subgrade will not be permitted.

3.7 SEPARATION OF EXCAVATED MATERIAL FOR REUSE

- A. Carefully remove acceptable material from excavated areas and store separately for further use as backfill material or for disposal or immediately reuse at the area of excavation as backfill.
- B. Reuse surplus acceptable excavated materials for backfill as indicated and in accordance with Section 02080 – SOIL AND FILL MANAGEMENT; deposit neatly and grade.

3.8 BACKFILL MATERIAL SELECTION

- A. Backfill Material Selection: Unless otherwise specified or required, material used for filling and backfilling shall meet the requirements specified under Backfill materials. In general, the material used for backfilling trench excavations within the zone above structures and 6 inches above pipe crowns shall be material removed from the excavation provided that the reuse of these materials result in the required trench compaction and meets the gradation requirements specified for on-site fill. In areas where the bottom of the excavation is in silt and clay, and is below the groundwater table, a working mat and drainage layer of 12 inches of compacted crushed stone wrapped in filter fabric shall be placed.
- B. Place backfill to a maximum loose lift thickness of 9 inches except where used as pipe bedding. Maintain backfill material with a uniform moisture content, with no visible wet or dry streaking, between plus 2 percent and minus 3 percent of optimum moisture content. The final filled soil mass shall be as uniform as possible in lift thickness, moisture content, and effort required to compact soil mass.

3.9 STRUCTURE AND TRENCH BACKFILL

- A. The trenches shall be backfilled as soon as practicable with the material specified herein. All trench backfilling shall be done with special care, in the following manner and as required by the Engineer.
- B. Backfill material for pipe bedding shall be deposited in the trench, uniformly on both sides of the pipe, for the entire width of the trench as indicated on the drawings. Sand borrow bedding shall be placed by hand shovels, in layers not more than 4-inches thick in loose depth, and each layer shall be thoroughly and evenly compacted by tamping on each side of the pipe to provide uniform support around the pipe, free from voids. Crushed stone bedding material shall be placed in layers not more than 6-inches thick in loose measure, and compacted with at least 4 passes using a vibratory plate or roller compactor.
- C. The balance of trench backfill around structures (not including manholes or catch basins) shall be CDF material from the crushed stone layer at the bottom of the structure to the common fill layer at the top of the structure. The common fill material shall be spread in layers not exceeding 9-inches in loose depth and each layer thoroughly compacted by mechanical methods and shall contain no rock, stones or boulders larger than 6-inches in their greatest dimension. The balance of the trench with no structures shall be common fill material placed in 9-inch thick lifts and compacted up to the bottom of the gravel subbase layer.
- D. All trench backfilling shall be done with special care and must be carefully placed so as not to disturb the work at any time if necessary, timber grillage or other suitable method shall be used to break the fall of material. The moisture content of the backfill material shall be such that proper compaction will be obtained. Backfill shall be made to grades required to establish the proper subgrade for the placement of topsoil or pavement base courses.
- E. In backfilling trenches, each layer of backfill material shall be moistened and compacted to a density as specified herein, and in such a manner as to permit the rolling and compaction of the filled trench or excavation with the adjoining earth to provide the required bearing value.
- F. Any trenches or excavations improperly backfilled or where settlement occurs shall be reopened, to the depth required for proper compaction, then refilled and compacted with the surface restored to the required grade and condition, at no additional expense to the Owner.
- G. During filling and backfilling operations, pipelines will be checked by the Engineer to determine whether any displacement of the pipe has occurred. If the observation of the pipelines shows poor alignment, displaced pipe or any

other defects they shall be remedied to meet Engineer and Owner requirements at no additional cost to the Owner.

3.10 BACKFILLING AGAINST STRUCTURES

- A. Backfilling against masonry or concrete shall not be done until permitted by the Engineer. The Contractor shall not place backfill against or on structures until they have attained sufficient strength to support the loads (including construction loads) to which they will be subjected, without distortion, cracking or other damage. As soon as practicable after the structures are structurally adequate and other necessary work has been satisfactorily completed, the Contractor, as required by the Engineer, shall make special leakage tests of the structures. After the satisfactory completion of leakage tests and the satisfactory completion of any other required work in connection with the structures, the backfilling around the structures shall proceed using CDF Material.
- B. Symmetrical backfill loading shall be maintained. Special care shall be taken to prevent any wedging action or eccentric loading upon or against the structures.
- C. In compacting and other operations, the Contractor shall conduct his operations in a manner to prevent damage to structures due to passage of heavy equipment over, or adjacent to, structures, and any damage thereto shall be remedied by the Contractor at no additional expense to the Owner.

3.11 EXCAVATION AND BACKFILL FOR ROADWAY AND STREETScape ELEMENTS

- A. Backfill procedures in roadway and sidewalk areas shall be in accordance with the applicable requirements of Sections 100 and 400 of the MassDOT Standard Specifications.
- B. See Section 32000 for requirements related to Sand Based Structural Soil.

3.12 CDF QUALITY CONTROL TESTING DURING CONSTRUCTION

- A. Slump: ASTM C143; one test at point of discharge for each day's placement; additional tests when CDF consistency seems to have changed.
- B. Compression Test Specimen: ASTM C31; one set of four (4) standard cylinders for each compression strength test, plus additional sets for each 100 cu yds more than the first 50 cu yds placed in any one day unless otherwise required.
- C. Compressive Strength Tests: ASTM C39; one set for each day's pour plus

additional sets for each 100 cu. yds more than the first 50 cu. yds placed in any one day; two specimens tested at 28 days, and two specimens tested at 90 days.

- D. Test results will be reported in writing to Engineer, Ready-Mix Producer, and Contractor within 24 hours after tests. Reports of compressive strength tests shall contain the project identification name and number, date of placement, name of testing service, fill type and class, location of fill batch along route, design compressive strength limits at 28 days and 90 days, fill mix proportions and materials, compressive breaking strength, and type of break for both 28 day tests and 90 day tests.

3.13 TRENCH EXCAVATION

- A. For pipe installation in a cradle or within bedding, excavate trench by machinery to, or just below designated subgrade. If material remaining at bottom of trench is disturbed, recompaction shall be required.
- B. When pipe is to be laid directly on bottom of trench, do not excavate lower part of trenches by machinery to subgrade. Remove remainder of material to be excavated by use of hand tools just before placing of pipe. Form a flat or shaped bottom, true to grade, so pipe will have a uniform and continuous bearing. Support on firm and undisturbed material between joints, except for limited areas where use of pipe slings have disturbed bottom.
- C. Excavate trenches to depths so as to permit pipe to be laid at elevations, slopes, or depths of cover indicated on drawings, and at uniform slopes between indicated elevations.
- D. Make trenches as narrow as practicable and do not widen by scraping or loosening materials from the sides. Make every effort to maintain sides of trenches firm and undisturbed until backfilling has been placed and compacted.
- E. Excavate trenches with approximately vertical sides between springline of pipe and elevation 1 ft. above top of pipe.

3.14 EXCAVATION NEAR EXISTING STRUCTURES

- A. Discontinue digging by machinery when excavation approaches pipes, conduits, or other underground structures. Continue excavation by use of hand tools. Include such manual excavation in work to be done when incidental to normal excavation and under items involving normal excavation.

- B. Excavate test pits when determination of exact location of pipe utilities or other underground structures is necessary for doing work properly.
- C. Execution of any earth excavation shall not commence until the related dewatering, soil and fill management, excavation support systems, and required backfill and fill materials submittals are reviewed by the Engineer and all Engineers' comments addressed.
- D. Carry out program of excavation, dewatering, and excavation support systems to eliminate possibility of undermining or disturbing foundations of existing structures or utilities of the work previously completed under this contract.
- E. Excavate to widths that give suitable room for constructing structures or laying and jointing piping.
- F. Do not plow, scrape or dig by machinery near to finished subgrade in a manner that would result in disturbance of subgrade.
- G. Excavate to lines and grades indicated in an orderly and continuous program.
- H. Establish limits of excavation to allow adequate working space for installing forms and for safety of personnel.
- I. Excavate to elevations indicated, or deeper, as required by the Engineer, to remove unacceptable subgrade material.
- J. Exercise care to preserve material below and beyond the lines of excavations.
- K. Boulders, rock fragments, and concrete less than one-half cubic yard encountered during excavation shall not be included for payment as rock.

3.15 REMOVAL OF SUBSURFACE OBSTRUCTIONS

- A. Remove indicated or approved subsurface structures and related obstructions to complete the work.
- B. Promptly notify the Engineer when any unexpected subsurface facilities are encountered during excavation such as utility lines and appurtenances, walls and foundations.

3.16 UNAUTHORIZED EXCAVATION

- A. When the bottom of any excavation is excavated beyond limits indicated or specified, backfill with crushed stone wrapped with non-woven geotextile

fabric. No additional payment will be made for the excavation of backfill or unauthorized excavation.

3.17 SUBGRADE PREPARATION AND PROTECTION

- A. As required by the Engineer, over-excavate any unacceptable materials below the subgrade, and replace with compacted structural fill.
- B. Utilize excavating equipment equipped with a toothless or smooth edged, excavating bucket to expose the pipe trench subgrade to avoid disturbance of the bearing surface.
- C. Backfill the overexcavation with structural fill and compact as previously indicated.
- D. Proof roll with a vibratory plate compactor or double drum roller (4 passes) the exposed subgrade prior to backfilling and filling operation, or placing soil-supported pipeline.

3.18 CARE AND RESTORATION OF PROPERTY

- A. Do not use or operate tractors, bulldozers, or other power-operated equipment on paved surfaces when their treads or wheels of which are so shaped as to cut or otherwise damage such surfaces. Restore surfaces damaged by the Contractor's operations to a condition at least equal to that in which they were found immediately before work commenced. Use suitable materials and methods for such restoration.

3.19 POLLUTION CONTROL

- A. During progress of work, conduct earth-moving operations and maintain work site so as to minimize the creation and dispersion of dust.
- B. Separation of Excavated Material for Reuse: Remove only existing pavement and all other surface materials, which may include concrete slabs, cobblestones, rail ties, by saw cutting that is necessary for prosecution of work.

PART 4 – COMPENSATION

Item 2210.1 – TEST PITS

METHOD OF MEASUREMENT:

Measurement for payment for Test Pits will be based on the actual cubic yards of material displaced during test pit excavation as required and measured by the Engineer. Depth of excavation will be measured to the average depth of the excavation. Irregularly deep parts

of the exaction will not be used as the excavation depth. The width of the excavation will be measured to an average width across the excavation. Irregularly wide parts of the excavation will not be considered the width of the excavation. Test Pits, completed for the Contractor's convenience, not approved by the Engineer, will be at the Contractor's expense and at no additional cost to the Owner.

BASIS OF PAYMENT / INCLUSIONS:

Payment for Test Pit shall be based on the cubic yards excavated complete for this item in the proposal. Under the per cubic yard price for this item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required for Test Pits. The work includes, but is not limited to; saw cutting bituminous and cement concrete; excavate and backfill such materials as necessary to locate pipe, utilities and other possible obstructions as indicated on the Drawings, as required by the Owner or Engineer, or as approved by the Owner or Engineer prior to performing the test pit; temporary excavation support; furnishing and placing backfill per one of the approved methods; compaction and compaction testing; coordination with utility companies/owners; survey of existing conditions including horizontal and vertical utility alignments and reflecting the actual conditions on the Project's As-built Drawings; and construction dewatering and all work incidental thereto and all work not specifically included for payment under other items.

EXCLUSIONS:

Test Pits completed for the purpose of soil characterization shall not be paid for under this item. Pre-trenching prior to the installation of temporary support of excavation or for any other purpose shall not be paid for herein unless approved by the Owner and Engineer prior to the pre-trenching or test pitting.

Item 2210.2 – CONTROL DENSITY FILL FOR BACKFILL

METHOD OF MEASUREMENT:

Measurement for payment for Control Density Fill for Backfill shall be made on the basis of cubic yards placed within the trench width pay limits shown indicated elsewhere in the Construction Documents or as otherwise approved by the Engineer.

BASIS OF PAYMENT / INCLUSIONS:

Payment for Control Density Fill for Backfill shall be based on the cubic yards installed complete for this item in the proposal. Under the per cubic yard price for this item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required for Control Density Fill for Backfill. The work includes, but is not limited to; furnish and install control density fill for backfill under existing utilities, in areas of difficult compaction, and where required by the Engineer; temporary bulkheads and forms; furnishing and installing filter fabric; and material testing.

EXCLUSIONS:

Control Density Fill used for the abandonment of pipes and structures will not be paid for under this item.

Item 2210.3 – OVEREXCAVATION OF ORGANIC SILT AND PEAT

METHOD OF MEASUREMENT:

Measurement for payment for Overexcavation of Organic Peat and Silt shall be made on the basis of cubic yards of peat or other unsuitable material excavated. The depth of unsuitable material in pipe trenches shall be measured from 6 inches below the invert of the pipe to the top of stiff clay. The width of unsuitable material shall be determined as outlined in the Typical Trench Detail included with the Contract Documents. The depth of unsuitable material in structure excavations shall be measured from 12 inches below the bottom of the structure slab to the top of stiff clay. The width of unsuitable material in structure excavations shall be based on a 1:1 slope from the edge of the bottom of the structure to the top of the acceptable material.

BASIS OF PAYMENT / INCLUSIONS:

Payment for Overexcavation of Organic Peat and Silt shall be based on the cubic yards excavated complete for this item in the proposal. Under the unit price bid, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required for overexcavation of peat or other unsuitable material below the grade of structures, pipe, or manholes, as required by the Engineer. The work includes, but is not limited to; excavate peat or other unsuitable material; load, transport, and dispose of such material away from the job; install temporary excavation support; furnishing and placing backfill per one of the approved methods; compaction and compaction testing; and construction dewatering and all work incidental thereto and all work not specifically included for payment under other items.

Item 2210.4 – UNCLASSIFIED EXCAVATION

METHOD OF MEASUREMENT:

Measurement for payment for Unclassified Excavation shall be made on the basis of cubic yards of concrete subbase, asphalt, cobbles, railroad track and ties, and gravel excavated to final grade as indicated elsewhere in the Construction Documents or as otherwise approved by the Engineer. Under the per cubic yard price for this item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required for the removal of concrete subbase, asphalt, cobbles, railroad track and ties, and gravel excavated to final grade. The work includes, but is not limited to; saw cutting bituminous and cement concrete; excavating, and all work incidental thereto and all work not specifically included for payment under other items.

BASIS OF PAYMENT / INCLUSIONS:

Payment for Unclassified Excavation shall be based on the cubic yards excavated complete for this item in the proposal. Under the per cubic yard price for this item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required for the removal of concrete subbase, cobbles, railroad track and ties, excavation of asphalt and gravel excavated to final grade. The work includes, but is not limited to; saw cutting bituminous and cement concrete; excavating concrete subbase, cobbles, railroad ties and tracks, asphalt, and gravel subbase; and all work incidental thereto and all work not specifically included for payment under other items.

EXCLUSIONS OR SPECIAL NOTES:

This item does not include payment for as removal of asphalt within the trench limits of structures, manholes, or pipe, as it is paid for elsewhere in the Contract Documents. This item does not include payment for removal of existing sidewalks (all types) as it is paid for elsewhere in the Contract Documents. This item does not include transportation and disposal of Unclassified Excavation, as it is paid for elsewhere in the Contract Documents.

Item 2210.5 – Imported Gravel Sub-Base

METHOD OF MEASUREMENT:

Measurement for Imported Gravel Sub-Base shall be based on the actual cubic yards of material complete-in-place, in accordance with Section 150.80 of the MassDOT Standard Specifications.

BASIS OF PAYMENT / INCLUSIONS:

Payment for Imported Gravel Sub-Base shall be based on the cubic yards installed complete for this item in the proposal. Under the per cubic yard price for this item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required for Imported Gravel Sub-Base. The work includes, but is not limited to; furnish and install gravel subbase and/or reclaimed pavement material for roadways, sidewalks, driveways; material testing, compaction and compaction testing. Should reclaimed pavement materials be used as sub-base, payment under this Item shall also constitute full compensation for transport of material to and from an on or off-site processing facility, and processing of material as required to meet the technical requirements specified herein.

EXCLUSIONS:

This item does not include payment for re-use of soil/fill excavated on site, staged, and later used as gravel sub-base on site or for soil/fill immediately reused on-site as backfill.

Item 2210.6 – Crushed Stone Cycle Track Base

METHOD OF MEASUREMENT:

Measurement for Crushed Stone Cycle Track Base shall be based on the actual cubic yards of material complete-in-place, in accordance with Section 150.80 of the MassDOT Standard Specifications.

BASIS OF PAYMENT / INCLUSIONS:

Payment for Crushed Stone Cycle Track Base shall be based on the cubic yards installed complete for this item in the proposal. Under the per cubic yard price for this item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required for Crushed Stone Cycle Track Base. The work includes, but is not limited to; furnish and install crushed stone base, material testing, compaction and compaction testing.

EXCLUSIONS:

This item does not include payment for installation of crushed stone for structures, pipe, or at

the outfall, which is paid for elsewhere.

Item 2210.7 – Fine Grading and Compacting Subgrade Areas

METHOD OF MEASUREMENT:

Measurement for Fine Grading and Compacting Subgrade Areas shall be based on the horizontal square yards of fine grading performed on the subgrade of full-depth roadway areas, in accordance with Section 170.80 of the MassDOT Standard Specifications.

BASIS OF PAYMENT / INCLUSIONS:

Payment for Fine Grading and Compacting Subgrade Areas shall be based on the area in horizontal square yards completed for this item. Under the per square yard price for this item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required for this item. This item will be paid for only when associated with full depth roadway construction.

EXCLUSIONS:

This item does not include grading and compaction of existing roadway subgrade soils upon which structural fill will be placed, which shall be considered incidental to the Structural Fill item. This item does not include grading and compaction associated with sidewalk and, cycle track areas, or associated with other work items.

END OF SECTION 02210

SECTION 02252

MANHOLES

2252.1	MANHOLE -PRECAST 4-FOOT DIAMETER	VERTICAL FOOT
2252.2	MANHOLE - PRECAST 5-FOOT DIAMETER	VERTICAL FOOT
2252.3	MANHOLE - PRECAST 5-FOOT DIAMETER EXTERIOR DROP	VERTICAL FOOT
2252.4	MANHOLE – PRECAST 6-FOOT DIAMETER	VERTICAL FOOT
2252.5	MANHOLE - PRECAST 6-FOOT DIAMETER EXTERIOR DROP	VERTICAL FOOT
2252.6	MANHOLE -PRECAST 8-FOOT DIAMETER	VERTICAL FOOT
2252.7	MANHOLE – PRECAST 8-FOOT DIAMETER EXTERIOR DROP	VERTICAL FOOT
2252.8	MANHOLE – 3’X4’ PRECAST	EACH
2252.9	EXISTING DRAINAGE OR SEWER STRUCTURE ADJUSTED	EACH
2252.10	DRAINAGE OR SEWER STRUCTURE REMODELED	EACH

PART 1 – GENERAL

1.1 SUMMARY

- A. This Section includes all labor, equipment, appliances, and materials required for construction of precast concrete sanitary sewer manholes and storm drain manholes, including manhole drops and drop over manholes, complete and in place, in accordance with the Drawings and Specifications and as required.
- B. Proposed manholes and structures installed prior to reconstruction of the roadway and sidewalks shall be installed to existing grade and later adjusted during the surface work.

1.2 RELATED WORK

- A. Section 02210 – EARTH EXCAVATION, BACKFILL, FILL AND

GRADING

- B. Section 02590 – BRICK MASONRY
- C. Section 03300 – CONCRETE
- D. Section 03315 – GROUT
- E. Section 03411 – PRECAST CONCRETE VAULTS AND STRUCTURES
- F. Section 07160 – DAMPPROOFING

1.3 SUBMITTALS

- A. General: Submit the following in accordance with General Conditions of Contract and Section 01300 – SUBMITTALS:
 - 1. Complete shop drawings for all precast manhole sections, cast iron frames and covers and appurtenances.
 - 2. Prior to fabrication, submit shop drawings showing details of precast monolithic base sections, risers, eccentric cone manhole tops and flat slab manhole tops, joints and gaskets, construction details, tolerances, and other information as required by the Owner.
 - 3. Submit manufacturer's recommended installation procedures for informational purposes.

PART 2 – PRODUCTS

2.1 MATERIALS

- A. Precast Bases and Risers:
 - 1. Precast reinforced concrete manhole bases, risers and top sections shall be of the sizes and types indicated or as required.
 - 2. Manhole sections shall conform to the requirements of ASTM C478, latest revision, except as modified herein and/or on the drawings.
 - 3. Each manhole section shall be constructed with a bell-and-spigot or tongue-in-groove joint.
 - 4. The manhole sections shall be manufactured by the centrifugal, roller suspension or vertical cast process; workmanship and methods shall

be in accordance with the best practices of modern shops for this type of work.

5. The height and diameter of manhole bases shall be as required to accommodate size of pipe used, as approved. The manhole risers shall be available in 2, 3, and 4-foot lengths.
6. Manhole tops of the eccentric cone type shall be 3 or 4 foot lengths with 30-inch inside diameter opening at top, unless otherwise noted as shown in the details.
8. Manhole tops of the flat slab type, where space restrictions exist or where required, shall be not less than 8 inches thick and reinforced as indicated, and shall have an opening having an inside diameter of 30-inches unless otherwise indicated.
9. Manhole bases and risers shall have the wall thicknesses as stated in the Drawings; cone type units shall taper to a minimum wall thickness of 8-inches at top.
10. All exterior concrete surfaces shall be coated with bituminous dampproofing as per Section 07160 – DAMPPROOFING.
11. Precast machine-made solid segments shall conform to ASTM C139.

B. Concrete:

1. All concrete shall conform to the requirements of Section 03300-CONCRETE and Section 03411 – PRECAST CONCRETE VAULTS AND STRUCTURES.
2. Not less than two concrete strength tests shall be made for each 100 vertical feet of manhole sections used and the test results submitted to the Owner and Engineer. Testing may be conducted at the manufacturer's plant or at an approved testing laboratory and shall be the responsibility of the Contractor, at no additional expense to the Owner.

- C. Frames and covers shall be heavy-duty Type A Massachusetts Standard and conform to the "Construction Standards" and "Standard Specifications for Highways and Bridges", of the Commonwealth of Massachusetts. All frames shall have a minimum clear opening of 24 inches unless otherwise noted. Submit shop drawings to Owner for approval before fabrication. Cast iron castings shall be true to pattern in form and dimensions, free from pouring faults, sponginess, cracks, blow-holes and other defects affecting the strength and value for the service intended. The finished coating shall be tough and

tenacious when cold and not brittle or with any tendency to scale off under reasonable temperature changes.

1. Unless otherwise noted on the Contract Drawings, the Contractor shall install heavy duty frames and covers that shall be product numbers 00200628C03, or 00211123C02 as manufactured by East Jordan Iron Works (formerly E. L. LeBaron Foundry Co.), or approved equal from Neenah Foundry Company or Campbell Foundry Company.
2. Pressure Type Frames and Covers :
 - a. Where noted on the Drawings, the Contractor shall furnish and bolted frames and covers that shall be product numbers 00211122W02 as manufactured by East Jordan Iron Works (formerly E. L. LeBaron Foundry Co.), or approved equal from Neenah Foundry Company or Campbell Foundry Company.
 - b. Pressure type frames shall have a clear opening of 24 inches or 30 inches opening as indicated in the Contract Drawings. Covers shall be secured with a stainless steel bolt and cam system. The cover shall have gaskets that provide a watertight seal. The frame and cover shall withstand H2O loadings.
 - c. Castings shall be true to pattern in form and dimensions, free from pouring faults, sponginess, cracks, blow-holes and other defects affecting the strength and value for the service intended. The finished coating shall be tough and tenacious when cold and not brittle or with any tendency to scale off under reasonable temperature changes.
3. Covers for all structures shall have the word "DRAIN", "SEWER" or other appropriate designation cast upon them.

D. Jointing:

1. Ends of each length of manhole riser, the bottom end of manhole tops of the cone type, base slabs, and the tops of monolithic bases shall be provided with bell-and-spigot or tongue-and-groove ends of concrete formed on machined rings to insure accurate joint surfaces.
2. Jointing shall be O-ring gaskets or butyl rubber molded sealants. All joints shall be provided so as to be watertight under all conditions of service. The ends of base, riser, and cone sections to be jointed using

neoprene "O-ring" type joints shall be designed to enclose the gasket on four surfaces when the joint is in its final position.

E. Gaskets:

1. Gaskets for sealing joints using the "O-ring" type gaskets shall conform to ASTM C443, latest revision, and shall be of rubber of a special composition having a texture to assure a watertight and permanent seal and shall be the product of a manufacturer having at least five years experience in the manufacture of neoprene gaskets for pipe joints, or shall be vulcanized butyl rubber sealants meeting or exceeding Federal Specifications SS-S-210.
2. Each gasket shall be a continuous ring of round solid cross-section having smooth surfaces free from blisters, porosity and other imperfections. The joint sealing gasket shall be of a composition and texture which shall be resistant to sewage, industrial wastes including gasoline, oils and groundwater, and which will endure permanently under the conditions likely to be imposed by this use. The tensile strength shall be at least 1,200 psi. The elongation shall be such that 2-inch gauge marks shall stretch to not less than 9 inches. The compression set (constant deflection) shall not exceed 25 percent of the original gauge length. The tensile strength after accelerated aging shall be not less than 80 percent of the original strength.
3. The butyl rubber sealant shall have a self adhesive nature and shall have a diameter of 1 inch and shall be furnished in coils. The sealant shall meet the following properties:

DESCRIPTION	SEALANT PROPERTY
Base	Vulcanized Butyl Rubber
Percent of solids	100%
Shore "A" Durameter:	
Initial	10
Aged	20
Adhesion to clean surfaces	Excellent
Temperature Range:	
Application	-20 degrees F to 120 degrees F
Service	-65 degrees F to 200 degrees F
Water Absorption after	
14 days immersion:	Less than 5%
Chemical Resistance after 7 days	
immersion in 5% Potassium Hydroxide	Excellent
and 5% Hydrochloride Acid	
Resistance to Water and	
Organic Solvents	Excellent

DESCRIPTION	SEALANT PROPERTY
Resistance to Shock, Heat, and Cold	Excellent
Color	Black
Shelf Life	Excellent
Elongation	
Initial	30%
2 weeks at 190 deg F, drying	250%
2 weeks in water	300%
Weather Resistance	Excellent
Moisture Diffusion Resistance	Excellent
Specific Gravity	1:18
Flash Point	None
Fire Point	Over 620 degrees F

F. Grout for Sealing Joints:

1. Grout for sealing grout-type joints, flexible manhole seals or field made pipe openings shall be a non-shrink type grout, factory-mixed ready-to-use product, containing especially prepared aggregate, cement and sand and other components which will produce a grout with properties to counteract shrinkage, increase density, withstand impact, improve workability, produce watertight joints, and which will be suitable for jointing around pipes entering manholes.
2. Where waterproofing of grouted joints is indicated or otherwise required due to site conditions such as high groundwater, contaminated groundwater, continuous submergence or zero leakage requirements, grout shall be installed with hydrophilic waterstops (Adeka or equal) or crystalline ad-mixture (Xypex or equal) as directed by the ENGINEER. Waterproofing of grouted joints shall be performed at no additional cost to the OWNER.

G. Mortar for Brickwork:

1. Per Section 02590 – BRICK MASONRY
2. Mortar and Brick for Raising Castings is prohibited.

H. Brick

1. Per Section 02590 – BRICK MASONRY
2. Mortar and Brick for Raising Castings is prohibited.

I. Bituminous Dampproofing

1. Per Section - 07160 – DAMPPROOFING

J. Flexible Manhole Seals

1. Flexible manhole seals shall be "New Lok Joint Flexible Sleeve" by Interpace, "A-Lok Manhole Sleeve" by L & L Concrete Products, "Press Wedge II" by Pre-Seal Basket Corporation, or approved equivalent.
2. Field applied seals shall be flexible rubber boots manufactured by Kor-N-Seal, Interpace, Pre-Seal Basket Corporation, L&L Concrete Products, or approved equivalent.
3. Manhole sleeves, gaskets and sealants shall be furnished complete with lubricants, stainless steel stops, inserts, clamps, etc.
4. All flexible manhole seals shall be capable of meeting a 10 psi internal hydraulic pressure.

PART 3 – EXECUTION

3.1 HANDLING:

- A. Manhole sections shall not be shipped for at least five days after manufacture.
- B. All manhole sections which have been damaged after delivery, and manhole sections installed in the work which are found to be damaged will be rejected and shall be removed and replaced, by the Contractor, with new, sound and approved material, at no additional expense to the Owner. At the time of inspection, the surfaces of the sections shall be dense and close-textured. Cores shall serve as a basis for rejection of manhole sections if poor bond or reinforcement is exposed.
- C. Each manhole section shall be handled into its position in the trench only in such manner and by such means as recommended by the manufacturer of the manhole sections, and as approved. Provide all necessary slings, straps and other devices for the safe and satisfactory handling and support of the manhole sections during lifting, installation and final positioning of the sections. Lifting holes may be permitted provided suitable rubber or concrete stopper or other approved devices are provided for plugging and sealing the holes and watertight, all as approved.

3.2 INSPECTION

- A. All manhole sections will be inspected upon delivery; manhole sections which do not conform to specification requirements will be rejected and shall

be removed immediately from the site and replaced by the Contractor at no additional cost to the Owner. The Contractor shall furnish all labor and facilities necessary to assist the Owner in inspecting the material.

- B. The quality of all materials, processes of manufacture, and the finished manhole sections shall be subject to inspection and approval of the Owner. Such inspection may be made at the place of manufacture and/or on the site, and the manhole sections shall be subject to rejection at any time because of failure to meet any of the specification requirements, even though sample manhole sections may have been accepted as satisfactory.

3.3 INSTALLATION

- A. Manhole sections shall be installed using approved type neoprene "O-Ring" type gasket or butyl rubber sealants for sealing joints of manhole sections; jointing shall be performed in accordance with the pipe manufacturer's recommendations, and as approved.
- B. Manhole sections shall be installed level and plumb.
- C. Manholes shall be constructed on a 12-inch compacted crushed stone or gravel base as indicated.
- D. Water shall not be permitted to rise over newly made joints until after inspection as to their acceptability. All jointing shall be done in a manner to insure watertight joints.
- E. The manhole frames shall be set with tops conforming accurately to the grade of the pavement or finished ground surface or as indicated on the drawings utilizing precast concrete risers and rings only. Brick and mortar shall not be used. Precast concrete manhole riser rings or approved equal shall be used. Interior and exterior joints shall be mortared. Frames shall be set in a full bed of mortar so that the space between the top of the brick and mortar and the bottom flange of the frame shall be completely filled and made watertight. A thick ring of mortar extending to the outer edge of the concrete shall be placed all around the bottom flange. The mortar shall be smoothly finished to a height of 4-inches above the flange.
- F. Opening in precast manhole sections to extent indicated on the drawings to receive entering pipes shall be made at the place of the manufacturer; where opening cannot be determined they shall be cut in the field. Depending upon the type of pipe seals to be furnished, pipe openings shall be provided with manhole seals of proper sizes to accommodate pipe sizes and shall be cast into the manhole at the time of manufacture. When openings are made in the field, the openings for entering pipes shall be of a size to provide a uniform annular space between the outside of pipe wall and the opening in the

manhole section of 3/4 inch, and after the pipe is in position the annular space shall be solidly filled with non shrink grout. Care shall be taken to assure that the openings are made to permit setting of the entering pipe at its correct elevation as indicated or directed. Openings which are cut in the manhole sections in the field shall be carefully made so as not to damage the sections; damaged sections will be rejected and shall be replaced at no additional expense to the Owner. Field cut openings shall be circular, not square and shall be made by the appropriate cutting or coring operation.

- G. Manhole inverts shall be brick masonry or concrete and shall have a cross-section shaped to conform to connecting pipes; changes in size shall be made gradually and evenly. Concrete and brick masonry for manhole inverts shall conform to Section 03300 - CONCRETE and Section 02590 – BRICK MASONRY, constructed as indicated and as specified.

3.4 BACKFILLING

- A. Conduct backfill operations of open cut trenches closely following laying, jointing, and bedding of pipe, and after initial inspection and testing are completed, all in accordance with Section 02210 - EARTH EXCAVATION, BACKFILL, FILL, AND GRADING.

3.5 INSPECTION AND TESTING

- A. Acceptance of precast reinforced concrete manhole sections will be made on the basis of plant tests, material tests, and inspection of the completed product, in accordance with the requirements of ASTM C478, latest revision, with the following modifications.
- B. Manhole sections shall not be shipped for at least five days after manufacture when cured by subjecting them to thoroughly saturated steam at a temperature between 100 and 150 degrees F for a period of not less than 8 hours, or when necessary, for such additional time as may be required to enable the manhole sections to meet specification requirements.
- C. Leakage Tests
 1. The manholes shall be made as nearly watertight as practicable.
 2. The Contractor shall perform leakage tests on each manhole installed using an approved low air pressure testing system. This type of test shall be used only immediately after assembly of the manhole and only prior to backfilling. The manhole to pipe connection should only be a flexible connector. All lift holes shall be plugged with a non-shrinking mortar. For this test, each manhole shall be tested under 10-inch Hg vacuum. The test shall pass if the vacuum remains

at 10-inch Hg or drops no lower than 9-inch Hg after 60 seconds for 4 or 5 foot manholes from 0 to 10 feet deep; 75 seconds for 4 or 5 foot manholes from 10 to 15 feet deep and for 6 or 8 foot manholes from 0 to feet deep; or 90 seconds for 4 or 5 foot manholes from 15 to 25 feet deep, 6 or 8 foot manholes 10 to 15 feet deep, and 10 foot manholes 0 to 10 feet deep; and 120 seconds for 4 or 5 foot manholes over 25 feet deep, 6 or 8 foot manholes 15 to 25 feet deep, and 10 foot manholes 10 to 15 feet deep.

- D. Manhole inserts shall be testing after installation. The complete unit shall not allow more than 5 gallons of inflow over a 24 hour period.

PART 4 – COMPENSATION

Item 2252.1– Manhole - Precast 4-Foot Diameter

METHOD OF MEASUREMENT:

Measurement for Manhole - Precast 4-Foot Diameter shall be based on the vertical feet of complete and functional manholes installed by the Contractor, as shown on the Contract Drawings or as required by the Engineer. Measurement shall be from the inside bottom of the structure to finished grade.

BASIS OF PAYMENT / INCLUSIONS:

Payment for Manhole - Precast 4-Foot Diameter shall be based on the vertical foot complete for this item in the proposal. Under the vertical foot price for this item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required for the installation of Manhole - Precast 4-Foot Diameter. The work includes, but is not limited to; furnish and install Pre-cast Concrete Manholes complete with all pre-cast bases, precast manhole riser sections, precast cones and top slabs, and precast sumps; local flow by-pass and pumping not included for payment elsewhere; saw cutting bituminous and cement concrete; excavation; construction dewatering; furnishing and placing backfill per one of the approved methods; furnish, install and compact gravel road sub-base; furnish and install filter fabric as required; compaction and compaction testing; temporary excavation support furnished and installed complete, left in place, and cut off below grade, where required or directed; furnish, install and compact bedding; bituminous dampproofing; flexible pipe sleeves; concrete, mortar; testing of the completed manhole; grout; frames and covers; cast-in-place concrete, pre-cast concrete riser rings or approved equal required to adjust frames and covers to grade; and connections to new and existing pipes and laterals; and all incidental work not specifically included for payment elsewhere.

SPECIAL NOTES ON EXCLUSIONS:

The following items are not included for payment under this item but are included for separate payment elsewhere under unclassified excavation; removal of concrete slab and railroad rail and ties.

Item 2252.2 – Manhole - Precast 5-Foot Diameter

METHOD OF MEASUREMENT:

Measurement for Manhole - Precast 5-Foot Diameter shall be based on the vertical feet of complete and functional manholes installed by the Contractor, as shown on the Contract Drawings or as required by the Engineer. Measurement shall be from the inside bottom of the structure to finished grade.

BASIS OF PAYMENT / INCLUSIONS:

Payment for Manhole - Precast 5-Foot Diameter shall be based on the vertical foot complete for this item in the proposal. Under the vertical foot price for this item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required for the installation of Manhole - Precast 5-Foot Diameter. The work includes, but is not limited to; furnish and install Pre-cast Concrete Manholes complete with all pre-cast bases, precast manhole riser sections, precast cones and top slabs, and precast sumps; saw cutting bituminous and cement concrete; excavation; construction dewatering; furnishing and placing backfill per one of the approved methods; furnish, install and compact gravel road sub-base; furnish and install filter fabric as required; compaction and compaction testing; temporary excavation support furnished and installed complete, left in place, and cut off below grade, where required or directed; furnish, install and compact bedding; bituminous dampproofing; flexible pipe sleeves; concrete, mortar; testing of the completed manhole; grout; frames and covers; cast-in-place concrete, pre-cast concrete riser rings or approved equal required to adjust frames and covers to grade; and connections to new and existing pipes and laterals; and all incidental work not specifically included for payment elsewhere

SPECIAL NOTES ON EXCLUSIONS:

The following items are not included for payment under this item but are included for separate payment elsewhere under unclassified excavation; removal of concrete slab and railroad rail and ties.

Item 2252.3 – Manhole - Precast 5-Foot Diameter Exterior Drop

METHOD OF MEASUREMENT:

Measurement for Manhole - Precast 5-Foot Diameter Exterior Drop shall be based on the vertical feet of complete and functional manholes installed by the Contractor, as shown on the Contract Drawings or as required by the Engineer. Measurement shall be from the inside bottom of the structure to finished grade. Payment will be the same whether the Contractor elects or is required to furnish a Precast or a Cast-in-place Base.

BASIS OF PAYMENT / INCLUSIONS:

Payment for Manhole - Precast 5-Foot Diameter Exterior Drop shall be based on the vertical foot complete for this item in the proposal. Under the vertical foot price for this item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required for the installation of Manhole - Precast 5-Foot Diameter Exterior Drop. The work includes, but is not limited to; furnish and install Pre-cast Concrete Manholes complete with all pre-cast bases, precast manhole riser sections, precast cones and top slabs, and precast sumps;

saw cutting bituminous and cement concrete; excavation; construction dewatering; furnishing and placing backfill per one of the approved methods; furnish, install and compact gravel road sub-base; furnish and install filter fabric as required; compaction and compaction testing; temporary excavation support furnished and installed complete, left in place, and cut off below grade, where required or directed; furnish, install and compact bedding; bituminous dampproofing; flexible pipe sleeves; concrete, mortar; testing of the completed manhole; grout; frames and covers; cast-in-place concrete, pre-cast concrete riser rings or approved equal required to adjust frames and covers to grade; and connections to new and existing pipes and laterals; and all incidental work not specifically included for payment elsewhere.

SPECIAL NOTES ON EXCLUSIONS:

The following items are not included for payment under this item but are included for separate payment elsewhere under unclassified excavation; removal of concrete slab and railroad rail and ties.

Item 2252.4 – Manhole - Precast 6-Foot Diameter

METHOD OF MEASUREMENT:

Measurement for Manhole - Precast 6-Foot Diameter shall be based on the vertical feet of complete and functional manholes installed by the Contractor, as shown on the Contract Drawings or as required by the Engineer. Measurement shall be from the inside bottom of the structure to finished grade. Payment will be the same whether the Contractor elects or is required to furnish a Precast or a Cast-in-place Base.

BASIS OF PAYMENT / INCLUSIONS:

Payment for Manhole - Precast 6-Foot Diameter shall be based on the vertical foot complete for this item in the proposal. Under the vertical foot price for this item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required for the installation of Manhole - Precast 6-Foot Diameter. The work includes, but is not limited to; furnish and install Pre-cast Concrete Manholes complete with all pre-cast bases, precast manhole riser sections, precast cones and top slabs, and precast sumps; saw cutting bituminous and cement concrete; excavation; construction dewatering; furnishing and placing backfill per one of the approved methods; furnish, install and compact gravel road sub-base; furnish and install filter fabric as required; compaction and compaction testing; temporary excavation support furnished and installed complete, left in place, and cut off below grade, where required or directed; furnish, install and compact bedding; bituminous dampproofing; flexible pipe sleeves; concrete, mortar; testing of the completed manhole; grout; frames and covers; cast-in-place concrete, pre-cast concrete riser rings or approved equal required to adjust frames and covers to grade; and connections to new and existing pipes and laterals; and all incidental work not specifically included for payment elsewhere.

SPECIAL NOTES ON EXCLUSIONS:

The following items are not included for payment under this item but are included for separate payment elsewhere under unclassified excavation; removal of concrete slab and railroad rail and ties.

Item 2252.5– Manhole - Precast 6-Foot Diameter Exterior Drop

METHOD OF MEASUREMENT:

Measurement for Manhole - Precast 6-Foot Diameter Exterior Drop shall be based on the vertical feet of complete and functional manholes installed by the Contractor, as shown on the Contract Drawings or as required by the Engineer. Measurement shall be from the inside bottom of the structure to finished grade. Payment will be the same whether the Contractor elects or is required to furnish a Precast or a Cast-in-place Base.

BASIS OF PAYMENT / INCLUSIONS:

Payment for Manhole - Precast 6-Foot Diameter Exterior Drop shall be based on the vertical foot complete for this item in the proposal. Under the vertical foot price for this item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required for the installation of Manhole - Precast 6-Foot Diameter Exterior Drop. The work includes, but is not limited to; furnish and install Pre-cast Concrete Manholes complete with all pre-cast bases, precast manhole riser sections, precast cones and top slabs, and precast sumps; saw cutting bituminous and cement concrete; excavation; construction dewatering; furnishing and placing backfill per one of the approved methods; furnish, install and compact gravel road sub-base; furnish and install filter fabric as required; compaction and compaction testing; temporary excavation support furnished and installed complete, left in place, and cut off below grade, where required or directed; furnish, install and compact bedding; bituminous dampproofing; flexible pipe sleeves; concrete, mortar; testing of the completed manhole; grout; frames and covers; cast-in-place concrete, pre-cast concrete riser rings or approved equal required to adjust frames and covers to grade; and connections to new and existing pipes and laterals; and all incidental work not specifically included for payment elsewhere.

SPECIAL NOTES ON EXCLUSIONS:

The following items are not included for payment under this item but are included for separate payment elsewhere under unclassified excavation; removal of concrete slab and railroad rail and ties.

Item 2252.6 – Manhole - Precast 8-Foot Diameter

METHOD OF MEASUREMENT:

Measurement for Manhole - Precast 8-Foot Diameter shall be based on the vertical feet of complete and functional manholes installed by the Contractor, as shown on the Contract Drawings or as required by the Engineer. Measurement shall be from the inside bottom of the structure to finished grade. Payment will be the same whether the Contractor elects or is required to furnish a Precast or a Cast-in-place Base.

BASIS OF PAYMENT / INCLUSIONS:

Payment for Manhole - Precast 8-Foot Diameter shall be based on the vertical foot complete for this item in the proposal. Under the vertical foot price for this item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required for the installation of Manhole - Precast 8-Foot Diameter. The work includes, but is not limited to; furnish and

install Pre-cast Concrete Manholes complete with all pre-cast bases, precast manhole riser sections, precast cones and top slabs, and precast sumps; saw cutting bituminous and cement concrete; excavation; construction dewatering; furnishing and placing backfill per one of the approved methods; furnish, install and compact gravel road sub-base; furnish and install filter fabric as required; compaction and compaction testing; temporary excavation support furnished and installed complete, left in place, and cut off below grade, where required or directed; furnish, install and compact bedding; bituminous dampproofing; flexible pipe sleeves; concrete, mortar; testing of the completed manhole; grout; frames and covers; cast-in-place concrete, pre-cast concrete riser rings or approved equal required to adjust frames and covers to grade; and connections to new and existing pipes and laterals; and all incidental work not specifically included for payment elsewhere.

SPECIAL NOTES ON EXCLUSIONS:

The following items are not included for payment under this item but are included for separate payment elsewhere under unclassified excavation; removal of concrete slab and railroad rail and ties.

Item 2252.7– Manhole - Precast 8-Foot Diameter Exterior Drop

METHOD OF MEASUREMENT:

Measurement for Manhole - Precast 8-Foot Diameter Exterior Drop shall be based on the vertical feet of complete and functional manholes installed by the Contractor, as shown on the Contract Drawings or as required by the Engineer. Measurement shall be from the inside bottom of the structure to finished grade. Payment will be the same whether the Contractor elects or is required to furnish a Precast or a Cast-in-place Base.

BASIS OF PAYMENT / INCLUSIONS:

Payment for Manhole - Precast 8-Foot Diameter Exterior Drop shall be based on the vertical foot complete for this item in the proposal. Under the vertical foot price for this item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required for the installation of Manhole - Precast 8-Foot Diameter Exterior Drop. The work includes, but is not limited to; furnish and install Pre-cast Concrete Manholes complete with all pre-cast bases, precast manhole riser sections, precast cones and top slabs, and precast sumps; saw cutting bituminous and cement concrete; excavation; construction dewatering; furnishing and placing backfill per one of the approved methods; furnish, install and compact gravel road sub-base; furnish and install filter fabric as required; compaction and compaction testing; temporary excavation support furnished and installed complete, left in place, and cut off below grade, where required or directed; furnish, install and compact bedding; bituminous dampproofing; flexible pipe sleeves; concrete, mortar; testing of the completed manhole; grout; frames and covers; cast-in-place concrete, pre-cast concrete riser rings or approved equal required to adjust frames and covers to grade; and connections to new and existing pipes and laterals; and all incidental work not specifically included for payment elsewhere.

SPECIAL NOTES ON EXCLUSIONS:

The following items are not included for payment under this item but are included for

separate payment elsewhere under unclassified excavation; removal of concrete slab and railroad rail and ties.

Item 2252.8 – Manhole – 3’x4’ Precast

METHOD OF MEASUREMENT:

Measurement for Manhole – 3’x4’ Precast shall be based on the each complete and functional manholes installed by the Contractor, as shown on the Contract Drawings or as required by the Engineer.

BASIS OF PAYMENT / INCLUSIONS:

Payment for Manhole – 3’x4’ Precast shall be based on the vertical foot complete for this item in the proposal. Under the vertical foot price for this item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required for the installation of Manhole – 3’x4’ Precast. The work includes, but is not limited to; furnish and install Pre-cast Concrete Manholes complete with all pre-cast bases, precast manhole riser sections, precast cones and top slabs, and precast sumps; saw cutting bituminous and cement concrete; excavation; construction dewatering; furnishing and placing backfill per one of the approved methods; furnish, install and compact gravel road sub-base; furnish and install filter fabric as required; compaction and compaction testing; temporary excavation support furnished and installed complete, left in place, and cut off below grade, where required or directed; furnish, install and compact bedding; bituminous dampproofing; flexible pipe sleeves; concrete, mortar; testing of the completed manhole; grout; frames and covers; cast-in-place concrete, pre-cast concrete riser rings or approved equal required to adjust frames and covers to grade; and connections to new and existing pipes and laterals; and all incidental work not specifically included for payment elsewhere.

SPECIAL NOTES ON EXCLUSIONS:

The following items are not included for payment under this item but are included for separate payment elsewhere under unclassified excavation; removal of concrete slab and railroad rail and ties.

Item 2252.9 –Existing Drainage or Sewer Structure Adjusted

METHOD OF MEASUREMENT:

Measurement for Existing Drainage or Sewer Structure Adjusted shall be based on the each of existing drainage or sewer structure adjusted up to 4-inches by the Contractor to final grade, as shown on the Contract Drawings or as required by the Engineer.

BASIS OF PAYMENT / INCLUSIONS:

Payment for Existing Drainage or Sewer Structure Adjusted shall be based on each adjusted existing drainage or sewer structure complete for this item in the proposal requiring the adjustment to final grade of up to 4-inches. Under the Unit Price for this item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required to adjust frames and covers; grout; concrete; furnish pre-cast concrete riser rings or approved equal required to adjust frames and covers to grade; and all incidental work not specifically

included for payment elsewhere.

SPECIAL NOTES ON EXCLUSIONS:

The following items are not included for payment under this item but are included for separate payment elsewhere; adjustment of drainage and sewer structures installed under this Contract. Contractor shall not be paid for more than one adjustment on an existing drainage or sewer structure.

Item 2252.10 – Drainage or Sewer Structure Remodeled

METHOD OF MEASUREMENT:

Measurement for Drainage or Sewer Structure Remodeled shall be based on the each of drainage or sewer structure remodeled by the Contractor, as shown on the Contract Drawings or as required by the Engineer. Both existing and new drainage or sewer structures requiring adjustments to final grade over 4-inches shall be paid for under this item.

BASIS OF PAYMENT / INCLUSIONS:

Payment for Drainage or Sewer Structure Remodeled shall be based on each remodeled existing or new drainage or sewer structure complete for this item in the proposal requiring the adjustment to final grade over 4-inches. Under the Unit Price for this item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required to adjust frames and covers; grout; concrete; furnish pre-cast concrete riser rings or approved equal required to adjust frames and covers to grade; modifications to precast risers; and all incidental work not specifically included for payment elsewhere.

SPECIAL NOTES ON EXCLUSIONS:

The following items are not included for payment under this item but are included for separate payment elsewhere; adjustment of drainage and sewer structures installed under this Contract. Contractor shall not be paid for more than one remodel on an existing or new drainage or sewer structure.

END OF SECTION 02252

SECTION 02271

RIPRAP

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section.
- B. For rounded riprap at shoreline refer to Specification Section 32000. This specification section only includes riprap related to outfall infrastructure work.

1.2 SUMMARY

- A. This section includes the following:
 - 1. Providing labor, materials, and equipment required to place stone riprap or slopes for embankment slopes protection, including backing layers as indicated and specified.
- B. Related section includes the following:
 - 1. Section 02210 - Excavation, Backfill, Fill and Grading

1.3 SUBMITTAL

- A. Shop Drawings: Submit the following in accordance with Section 01300 - SUBMITTAL PROCEDURES:
 - 1. Material specifications and conformance to standards specified.

PART 2 - PRODUCTS

2.1 STONE

- A. Massachusetts Highway Department Standard
- B. Specific gravity 2.5 min., absorption 2 percent max. in accordance with ASTM C127.
- C. Soundness 5 percent max. loss in accordance with ASTM C88.
- D. Facing stone size and gradation as indicated and uniformly graded.
- E. Shape:
 - 1. Suitable to form protective structure.
 - 2. Generally angular, may use rounded cobbles or boulders for slopes flatter than 2 horizontal to 1 vertical.
 - 3. Flat or needle shapes NOT acceptable, unless thickness greater than 1/3 length.

2.2 GRAVEL

- A. Conform to requirements specified in Section 02210.

2.3 MATERIAL SOURCE

- A. Obtain from rock excavation under contract, if meeting above requirements.

PART 3 - EXECUTION

3.1 PLACEMENT

- A. Trim and dress areas to conform to lines and grades indicated.
- B. Place spread, and compact bank-run gravel backing where indicated.
- C. Choke voids and interstices in existing rock fill with bank-run gravel and sand by jetting method.
- D. Excavate footing trench along slope toe as indicated, and place larger rocks there.

- E. Placing rocks:
 - 1. Machine place rocks with longitudinal axis normal to embankment face.
 - 2. Leave minimum voids so that rock above foundation course has 3-point bearing on underlying rocks. Bearing on smaller rocks used for chinking voids and dumping NOT acceptable.
 - F. Placing rocks:
 - 1. Provide minimum voids.
 - 2. Place larger rocks in foundation course and on outside of slope protection.
 - 3. Dumping and spreading by equipment is acceptable.
 - G. Dress up outer facing to render.
 - 1. Smooth surface
 - 2. Irregularities not more than 0.5 ft measured normal to the slope.
 - H. Chink voids in outer facing with smaller stones. Remove loose stones.
 - I. Fill footing trench with excavated material without compaction.
- 3.2 CONTRACT CLOSEOUT
- A. Provide in accordance with Section 01700.

END OF SECTION 02271

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SECTION 02590

BRICK MASONRY

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The work covered under this Section includes the furnishing of all plant, labor, equipment, appliances and materials, and in performing all operations in connection with providing brick masonry, as directed, for furnishing and installing masonry plugs, manhole risers, and for all other necessary appurtenant work complete and accepted in accordance with the Drawings and Specifications and as required.

1.2 RELATED WORK

- A. Section 02252 – MANHOLES
- B. Section 02604 – CATCH BASINS
- C. Section 02609 – REINFORCED CONCRETE PIPE
- D. Section 03411 – PRECAST CONCRETE VAULTS AND STRUCTURES

1.3 SUBMITTALS

- A. Shop Drawings: Submit the following in accordance with Section 01300 – SUBMITTALS.
 - 1. Submit manufacturer specification sheets for and shop drawings for all masonry items, mortar and appurtenances.

PART 2 - MATERIALS

2.1 Bricks

- A. Bricks in general shall be clay or shale brick and shall conform in all respects to ASTM C32, latest revision, Grade SS. Bricks that are broken, warped, cracked or of improper size or quality, or otherwise defective shall not be used in the work and shall be removed from the site. Brick for extending manhole frames to grade shall be concrete brick conforming to ASTM C139, latest revision.

2.2 Cement

- A. Cement shall conform to the standard specifications for Portland cement of ASTM C150, latest revision, Type II, unless otherwise directed. Whenever directed by the Owner, a quick-setting cement (Type III) shall be used for any desired purpose at no additional expense to the Owner.

2.3 Sand

- A. Sand for mortar shall be graded uniformly from fine to coarse and when dry shall pass a No. 8 sieve. Sand shall consist of aggregate having clean, hard, durable, strong, uncoated grains and free from injurious amounts of dust, lumps, soft or flaky particles, shale, alkali, organic matter, loam or other deleterious substances. The sand shall be washed clean before loading on delivery trucks. Natural sand which shows a color darker than the standard color when tested in accordance with the Colorimetric Test for Sands as described in ASTM C40, latest revision, will be cause for rejection.

2.4 Lime

- A. Lime shall be hydrated lime conforming to ASTM C207, latest revision.

2.5 Water

- A. Mixing water for concrete and mortar shall be clean and free from oil, acid, alkali, injurious amounts of vegetable matter and other impurities. Potable water obtained from a municipal supply is preferable.

2.6 Mortar

- A. Mortar and mortar plaster shall be composed of one part Type II portland cement, and two parts sand to which a small amount of hydrated lime, not to exceed 10 lbs. to each bag of cement, shall be added. Only a sufficient amount of water shall be added to make a stiff plastic mortar of a consistency and texture satisfactory to the Owner. Retempering of mortar in which the cement has started to set will not be permitted.

PART 3 - EXECUTION:

- 3.1 Masonry shall include brick masonry for plugs for pipes and structures, manhole invert tables, cement mortar plaster on interior and exterior surfaces of masonry walls, mortar and related work. Brick masonry plugs for pipes and structures shall be 8 inches thick, unless otherwise shown or required. Other brick masonry shall be provided to the details and the dimensions specified, indicated or as directed.

- 3.2 All exterior surfaces of masonry walls shall be plastered with mortar plaster to provide a minimum thickness of 1/2 inch. Mortar plaster shall be applied with sufficient pressure to insure a dense plaster completely filling all voids and thoroughly bonded to the masonry wall. Masonry construction shall be done in a manner to insure watertight construction and all leaks in masonry shall be sealed.
- 3.3 All workmanship shall conform to the best standard practice, and all brick masonry shall be laid by skilled workmen. Brick masonry walls shall be constructed to the thickness indicated. All beds on which masonry is to be laid shall be cleaned and wetted properly. Brick shall be wetted as required and shall be damp but free of any surface water when placed in the work. Bed joints shall be formed of a thick layer of mortar which shall be smoothed or furrowed slightly. Head joints shall be formed by applying to the brick to be laid a full coat of mortar on the entire end, or on the entire sides as the case requires, and then shoving the mortar-covered end or side of the brick tightly against the bricks laid previously; the practice of buttering at the corners of the brick and then throwing mortar or scrapings into the empty joints will not be permitted. Dry or butt joints will not be permitted. Joints shall be uniform in thickness and shall be approximately 3/8-inch thick. Joints on the inside face of walls shall be tooled slightly concave with an approved jointer when the mortar is thumbprint hard; the mortar shall be compressed with complete contact along the edges so as to seal the surface of the joints. Brickwork shall be constructed accurately to dimensions, and brickwork at top of manholes shall be to the dimensions of the flange of the cast iron frames.
- 3.4 No water shall be allowed to flow against brickwork or to rise on the masonry for 60 hours after it has been laid, and any brick masonry damaged in this manner shall be replaced as directed at no additional expense to the Owner. Adequate precautions shall be taken in freezing weather to protect the masonry from damage by frost. Plaster shall be troweled to a smooth hard finish and no backfill shall be placed until the mortar has thoroughly hardened.

PART 4 – COMPENSATION (Not Used)

END OF SECTION 02590

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SECTION 02604

CATCH BASINS

2604.1	CATCH BASIN - TYPE 1 SINGLE GRATE (4-FOOT DIAMETER)	VERTICAL FOOT
2604.2	DIRECT INLET	EACH

PART I – GENERAL

1.1 WORK INCLUDED

- A. The work covered under this Section includes the furnishing of all plant, labor, equipment, appliances and materials, and performing all operations in connection with installing catch basins, drop inlets, frames and grates, and hoods at the locations and to the details indicated and/or directed, including pre-cast concrete sections, bases, and tops; brick, grout, and mortar; catch basin hoods; and frame and grate; as well as repairing sidewalks, pavement and curbs affected by catch basin installation.
- B. Removed catch basin fixtures must not be reused and shall be salvaged and delivered to the City of Cambridge Public Works storage yard unless required by the owner to dispose off site.

1.2 SUBMITTALS

- A. The Contractor shall furnish complete shop drawings for all pre-cast sections, cast iron frames, grates and other appurtenances in accordance with Section 01300 – SUBMITTALS
- B. Shop drawings and manufacturers data showing dimensions, reinforcing, and materials for all items furnished under this section.

PART 2 – PRODUCTS

2.1 CATCH BASINS AND DIRECT INLETS

- A. Catch basins and direct inlets shall be constructed as detailed. Single grate catch basins shall be a minimum of 4 feet inside diameter or 4-ft x 3-ft inside dimensions. Catch basins shall be designed for a minimum of H-20 loading. Double grate catch basins shall be a minimum of 5 feet inside diameter or 4-ft x 3-ft inside dimensions. Catch basins shall have a minimum of 6 ft sump depth, unless otherwise noted and shall conform to ASTM C478-72.

- B. Pre-cast concrete catch basins and sump manholes shall further conform to the applicable requirements of Section 02252 – MANHOLES and applicable details.
- C. Mortar where required shall conform to Section 02590 – BRICK MASONRY.

2.2 FRAMES

- A. Single Catch Basin Frames shall be as manufactured by East Jordan Iron Works (formerly E. L. LeBaron Foundry Co.), model LK120D for three flange, Neenah Foundry Co., Campbell Foundry Co., or equivalent.
- B. Double Catch Basin Frames shall be as manufactured by East Jordan Iron Works (formerly E. L. LeBaron Foundry Co.), model LV2448-2 with longside flange removed, Neenah Foundry Co., Campbell Foundry Co., or equivalent.

2.3 GRATES

- A. Single and Double Catch Basin Grates shall be cascade type, as manufactured by East Jordan Iron Works (formerly E. L. LeBaron Foundry Co.), model L24SG18, by Neenah Foundry Co., by Campbell Foundry Co., or equivalent unless otherwise shown on the Drawings.

2.4 HOODS

- A. Catch Basin Hoods shall be as manufactured by East Jordan Iron Works (formerly E. L. LeBaron Foundry Co.), model L-202, Neenah Foundry Co., Campbell Foundry Co., or equivalent for Type 1 and Type 2 Catch Basins. Catch Basin Hoods for Type 3 Catch Basins shall be as manufactured by East Jordan Iron Works (formerly E. L. LeBaron Foundry Co.), model L-203, Neenah Foundry Co., Campbell Foundry Co., or equivalent.

2.5 DON'T DUMP PLACARDS

- A. The City will furnish cast iron “Don’t Dump Placards” to the Contractor for installation within the sidewalk at locations where catch basins connect to storm drain system.

PART 3 – EXECUTION

3.1 SETTING PRECAST CONCRETE CATCH BASIN SECTIONS

- A. Catch basins shall be constructed with a pre-cast concrete base placed on a firm compacted ¾-in crushed stone sub-base as specified and as detailed on

the Drawings. Infiltration basins shall be installed as specified and as detailed on the Drawings. Catch basins and infiltration basins shall be installed level, plumb and in accordance with the provisions of Section 02252 - MANHOLES.

- B. Catch basins and infiltration basins shall be installed with specified joint sealant as specified in Section 02252 - MANHOLES.
- C. Care shall be taken to assure that the openings are made to permit setting of the entering pipe at its correct elevation as indicated or required and also to accommodate the correct outside diameter of the pipe.
- D. All holes in sections used for handling shall be thoroughly plugged with non-shrink grout.
- E. Cutting or tampering of catch basin and/or infiltration basin structures in the field, for the purpose of creating new openings or modifying existing openings, will not be permitted.

3.2 LAYING BRICKWORK

- A. Only clean bricks shall be used in brickwork for catch basins and infiltration basins. The brick shall be moistened by suitable means, as directed, until they are neither so dry as to absorb water from the mortar nor so wet as to be slippery when laid.

3.3 SETTING CATCH BASIN FRAMES AND GRATES

- A. Catch Basin frames shall be set with tops conforming accurately to the grade of the pavement or finished ground surface or as indicated on the Drawings. Frames shall be set concentric with the top of the manhole and in a full bed of mortar so that the space between the top of the brick and mortar and the bottom flange of the frame shall be completely filled and made watertight. A thick ring of mortar extending to the outer edge of the concrete shall be placed all around the bottom flange. The mortar shall be smoothly finished to a height of 4-inches above the flange.

3.4 INSTALLING HOODS

- A. Hoods shall be built into the catch basin wall, shall be watertight, and shall be installed in conformance with the manufacturer's instructions.

3.5 CLEANING

- A. All excess material including dirt, loose concrete, bricks, grit, stones and any other material, shall be removed from all manholes prior to final review by

the Engineer. A final cleaning shall be performed, to include complete removal of all accumulated debris and fluids from each catch basin, upon complete project completion.

PART 4 - COMPENSATION

Item 2604.1 --- Catch Basin - Type 1 Single Grate

METHOD OF MEASUREMENT:

Catch Basin - Type 1 Single Grate shall be paid per vertical foot of Catch Basin - Type 1 Single Grate installed complete.

BASIS OF PAYMENT / INCLUSIONS:

Catch Basin - Type 1 Single Grate (4-Foot Diameter) shall be based on the unit price bid for this item in the proposal. Under the Unit Price for this item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required for the complete installation of Catch Basin - Type 1 Single Grate (4-Foot Diameter) as shown and indicated in the Contract Documents, at the requirements of the Engineer and as specified. The work includes but is not limited to; saw cutting bituminous and cement concrete; excavation; construction dewatering; furnish and install pre-cast sections and structures; furnish and install temporary support of excavation; for vertical wood sheeting or soldier piles and lagging, cut off 5-ft below grade and leave in place where required; furnish, install and compact bedding; furnish and install backfill per one of the approved methods; furnish, install and compact gravel road sub-base; compaction and compaction testing; frames and grates; hoods; installation of "Don't Dump" placards; dampproofing; testing; grouting; gaskets; adjusting frames to grade; pipe connections, including flexible sleeves; and all other work required for the installation of Catch Basin - Type 1 Single Grate (4-Foot Diameter), not included for payment elsewhere.

SPECIAL NOTES/EXCLUSIONS:

The following items are not included for payment under this item but are included for separate payment elsewhere under unclassified excavation; removal of concrete slab and railroad rail and ties. Installation of sediment filter devices shall not be paid for under this Bid Price Item and are paid for elsewhere.

Item 2604.2 --- Direct Inlet

METHOD OF MEASUREMENT:

Direct Inlet shall be paid per each number of Drop Inlet installed complete.

BASIS OF PAYMENT / INCLUSIONS:

Direct inlet shall be based on the unit price bid for this item in the proposal. Under the Unit Price for this item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required for the complete installation of Direct Inlet as shown and indicated in the Contract Documents, at the requirements of the Engineer and as specified. The work includes but is not limited to; saw cutting bituminous and cement concrete; excavation;

construction dewatering; furnish and install pre-cast sections and structures; furnish and install temporary support of excavation; furnish, install and compact bedding; furnish and install backfill per one of the approved methods; furnish, install and compact gravel road sub-base; installation of "Don't Dump" placards; compaction and compaction testing; frames and grates; dampproofing; testing; grouting; gaskets; adjusting frames to grade; pipe connections, including flexible sleeves; and all other work required for the installation of Direct Inlet not included for payment elsewhere.

SPECIAL NOTES/EXCLUSIONS:

The following items are not included for payment under this item but are included for separate payment elsewhere under unclassified excavation; removal of concrete slab and railroad rail and ties. Installation of sediment filter devices shall not be paid for under this Bid Price Item and are paid for elsewhere.

END SECTION 02604

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SECTION 02609

REINFORCED CONCRETE PIPE

2609.1	PIPE – RCP (GRAVITY) 18-INCH	LINEAR FOOT
2609.2	PIPE – RCP (GRAVITY) 24-INCH	LINEAR FOOT
2609.3	PIPE – RCP (GRAVITY) 36-INCH	LINEAR FOOT
2609.4	PIPE – RCP (GRAVITY) 48-INCH	LINEAR FOOT

PART 1 – GENERAL

1.1 DESCRIPTION

- A. Furnish and install reinforced concrete pipe as indicated and specified.

1.2 RELATED WORK

- A. Section 02210 – EARTH EXCAVATION, BACKFILL, FILL AND GRADING
- B. Section 02252 – MANHOLES
- C. Section 03300 – CONCRETE
- D. Section 03411-PRECAST CONCRETE VAULTS AND STRUCTURES

1.3 SUBMITTALS

- A. Shop Drawings: Submit the following in accordance with Section 01300 – SUBMITTALS:
 - 1. Submit shop drawings of pipe and fittings.
 - 2. Submit product data and certified dimensional drawings of all pipes, fittings, and appurtenances.
 - 3. Submit gasket and pipe manufacturer’s joint assembly directions.
 - 4. Submit certified affidavit of compliance for all pipe and other products or materials furnished under this Section of the Specifications, as specified in the referenced standards.

5. For informational purposes only, submit manufacturer's printed installation instructions.
6. Submit certification with each delivery, that pipe complies to this specification.
7. Submit anticipated production and delivery schedule.

1.4 DELIVERY AND STORAGE

- A. Arrange for the delivery of the pipe sections at approved locations in the vicinity of the location in which the pipe sections are to be laid. Pipe shall be stored in an approved orderly manner so that there will be a minimum of handling from the storage area into the final position in the work, and so that there is a minimum of obstruction and inconvenience to any kind of traffic. Deliveries shall be scheduled so that the progress of the work is at no time delayed, and also so that large quantities of pipe shall not be stored on areas over structures of utilities which might be damaged by the superimposed load, and storage of pipe will be restricted to approved or permitted areas. Pipe shall be struted, if necessary, for proper protection of the pipe during storage or handling. Pipe shall be handled and stored in such a manner and by such means as recommended by the pipe manufacturer, and so that the pipe, including the interior pipe, will not be damaged.

PART 2 – PRODUCTS

2.1 MATERIALS

- A. Reinforced Concrete Pipe
 1. The concrete pipes provided shall be of types having bell and spigot or tongue-and-groove ends, and the pipe units modified as required to receive the type of gaskets specified. Except as modified herein or on the Drawings, all precast reinforced concrete pipe shall meet the requirements of ASTM C76, latest revision, for Wall "B" or Wall "C" pre-cast concrete pipe. Pipe shall be of the Class indicated in the table below or as specifically indicated on the Plans. Regardless of the process used in the manufacture of the pipe, all pipe shall be manufactured of concrete having uniform high density and impermeability, and free from any objectionable voids, and shall have uniform positive and complete steel reinforcement bond and shall conform to the additional requirements specified herein. Workmanship and methods shall be in accordance with the best practices of modern shops for this type

of work and shall be the product of a manufacturing firm having at least five years experience in the manufacture of this type of pipe. Pipe shall have a smooth and even interior surface free from roughness or irregularities. Prior to fabrication of pipe, submit shop drawings showing lengths of pipe, pipe joint details, construction details and tolerances as required by the Owner. Each pipe shall be marked with the date of manufacture, mark or trademark of the manufacturer, and the class, wall thickness of the pipe, and serial number. No slurry mix shall be used on interior of pipe.

Nominal Diameter Inches	Fill Height: Greater than 1'- 0" Not exceeding 3'	Fill Height: Greater than 3' Not exceeding 10'	Fill Heights: Greater than 10' Not exceeding 15'	Fill Height: Greater than 15' Not exceeding 20'	Fill Height: Greater than 20' Not exceeding 25'	Fill Height: Greater than 25' Not exceeding 30'	Fill Height: Greater than 30' Not exceeding 35'
10	NA	NA	NA	NA	NA	NA	NA
12	IV	III	IV	V	V-3160D	V-3790D	V-4000D
15	IV	III	IV	V	V-3080D	V-3390D	V-3575D
18	IV	III	IV	V	V	V-3115D	V-3300D
21	IV	III	IV	V	V	V	V-3100D
24	IV	III	IV	V	V	V	V
27	IV	III	IV	V	V	V	V
30	III	III	IV	V	V	V	V
33	III	III	IV	IV	V	V	V
36	III	III	IV	IV	V	V	V
42	II	III	IV	IV	V	V	V
48	II	III	IV	IV	V	V	V
54	II	III	IV	IV	V	V	V
60	I	II	IV	IV	V	V	V
66	I	II	III	IV	IV	V	V
72	I	II	III	IV	IV	V	V
78	I	II	III	IV	IV	V	V
84	I	II	III	IV	IV	V	V
90	I	II	III	IV	IV	V	V
96	I	II	III	IV	IV	V	V
102	I	II	III	IV	IV	V	V
108	I	II	III	IV	IV	V	V

2. Bends, fittings, and special sections shall be fabricated by cutting the pipe at the required angle and then rejoining the sections. Special pipe sections are defined as manhole pipe with and without a branch wye or tee and manhole pipe bends with both horizontal and vertical rotation. Complete shop drawings shall be submitted to the Engineer before fabrication. Concrete for repairs shall be as specified herein. The interior surface (face) of all repairs shall be smooth finished, equal to the pipe interior finish. All materials and workmanship shall be subject to the approval of the Engineer.
3. Reinforced concrete pipe shall be provided in full-length units, except where shorter lengths are indicated and/or required to meet field conditions; field cutting of pipe shall be avoided wherever possible. The cross-section of all ASTM C76 pipe shall be circular with circular reinforcing cages properly held in place with adequate longitudinal members to insure the accurate placement of all steel. The total cross-sectional area of steel in the pipe for the class and wall thickness specified herein shall be not less than that shown in ASTM C76, latest revision.

B. Pipe Joints

1. Each length of pipe shall be provided with bell-and-spigot or tongue-and-groove ends of concrete formed on machined joint rings in a manner to insure accurate joint surfaces. The diameter of the joint surfaces depended upon to compress the gasket shall not vary from the theoretical diameters by more than 1/16 inch. The joint shall be sealed by a round rubber gasket so that the joint will remain watertight under all conditions of service, including movement due to expansion, contraction, and normal settlement. The bell-and-spigot or tongue-and-groove ends of pipe shall be designed to enclose the gasket on four surfaces when the joint is in its final position. Pipe for jacking shall be provided with steel end rings and rubber gaskets.
2. Gaskets for sealing joints shall be the "O-ring" type gaskets or Profile type gaskets meeting requirements of ASTM C443, latest revision, having a texture to assure a watertight and permanent seal and shall be the product of a manufacturer having at least five years experience in the manufacture of rubber gaskets for pipe joints. Gaskets shall be of a composition and texture which shall be resistant to sewage, gasoline, industrial wastes, including oils and groundwater, and which will endure permanently under the conditions likely to be imposed by this use. Each gasket shall be a continuous ring of round solid section having smooth surfaces free from blisters, porosity and other imperfections. The gasket shall

be the sole element of sealing and depended upon to make the joint watertight. When the pipe is laid, the gaskets shall be of adequate size to fill the groove on the spigot ring in which the gasket is placed. Cement mortar or other plastic materials, if required to finish the joints, shall not be employed as means for making joints watertight. Each compression ring shall be marked with type of rubber used. The jointing of the precast reinforced concrete pipe and stoppers using the watertight joints specified above shall be installed in strict accordance with the published recommendations of the pipe manufacturer and as approved. Lubricants shall be used for jointing of pipe and shall be as recommended by the pipe manufacturer. The position of the gasket shall be checked and examined to insure the proper positioning of the gasket; joints that have been improperly made shall be taken apart and remade. It shall be the Contractor's responsibility to install the pipe in a manner that will maintain the gasket joint in adequate compression to insure watertight joints conforming to the test requirements specified herein.

3. Provide flat gaskets when size of pipe requires this type. The gasket manufacturer shall supply test data and affidavits showing compliance with these Specifications.
4. Where new Elliptical RCP pipe joints with existing Elliptical pipe of any material, in addition to the cast-in-place concrete collar, the Contractor shall seal the exterior joints with an elastomeric joint wrap of not less than 9" wide, manufactured by Hamilton Kent, Co., Henry Co., Cadilloc External Joint Pipe, Concrete Sealants, Inc., or approved equal.

C. Concrete

1. Concrete used in the manufacture of all precast reinforced concrete pipe shall have an average strength of not less than 4,000, 5,000 and 6,000 pounds per square inch at 28 days as applicable for the size class and wall specified. Strength of concrete used in the manufacture of the pipe shall be determined by tests on 6-inch by 12-inch vibrated test cylinders cured in the same manner as the pipe or by cores cut from pipe wall or by other approved method. Cement shall be moderate heat of hydration Portland cement conforming to ASTM C150, latest revision, Type II. Absorption: Before load test, take 3 cores from each unit. Test by boiling. Average absorption : Maximum 8 percent of dry weight, no single test more than 9 percent.

D. Marking

1. Each length of pipe shall be plainly marked with the piping class designation which it is designed for, wall of pipe, its individual identifying serial number, the date of its manufacture, manufacturer's mark or trademark, and in addition, all other identification marking or data required by the Owner.

2.2 INSPECTION AND REJECTION OF REINFORCED CONCRETE PIPE

A. General

1. Acceptance of pipe shall be made on the basis of certificates of compliance that the pipe meets all material specifications.
2. The quality of all materials, the process of manufacture, and the finished pipe may be subject to the inspection and approval of the Owner. Such inspection may be made at the place of manufacture or on the work after delivery, or at both places, and the pipe shall be subject to rejection at any time on account of failure to meet any of the specification requirements even though sample pipe may have been accepted as satisfactory. The Owner reserves the right to apply such tests as deemed necessary, and to take samples of the concrete after it has been mixed or as it is being placed in the forms or molds and to make such tests thereof as deemed necessary. All pipe will be inspected upon delivery prior to and after installation of the pipelines, and pipe which has been damaged or which does not meet the requirements of these Specifications will be rejected and shall be immediately removed from the site and replaced with sound pipe meeting specification requirements at no additional expense to the Owner. Furnish such labor and assistance to the Owner as he may require for inspection purposes.

PART 3 – EXECUTION

3.1 GENERAL

A. Pipe and Pipe Fittings

1. General: Install piping in accordance with governing authorities having jurisdiction, except where more stringent requirements are indicated.

2. Handling Pipe: Each pipe unit shall be handled into its position in the trench only in such manner and by such means, as the Engineer accepts as satisfactory. The Contractor will be required to furnish suitable devices to permit satisfactory support of all parts of the pipe unit when it is lifted.
3. Laying Pipe: Except where a concrete cradle or envelope is required, all pipe greater than or equal to 18-inches (450 mm) in diameter shall be laid in a crushed stone cradle in accordance with Section 02210 – EARTH, EXCAVATION, BACKFILL, FILL AND GRADING. In trenches, no blocking or supporting of the piping by concrete, stones, bricks, wooden wedges, or method other than bedding the pipe on crushed stone will be permitted. Each length of pipe shall be shoved home against the pipe previously laid and held securely in position. Joints shall not be "pulled" or "cramped" without approval of the Engineer.
4. Jointing Pipe: After the pipe are aligned in the trench and are ready to be jointed, all joint surfaces shall be cleaned.
5. Alignment and Placement: All pipe shall be laid with extreme care as to grade and alignment. Each pipe shall be so laid as to form a close joint with the next adjoining pipe and bring the inverts continuously to the required grade.
6. Stakeout of drain work and setting of line and grade is the responsibility of the Contractor. The Contractor shall establish centerline and offset stakes at each manhole, plus one intermediate centerline and offset stake as a checkpoint between manholes. Laser aligning shall not be used to establish a continuous line in excess of 400 feet.
7. Cleaning: Care shall be taken to prevent earth, water and other materials from entering the pipeline. As soon as possible after the pipe and manholes are completed, the Contractor shall clean out the pipeline and manholes being careful to prevent soil, water and debris from entering any existing drain.
8. Place plugs in end of uncompleted conduit at end of day or whenever work stops. Flush lines between manholes if required to remove collected debris.
9. Review of Completed Storm Drain System: If the visual observation of the completed drain or any part thereof shows any pipe, manhole, or joint to be of defective work or material the defect shall be replaced or repaired as required. The visual observation shall be

conducted by the Engineer and any defects shall be as identified by such. The Contractor shall coordinate and provide site access for the Engineer.

B. Leakage Tests

1. Leakage tests will be required by the Owner for all pipe and manhole installations. Tests shall meet all requirements of this paragraph. Leakage into or from the piping and structures, except storage tanks, will be determined respectively by infiltration tests or by exfiltration tests, as specified herein and as required. The maximum allowable amount of infiltration into the piping or exfiltration from the piping as determined respectively by the infiltration tests or by the exfiltration tests, including manholes, shall be at a rate of not greater than 150 gallons per inch of pipe diameter per mile of pipe per 24 hours, and there shall be no gushing or spurting streams of water into or from the piping or manholes. The phrase, "per mile of pipe" shall refer to the total length of pipe measured through manholes. Where the groundwater level can be maintained at a height of not less than one foot above the top of the pipe for the full length of the section of pipe being tested for leakage, the leakage into the piping and manholes shall be determined as specified under "Infiltration Tests." Where the groundwater cannot be maintained at a level of not less than one foot above the top of the pipe for the full length of the section of pipe being tested, the leakage from the piping and manholes shall be determined as specified under "Exfiltration Tests." Perform all work, provide all necessary weirs or such other measuring devices as required, do all pumping and furnish all equipment necessary for the proper performance of leakage tests at no additional cost to the Owner. Leakage testing of piping shall be satisfactorily performed in sections as the work progresses, and as required.

C. Infiltration Tests:

1. The tests shall be conducted at such times as the groundwater level is at a height of not less than one foot above the top of the pipe for the full length of the section of the pipe being tested. The groundwater leakage into the pipe will be measured by the Owner at such point or points as required. Construct such weirs or other means of measurement as required and pump as necessary for the tests to be properly made.

D. Exfiltration Tests:

1. Where exfiltration tests are required, the section of pipe to be tested shall be subjected to an internal pressure. The lower end of the section of pipe to be tested shall be closed and the entire section of the pipe, including manholes, shall be filled with clean water so as to obtain a minimum head of 2 feet above the crown of the pipe at the upper end. The length of the section of pipe being tested is limited to the amount of pipe that can be tested without exceeding 8 feet above the crown of the lowest portion of the pipe. The rate of leakage from each section of the pipe being tested will be determined by the Owner by measuring the amount of water required to maintain the minimum head of 2 feet above the top of the pipe for the full length of each section of the pipes being tested.
2. Should the infiltration or exfiltration test on any section of the pipelines, including manholes, show a rate of leakage into or from the pipeline exceeding the maximum allowable rate of infiltration or exfiltration specified herein, locate, repair, or replace defective joints and work per the Owner's requirements and retest at no additional cost to the Owner until the rate of infiltration into or exfiltration from each section of the pipeline being tested does not exceed the rate specified herein for infiltration or exfiltration.
3. The completed pipe and joints shall be visually observed by the Engineer. If the Contractor is unable to pass a pressure test because lines are "live", the Contractor shall perform closed circuit television inspections of the lines at no additional cost to the Owner. The Engineer must be able to witness the tests and must be provided with a video recording of each test for further inspection.

PART 4 – COMPENSATION

Item 2609.1 - Pipe – RCP (Gravity) 18-inch

METHOD OF MEASUREMENT:

Measurement for payment for Pipe – RCP (Gravity) 18-inch will be based on the actual linear feet of pipe installed, of all classes and at all depths, tested, and accepted, complete as shown on the Contract Drawings or as required by the Engineer and as measured by the Engineer along the centerline of the pipe from the inside face of structures to inside face of structures or to the points of connection with existing pipes.

Pipe installed but not successfully tested and accepted shall be paid for at a maximum of 95 percent of the unit prices bid under this item. The remaining 5 percent shall be paid upon

receipt of successful test results by the Engineer. All reductions in payment due to unsuccessful testing shall be made prior to normal retainage.

BASIS OF PAYMENT:

Payment for Pipe – RCP (Gravity) 18-inch will be based on the unit price bid for this item in the proposal. Under the unit price for each pipe item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required to install 18-in Reinforced Concrete Pipe (Gravity) complete as shown on the Contract Drawings or at the requirements of the Engineer. The work includes, but is not limited to; saw cutting bituminous and cement concrete; excavation; furnishing and placing backfill per one of the approved methods; preparation of subgrade; furnish, install and compact gravel road sub-base; furnish and install filter fabric as required; compaction; compaction testing; temporary excavation support furnished and installed complete, left in place, and cut off below grade as required or where required; furnishing, installing and compacting bedding; furnishing and installing reinforced concrete pipe, fittings, couplings and appurtenances; connections to existing and proposed pipes and structures; testing by infiltration / exfiltration or by CCTV; construction dewatering; and all incidental work not specifically included for payment elsewhere.

SPECIAL NOTES/EXCLUSIONS:

The following items are not included for payment under this item but are included for separate payment elsewhere under unclassified excavation; removal of concrete slab and railroad rail and ties.

Item 2609.2 - Pipe – RCP (Gravity) 24-inch

METHOD OF MEASUREMENT:

Measurement for payment for Pipe – RCP (Gravity) 24-inch will be based on the actual linear feet of pipe installed, of all classes and at all depths, tested, and accepted, complete as shown on the Contract Drawings or as required by the Engineer and as measured by the Engineer along the centerline of the pipe from the inside face of structures to inside face of structures or to the points of connection with existing pipes.

Pipe installed but not successfully tested and accepted shall be paid for at a maximum of 95 percent of the unit prices bid under this item. The remaining 5 percent shall be paid upon receipt of successful test results by the Engineer. All reductions in payment due to unsuccessful testing shall be made prior to normal retainage.

BASIS OF PAYMENT:

Payment for Pipe – RCP (Gravity) 24-inch will be based on the unit price bid for this item in the proposal. Under the unit price for each pipe item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required to install 24-in Reinforced Concrete Pipe (Gravity) complete as shown on the Contract Drawings or at the requirements of the Engineer. The work includes, but is not limited to; saw cutting bituminous and cement concrete; excavation; furnishing and placing backfill per one of the approved methods; preparation of subgrade; furnish, install and compact gravel road

sub-base; furnish and install filter fabric as required; compaction; compaction testing; temporary excavation support furnished and installed complete, left in place, and cut off below grade as required or where required; furnishing, installing and compacting bedding; furnishing and installing reinforced concrete pipe, fittings, bends, couplings and appurtenances; connections to existing and proposed pipes and structures; testing by infiltration / exfiltration or by CCTV; construction dewatering; and all incidental work not specifically included for payment elsewhere.

SPECIAL NOTES/EXCLUSIONS:

The following items are not included for payment under this item but are included for separate payment elsewhere under unclassified excavation; removal of concrete slab and railroad rail and ties.

Item 2609.3 - Pipe – RCP (Gravity) 36-inch

METHOD OF MEASUREMENT:

Measurement for payment for Pipe – RCP (Gravity) 36-inch will be based on the actual linear feet of pipe installed, of all classes and at all depths, tested, and accepted, complete as shown on the Contract Drawings or as required by the Engineer and as measured by the Engineer along the centerline of the pipe from the inside face of structures to inside face of structures or to the points of connection with existing pipes.

Pipe installed but not successfully tested and accepted shall be paid for at a maximum of 95 percent of the unit prices bid under this item. The remaining 5 percent shall be paid upon receipt of successful test results by the Engineer. All reductions in payment due to unsuccessful testing shall be made prior to normal retainage.

BASIS OF PAYMENT:

Payment for Pipe – RCP (Gravity) 36-inch will be based on the unit price bid for this item in the proposal. Under the unit price for each pipe item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required to install 36-in Reinforced Concrete Pipe (Gravity) complete as shown on the Contract Drawings or at the requirements of the Engineer. The work includes, but is not limited to; saw cutting bituminous and cement concrete; excavation; ; removal of abandoned sheeting from construction of MWRA NCRS within limits of trench crossing Memorial Drive; furnishing and placing backfill per one of the approved methods; preparation of subgrade; furnish, install and compact gravel road sub-base; furnish and install filter fabric as required; compaction; compaction testing; temporary excavation support furnished and installed complete, left in place, and cut off below grade as required or where required; furnishing, installing and compacting bedding; furnishing and installing reinforced concrete pipe, fittings, bends, couplings and appurtenances; connections to existing and proposed pipes and structures; testing by infiltration / exfiltration or by CCTV; construction dewatering; and all incidental work not specifically included for payment elsewhere.

SPECIAL NOTES/EXCLUSIONS:

The following items are not included for payment under this item but are included for separate payment elsewhere under unclassified excavation; removal of concrete slab and railroad rail and ties.

Item 2609.4 - Pipe – RCP (Gravity) 48-inch

METHOD OF MEASUREMENT:

Measurement for payment for Pipe – RCP (Gravity) 48-inch will be based on the actual linear feet of pipe installed, of all classes and at all depths, tested, and accepted, complete as shown on the Contract Drawings or as required by the Engineer and as measured by the Engineer along the centerline of the pipe from the inside face of structures to inside face of structures or to the points of connection with existing pipes.

Pipe installed but not successfully tested and accepted shall be paid for at a maximum of 95 percent of the unit prices bid under this item. The remaining 5 percent shall be paid upon receipt of successful test results by the Engineer. All reductions in payment due to unsuccessful testing shall be made prior to normal retainage.

BASIS OF PAYMENT:

Payment for Pipe – RCP (Gravity) 48-inch will be based on the unit price bid for this item in the proposal. Under the unit price for each pipe item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required to install 48-in Reinforced Concrete Pipe (Gravity) complete as shown on the Contract Drawings or at the requirements of the Engineer. The work includes, but is not limited to; saw cutting bituminous and cement concrete; excavation; furnishing and placing backfill per one of the approved methods; preparation of subgrade; furnish, install and compact gravel road sub-base; furnish and install filter fabric as required; compaction; compaction testing; temporary excavation support furnished and installed complete, left in place, and cut off below grade as required or where required; furnishing, installing and compacting bedding; furnishing and installing reinforced concrete pipe, fittings, bends, couplings and appurtenances; connections to existing and proposed pipes and structures; testing by infiltration / exfiltration or by CCTV; construction dewatering; and all incidental work not specifically included for payment elsewhere.

SPECIAL NOTES/EXCLUSIONS:

The following items are not included for payment under this item but are included for separate payment elsewhere under unclassified excavation; removal of concrete slab and railroad rail and ties.

END OF SECTION 02609

SECTION 02615

DUCTILE IRON PIPE FOR SANITARY
AND STORM DRAIN GRAVITY

2615.1	PIPE – DI (GRAVITY) 12-INCH	LINEAR FOOT
2615.2	PIPE – DI (GRAVITY) 36-INCH	LINEAR FOOT

PART 1 - GENERAL

1.1 SUMMARY

- A. This section includes the following:
 - 1. Furnishing, installing, and testing ductile-iron pipe and fittings for sanitary and storm drain service, as indicated and specified.
- B. Options:
 - 1. For joints in buried pipelines, provide either push-on, flanged or mechanical-joint as shown on the Drawings. All fittings shall be mechanical joint.
- C. Related sections include the following:
 - 1. Section 02210 – EARTH EXCAVATION, BACKFILL, FILL AND GRADING
 - 2. Section 02252 – MANHOLES
 - 3. Section 02604– CATCH BASINS
 - 4. Section 02622 – POLYVINYL CHLORIDE PIPE
 - 5. Section 03300 - CONCRETE

1.2 SUBMITTALS

- A. Shop Drawings: Submit the following in accordance with Section 01300 - SUBMITTALS:

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1. Submit shop drawings or descriptive literature, or both, showing dimensions, joint and other details for each type and class of pipe, fitting and restraint system to be furnished for the project. All materials furnished under the Contract shall be manufactured only in accordance with the Specifications. Submittals shall include material information, dimensions, pipe class information, weights, coating and lining system data.
2. Submit manufacturer's Certificates of Compliance with these Specifications and certification that the ductile iron pipe and fittings have been manufactured and tested in accordance with AWWA/ANSI specifications.
3. Submit a detailed description of proposed testing and flushing procedures to be used for this project. The description shall contain the name of the person responsible for the testing and flushing work, equipment to be used, chemical to be used and method of measuring flow during flushing procedures. Review of the description shall not be construed as approval of any methods to be used, the Contractor shall be fully responsible for achieving the specified test results.

1.3 QUALITY CONTROL

- A. Provide in accordance with Section 01400 – QUALITY CONTROL and as specified.
- B. Owner reserves right to inspect and test by independent service at manufacturer's plant or elsewhere at his own expense.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Provide in accordance with Section 01600 – PRODUCTS, MATERIALS AND EQUIPMENT.

PART 2 - PRODUCTS

2.1 PIPE

- A. Ductile Iron:
 1. Ductile iron pipe shall be that of a United States manufacturer who can demonstrate at least 5 years of successful experience in

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manufacturing ductile iron pipe. The pipe shall be equipped with push-on type, restrained joint, or mechanical joints, as required.

2. All ductile iron pipe shall conform to ANSI A21.50 (1976) (AWWA C150) and ANSI A21.51 (AWWA C151).
3. The ductile iron pipe shall be Pressure Class 350 and furnished in nominal 18-foot lengths, with Push-on, Flanged, or Mechanical Joints as manufactured by U.S. Pipe and Foundry Company, Griffin Pipe Co., Clow Corporation, or equal with gaskets conforming to AWWA C111 ANSI A21.11 "Rubber Gasket Joints".
4. The ductile iron pipe shall be double cement lined inside and then asphalt seal coated on the outside and inside approximately 1 mil. thick. The cement lining shall conform to AWWA C104 ANSI A21.4. The pipe shall be furnished along with necessary materials and equipment recommended by the manufacturer for use in joining pipe lengths and fittings.

2.2 FITTINGS

- A. Fittings shall be compact ductile iron Class 350 Mechanical Joint, conforming to ANSI Specification A21.53 (AWWA C153), latest edition, for pipe sizes 16-inches and smaller, and Class 350 standard Mechanical Joint fittings conforming to AWWA C110/ANSI A21.10, latest edition except as specified, for pipe sizes 16 through 24-inches, unless specifically stated otherwise in the specifications or on the drawings. Fittings shall be suitable for use with restraints as specified hereinafter. Fittings shall be manufactured in the United States. Fittings shall be of the same material and have the same lining and coating as the pipe specified above. All fittings shall be marked with the weight and shall have distinctly cast upon them the pressure rating, the manufacturer's identification, nominal diameter of openings and the number of degrees or fraction of the circle on all bends.
 1. Caps and plugs installed in all new work as indicated on the drawings shall be provided with a threaded corporation or bleeder valve so that air and water pressure can be relieved prior to future connection.
 2. Solid sleeves shall be ductile iron with 350 psi rating. Sleeves shall conform to ANSI/AWWA C110.

2.3 GASKET MATERIALS

- A. Push-on and mechanical joint gaskets shall be acrylonitrile butadiene rubber gasket acceptable for use in an environment which will handle fats, oils and greases unless otherwise noted or approved.

2.4 ADAPTERS

- A. Furnish and install for joining pipe of different types, unless solid sleeves indicated.
 - 1. Provide ends conforming to above specifications for appropriate type of joint, to receive adjoining pipe.

2.5 JOINTS

- A. Provide mechanical joint, flanged or push-on joint pipe with necessary accessories, conforming to ANSI A21.11.

2.6 STANDARD LINING AND COATING

- A. Inside of pipe and fittings: Ductile iron sewer pipe in all locations except where epoxy lined ductile pipe is indicated, shall have a lining specially formulated for use in sanitary sewer applications.
- B. Outside of pipe and fittings within structures: Clean and apply one shop coat of Koppers Pug Primer made by Koppers Co., Inc., Pittsburgh, PA; Chem-Prime 37-77 made by Tnemec Co., North Kansas City, MD; 13-R-50 Chromax Primer made by Valspar Corp. Short Hills, NJ; or acceptable equivalent.
- C. Outside of other pipe and fittings: Standard bituminous coating conforming to appropriate ANSI Standard.

PART 3 - EXECUTION

3.1 HANDLING PIPE

- A. The Contractor shall take care not to damage pipe by impact, bending, compression, or abrasion during handling, and installation. Joint ends of pipe especially shall be kept clean.
- B. Pipe shall be stored above ground at a height no greater than 5 feet, and with even support for the pipe barrel.

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- C. Only nylon-protected slings shall be used for handling the pipe. No hooks or bare cables will be permitted.
- D. Gaskets shall be shipped in cartons and stored in a clean area, away from grease, oil, heat, direct sunlight and ozone producing electric motors.

3.2 ALIGNMENT AND PLACEMENT OF PIPE

- A. Jointing of ductile iron pipe and fittings shall be done in accordance with the printed recommendations of the manufacturer and as specified. The last 8-inches of the outside of the spigot end of pipe and the inside of the bell end of pipe shall be thoroughly cleaned. The joint surfaces and the gasket shall be painted with a lubricant just prior to making up the joint. The spigot end shall then be gently pushed home into the bell. The position of the gasket shall be checked to insure that the joint has been properly made and is watertight. Care shall be taken not to exceed the manufacturer's recommended maximum deflection allowed for each joint.
- B. Installation and jointing of push-on ductile iron pipe shall be in accordance with AWWA C600 Sections 9b and 9c, latest revision, as applicable.
- C. Mechanical joints on force mains shall be installed with Mega-Lug, Uni-Flange or MJR restraints. Restraints shall be installed in full accordance with the manufacturers' instructions. All bolt heads on Mega-Lugs or Uni-flanged or approved equivalent shall be tightened sufficiently so that they shear off to provide indication that proper tightening torque was achieved.
- D. Restrained push-on joints for force mains shall be installed with specified gasket joint restraints. Restraints shall be installed in full accordance with the manufacturers' instructions.
- E. Fittings and valves shall be restrained as shown on the drawings.

3.3 INSTALLATION

- A. Piping Support:
 - 1. Furnish and install supports to hold piping at lines and grades indicated or specified.
 - 2. Support pipe and appurtenances connected to equipment to prevent any strain imposed on equipment.
- B. Pipe and Fittings:

1. Remove and replace defective pieces.
 2. Clear of all debris and dirt before installing and keep clean until accepted.
 3. Lay accurately to lines and grades indicated or required. Provide accurate alignment, both horizontally and vertically.
 4. Provide firm bearing along entire length of buried pipelines.
- C. Appurtenances: Set valves, fittings and appurtenances as indicated.

3.4 JOINTS AND COUPLINGS

A. Push-on Joints:

1. Insert gasket into groove bell. Apply thin film of nontoxic gasket lubricant over inner surface of gasket in contact with spigot end.
2. Insert chamfered end into gasket. Force pipe past it until it seats against socket bottom.
3. Where required install restraint and secure in accordance with manufacturer's instructions.

B. Mechanical Joints:

1. Wire brush surfaces in contact with gasket and clean gasket.
2. Lubricate gasket, bell, and spigot with soapy water.
3. Slip gland and gasket over spigot, and insert spigot into bell until seated.
4. Seat gasket and press gland firmly against gasket.
5. After bolts inserted and nuts made finger-tight, tighten diametrically opposite nuts progressively and uniformly around joint by torque wrench. Torque bolts to values specified above.

3.5 TESTING

- A. Clean of all dirt, dust, oil, grease and other foreign material, before conducting pressure and leakage tests.

- B. Gravity lines shall be tested in accordance with Specification Sections 02622.3.1 C, D, and E

3.6 CONTRACT CLOSEOUT

- A. Provide in accordance with Section 01701.

PART 4 – COMPENSATION

Item 2615.1 - Pipe – DI (Gravity) 12-inch

METHOD OF MEASUREMENT:

Measurement for payment for Pipe – DI (Gravity) 12-inch will be based on the actual linear feet of pipe installed, tested, and accepted, complete as shown on the Contract Drawings or as required by the Engineer and as measured by the Engineer along the centerline of the pipe from the inside face of structures to inside face of structures or to the points of connection with existing pipes.

Pipe installed but not successfully tested and accepted shall be paid for at a maximum of 95 percent of the unit prices bid under this item. The remaining 5 percent shall be paid upon receipt of successful test results by the Engineer. All reductions in payment due to unsuccessful testing shall be made prior to normal retainage.

BASIS OF PAYMENT:

Payment for Pipe – DI (Gravity) 12-inch will be based on the unit price bid for this item in the proposal. Under the linear foot price for the item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required to install each pipe complete as shown on the Contract Drawings or at the requirements of the Engineer. The work includes, but is not limited to; saw cutting bituminous and cement; excavation; construction dewatering; furnishing and placing backfill per one of the approved methods; furnish, install and compact gravel road sub-base; furnish and install filter fabric as required; compaction; compaction testing; temporary excavation support furnished and installed complete, left in place, and cut off below grade where required or required; bedding; furnish and install ductile iron pipe, couplings, fittings, adaptors, restraints, transitions, gaskets and appurtenances; connections to existing and proposed pipes and structures; flushing and testing; dye testing to verify proper service connections; and all incidental work not specifically included for payment elsewhere.

SPECIAL NOTES/EXCLUSIONS:

The following items are not included for payment under this item but are included for separate payment elsewhere under unclassified excavation; removal of concrete slab and railroad rail and ties.

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Item 2615.2 - Pipe – DI (Gravity) 36-inch

METHOD OF MEASUREMENT:

Measurement for payment for Pipe – DI (Gravity) 36-inch will be based on the actual linear feet of pipe installed, tested, and accepted, complete as shown on the Contract Drawings or as required by the Engineer and as measured by the Engineer along the centerline of the pipe from the inside face of structures to inside face of structures or to the points of connection with existing pipes.

Pipe installed but not successfully tested and accepted shall be paid for at a maximum of 95 percent of the unit prices bid under this item. The remaining 5 percent shall be paid upon receipt of successful test results by the Engineer. All reductions in payment due to unsuccessful testing shall be made prior to normal retainage.

BASIS OF PAYMENT:

Payment for Pipe – DI (Gravity) 36-inch will be based on the unit price bid for this item in the proposal. Under the linear foot price for the item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required to install each pipe complete as shown on the Contract Drawings or at the requirements of the Engineer. The work includes, but is not limited to; saw cutting bituminous and cement; excavation; construction dewatering; furnishing and placing backfill per one of the approved methods; furnish, install and compact gravel road sub-base; furnish and install filter fabric as required; compaction; compaction testing; temporary excavation support furnished and installed complete, left in place, and cut off below grade where required or required; bedding; furnish and install ductile iron pipe, couplings, fittings, adaptors, restraints, transitions, gaskets and appurtenances; connections to existing and proposed pipes and structures; flushing and testing; dye testing to verify proper service connections; and all incidental work not specifically included for payment elsewhere.

SPECIAL NOTES/EXCLUSIONS:

The following items are not included for payment under this item but are included for separate payment elsewhere under unclassified excavation; removal of concrete slab and railroad rail and ties.

END OF SECTION 02615

DUCTILE IRON PIPE FOR SANITARY
AND STORM DRAIN GRAVITY

SECTION 02622

POLYVINYL CHLORIDE GRAVITY PIPE

2622.1	PIPE – PVC (GRAVITY) 6-INCH PERFORATED UNDERDRAIN	LINEAR FOOT
2622.2	PIPE – PVC (GRAVITY) 10-INCH	LINEAR FOOT
2622.3	PIPE – PVC (GRAVITY) 12-INCH	LINEAR FOOT
2622.4	PIPE – PVC (GRAVITY) 15-INCH	LINEAR FOOT
2622.5	PIPE – PVC (GRAVITY) 18-INCH	LINEAR FOOT
2622.6	PIPE – PVC (GRAVITY) 21-INCH	LINEAR FOOT
2622.7	PIPE – PVC (GRAVITY) 24-INCH	LINEAR FOOT
2622.8	RECONNECT, REPAIR OR RELOCATE EXISTING SANITARY SEWER AND STORM DRAIN LATERALS	LINEAR FOOT

PART 1 – GENERAL

1.1 DESCRIPTION

- A. Furnish, install, and test PVC pipe and fittings for sanitary and storm gravity sewer piping as indicated and specified.
- B. Where the word “pipe” is used it shall refer to pipe, fittings, connections, or appurtenances unless otherwise note.

1.2 RELATED WORK

- A. Section 02210 - EARTH EXCAVATION, BACKFILL, FILL AND GRADING
- B. Section 02252 – MANHOLES
- C. Section 03411 – PRECAST CONCRETE VAULTS AND STRUCTURES

1.3 SUBMITTALS

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A. Shop Drawings: Submit the following in accordance with Section 01300 – SUBMITTALS:

1. Submit shop drawings, product data sheets, and laying diagrams of all pipe, joints, bends, special fittings, and piping appurtenances including filter fabric subdrain sock.
2. Submit anticipated production and delivery schedule.
3. Submit manufacturer's certificates for all materials indicating conformance to the Contract Documents.
4. For informational purposes only, submit manufacturer's printed installation instructions.
5. Submit detailed testing procedures as specified.

1.4 QUALITY ASSURANCE

- A. Testing: All materials testing will be based upon applicable ASTM Test Methods and AWWA Standards referenced herein for the materials specified.
- B. All costs of such inspection and tests shall be at no additional cost to the Owner.
- C. Certificates: Manufacturer's notarized certificates of compliance shall be furnished by the Contractor.
- D. The pipe shall be subjected to the specified hydrostatic strength tests, flexure tests, and crushing tests. The crushing tests shall be made on samples taken from the center of full-length sections of pipe.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General

1. All PVC pipe shall be continuously and permanently marked with the manufacturer's name, pipe size, and pressure rating or stiffness in psi (kpa).
2. The Contractor shall also require the manufacturer to mark the date of extrusion on the pipe. This dating shall be done in conjunction

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with records to be held by the manufacturer for 2 years, covering quality control tests, raw material batch number, and other information deemed necessary by the manufacturer.

B. Pipe

1. All PVC pipe shall be joined by compression joints unless otherwise shown or specified, and shall conform to the following requirements:
 - a. Polyvinyl chloride pipe (PVC) shall conform to the requirements of ASTM D 3034, Class SDR 35. Material for PVC pipe shall conform to the requirements of ASTM D 1784 for Class 12454-B or 12454-C as defined therein. All diameters shall be as specified on the Contract Drawings.
3. Elastomeric seals for compression type joints for PVC pipe and fittings shall conform to the requirements of ASTM D 3212.
4. Service pipes for storm services shall be minimum of 8-inches and shall match diameter of existing services for reconnections. Service pipes for sanitary services shall be minimum of 6-inches and shall match diameter of existing, services for reconnections.

C. Fittings

1. All fittings shall conform to the requirements of ASTM D 3034 or ASTM F 679. The ring groove and gasket ring shall be compatible with PVC pipe ends. The flanged fittings shall be compatible with cast-iron or ductile iron pipe fittings.
2. The strength class of the fittings shall be not less than the strength class of any adjoining pipe.
3. PVC pipe fittings shall be full-bodied, either injection molded or factory fabricated. Saddle-type tee or wye fittings are not acceptable.

D. Connections

1. Sanitary services shall be connected to new, parallel or replacement sanitary sewer lines with full bodied tees or wye fittings.
2. Storm services shall be connected to new, parallel, or replacement storm sewer lines with full bodied tees or wye fittings for all pipes

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up to 18-inches in diameter. Connections to pipes larger than 18-inches in diameter or odd sizes shall be made with saddle tap connections, as approved by Engineer.

3. Connections of storm and sanitary service lines to existing storm and sanitary main lines shall be made with full bodied tees or wye fittings wherever possible for existing lines less than 18-inches in diameter and with tapping saddles as approved by Engineer for existing lines greater than 18-inches in diameter and in odd sizes.

E. Bedding Materials

1. Unless otherwise specified or shown, all material used for pipe bedding shall conform to the requirements in Section 02210 – EARTH EXCAVATION, BACKFILL, FILL AND GRADING.

F. Gaskets

1. Gaskets shall be flexible elastomeric rings conforming with ASTM F 477.

G. Filter Fabric Sock

1. Perforated underdrain pipe shall be factory or field-fitted with a filter fabric covering (sock). The sock shall meet the requirements of ASTM D6707 and the following:

<u>Property</u>	<u>Test Method</u>	
Material	-	Polyester
Fabric	-	Knitted
Permittivity (min.)	ASTM D4491	5.5 sec-1
Puncture Resistance (min.)	ASTM D6241	1000 N
AOS (max.)	ASTM D4751	30 U.S. Sieve
FOS (max.)	CAN/CGSB-148.1, M10-94	450 microns
Mass (relaxed)	ASTM D3887	3.0-3.9 oz/yd ²
Mass (applied minimum)		2.7-3.5 oz/yd ²
Thickness (min.)	ASTM D4491	24.0 mils
Permeability (K) (min.)	ASTM D4491	0.390 cm/sec
Burst Strength (min.)	ASTM D3887	830 kpa
Air Permeability (min.)	ASTM D737	700ft ³ /ft ² /min

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Water Flow Rate (min.)	ASTM D4491	(2" constant head) 300 gal/min/ft2
Yarn Denier	-	150
Specific Gravity	-	1.3
Melt Temperature	-	450degrees F.

H. Acceptance of Pipe

1. Acceptance will be on the basis of tests specified hereinbefore. The quality of all materials used in the pipe, the process of manufacture, and the finished pipe shall be subject to review by the Engineer. Inspection may be made at the place of manufacture, or on the work site after delivery or at both places and the pipe shall be subject to rejection at any time on account of failure to meet any of the specification requirements, even though sample pipe units may have been accepted as satisfactory at the place of manufacture. All pipe which is rejected shall be immediately removed from the project site by the Contractor.

2.2 DELIVERY AND STORAGE

- A. Arrange for the delivery of the pipe sections at approved locations in the vicinity of the location in which the pipe sections are to be laid. Pipe shall be stored in an approved orderly manner so that there will be a minimum of handling from the storage area into the final position in the work, and so that there is a minimum of obstruction and inconvenience to any kind of traffic. Deliveries shall be scheduled so that the progress of the work is at no time delayed, and also so that large quantities of pipe shall not be stored on areas over structures of utilities which might be damaged by the superimposed load, and storage of pipe will be restricted to approved or permitted areas. Pipe shall be strutted, if necessary, for proper protection of the pipe during storage or handling. When unit packages of PVC pipe are stacked, ensure that the weight of upper units does not cause deformation to pipe in lower units. Pipe shall be handled and stored in such a manner and by such means as recommended by the pipe manufacturer, and so that the pipe, including the interior pipe, will not be damaged.

2.3 PERFORATIONS

- A. Where perforated pipe is specified on the Drawings, perforations shall conform to the following requirements:
 1. Perforations shall be either circular or slots. As the purpose of subdrain is to provide overflow groundwater relief beneath pervious asphalt pavements, perforations shall only be provided in the upper

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quadrant of the pipe.

2. Circular perforations shall be $1/4 \pm 1/16$ -inch diameter holes arranged in four rows parallel to the axis of the pipe. Perforations shall be evenly spaced along each row such that the center-to-center distance between perforations is not less than eight (8) times the perforation diameter. Perforations may appear at the ends of short and random lengths. Rows shall be arranged in two (2) equal groups at equal distance from the top on each side of the vertical centerline of the pipe. The uppermost rows of perforations shall be separated by an arc of not less than 60° or more than 125° . The lowermost rows of perforations shall be separated by an arc not to exceed 166° . The spacing of rows between these limits shall be uniform.
3. Slot perforations shall be symmetrically located in two (2) rows, one on each side of the pipe centerline. Slot perforations shall be located within the upper quadrants of the pipe with slots no wider than $1/8$ inch and spaced not to exceed 11 times the perforation width.
4. On both the inside and outside of the pipe, perforations shall be free of cuttings or frayed edges and any materials that would reduce the effective opening.

2.4 INSPECTION, TESTS AND ACCEPTANCE

- A. All pipe delivered to the job site shall be accompanied by test reports certifying that the pipe and fittings conform to the above-mentioned ASTM Specifications. In addition, the pipe shall be subject to thorough inspection and tests, as deemed necessary by the Engineer.
- B. All tests shall be made in accordance with the methods prescribed by the above mentioned ASTM Specifications, and the acceptance or rejection shall be based on the test results.
- C. The Contractor shall furnish all labor to assist the Engineer in inspecting the pipe. Pipe will be inspected upon delivery, and such as does not conform to the requirements of this contract shall be rejected and shall immediately be removed from the project site by the Contractor.

PART 3 – EXECUTION

3.1 GENERAL

- A. Installation

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1. Each pipe unit shall be inspected before being installed. No single piece of pipe shall be laid unless it is generally straight. The centerline of the pipe shall not deviate from a straight line drawn between the centers of the openings at the ends of the pipe by more than 1/16-inch per foot of length. If a piece of pipe fails to meet this requirement for straightness, it shall be rejected and removed from the site. Any pipe unit or fitting discovered to be defective either before or after installation shall be removed and replaced with a sound unit.
2. No pipe or fitting shall be permanently supported on saddles, blocking, or stones. Crushed stone shall be as specified in Section 02210 – EARTH EXCAVATION, BACKFILL, FILL AND GRADING.
3. Suitable bell holes shall be provided, so that after placement, only the barrel of the pipe receives bearing pressure from the supporting material. Special care shall be taken to hold the trench width at the crown of the pipe to the maximum indicated on the Trench Detail included in the Details Section of these specifications.
4. All pipe and fittings shall be cleared of all debris, dirt, etc., before being installed and shall be kept clean until accepted in the completed work.
5. Pipe and fittings shall be installed to the lines and grades indicated on the Drawings. Care shall be taken to ensure true alignments and gradients.
6. Before any joint is made, the previously installed unit shall be checked to assure that a close joint with the adjoining unit has been maintained and that the inverts are matched and conform to the required grade. The pipe shall not be driven down to the required grade by striking it with a shovel handle, timber or other unyielding object.
7. All joint surfaces shall be cleaned. Immediately before jointing the pipe, the bell or groove shall be checked to see that the rubber ring is properly seated. Apply lubricant to the spigot end only, paying particular attention to the bevel, in accordance with the manufacturer's recommendation. Each pipe unit shall then be carefully pushed into place without damage to pipe or gasket. Suitable devices shall be used to force the pipe units together so that they will fit with minimum open recess inside and outside and have tightly sealed joints. Care shall be taken not to use such force

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as to wedge apart and split the bell or groove ends. Joints shall not be "pulled" or "cramped" unless permitted by the Engineer.

8. Where any two pipe units do not fit each other closely enough to enable them to be properly jointed, they shall be removed and replaced with suitable units and new gaskets.
9. Details of gasket installation and joint assembly shall follow the directions of the manufacturers of the joint materials and of the pipe, all subject to review by the Engineer. The resulting joints shall be watertight and flexible.
10. All premolded gasket joint polyvinyl chloride pipe of a particular manufacturer may be rejected if there are more than five unsatisfactory joint assembly operations or "bell breaks" in 100 consecutive joints, even though the pipe and joint conform to the appropriate ASTM Specifications as hereinbefore specified. If the pipe is unsatisfactory, as determined above, the Contractor shall, if required, remove all pipe of that manufacturer of the same shipment from the work and shall furnish pipe from another manufacturer which will conform to all of the requirements of these specifications.
11. Open ends of pipe and branches shall be closed with polyvinyl chloride stoppers secured in place in an acceptable manner.
12. After each pipe has been properly bedded, enough crushed stone shall be placed between the pipe and the sides of the trench, and thoroughly compacted, to hold the pipe in correct alignment. Bell holes, provided for jointing, shall be filled with crushed stone and compacted, and then crushed stone shall be placed and compacted to complete the pipe bedding.
13. The Contractor shall take all necessary precautions to prevent flotation of the pipe in the trench. At all times pipe installation is not in progress, the open ends of the pipe shall be closed with temporary watertight plugs, or by other acceptable means.
14. If water is in the trench when work is to be resumed, the plug shall not be removed until suitable provisions have been made to prevent water, earth, or other substances from entering the pipe. Pipelines shall not be used as conductors for trench drainage during construction. Install PVC pipe and fittings in accordance with manufacturer's printed instructions.

B. Allowable Pipe Deflection

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1. Pipe provided under this Specification shall be so installed as to not exceed a maximum deflection of 5.0 percent. Such deflection shall be computed by multiplying the amount of deflection (nominal diameter less minimum diameter when measured) by 100 and dividing by the nominal diameter of the pipe.
2. Upon completion of a section of pipe, including placement and compaction of backfill, the Contractor shall measure the amount of deflection by pulling a specially designed gage assembly through the completed section. The gage assembly shall be in accordance with the recommendations of the pipe manufacturer, and be reviewed by the Engineer. The section of pipe must be placed and backfilled for a minimum of 90 days before the deflection can be measured.
3. Should the installed pipe fail to meet this requirement, the Contractor shall do all work to correct the problem without additional compensation.

C. Cleaning

1. Care shall be taken to prevent earth, water and other materials from entering the pipeline. As soon as possible after the pipe and manholes are completed, the Contractor shall clean out the pipeline and manholes being careful to prevent soil, water and debris from entering any existing pipe.

D. Testing of Pipe

1. If the visual inspection of the completed pipe or any part thereof shows any pipe, manhole or joint which allows infiltration of water in a noticeable stream or jet, the defective work or material shall be replaced or repaired as required.
2. After completing installation and backfill of pipe, the Contractor shall, at his expense, conduct a line acceptance test using low pressure air.
3. Equipment used shall meet the following minimum requirements: Pneumatic plugs shall have a sealing length equal to or greater than the diameter of the pipe to be inspected; Pneumatic plugs shall resist internal test pressures without requiring external bracing or blocking; All air used shall pass through a single control panel.
4. Three individual hoses shall be used for the following connections.

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- a. From control panel to pneumatic plugs for inflation.
 - b. From control panel to sealed line for introducing the low pressure air.
 - c. From sealed line to control panel for continually monitoring the air pressure rise in the sealed line.
5. All pneumatic plugs shall be seal tested before being used in the actual test installation. One length of pipe shall be laid on the ground and sealed at both ends with the pneumatic plugs to be checked. Air shall be introduced into the plugs per plug manufacturer's requirements. The sealed pipe shall be pressurized to 5 psig. The plugs shall hold against this pressure without bracing and without movement of the plugs out of the pipe.
 6. After a manhole to manhole reach of pipe has been backfilled and cleaned, and the pneumatic plugs are checked by the above procedure, the plugs shall be installed in the line at each manhole and in accordance with the plug manufacturer's requirements. Low pressure air shall be introduced into this sealed line until the internal air pressure reaches 4 psig greater than the average back pressure of any groundwater that may be over the pipe. At least two minutes shall be allowed for the air pressure to stabilize.
 7. After the stabilization period (3.5 psig minimum pressure in the pipe), the air hose from the control panel to the air supply shall be disconnected. The portion of line being tested shall be termed "Acceptable" if the time required in minutes for the pressure to decrease from 3.5 to 2.5 psig (greater than the average back pressure of any groundwater that may be over the pipe) is not less than the time shown for the given diameter in the following table:

Pipe Diameter	Specification Time for Length Shown (min:sec)			
<u>Inches</u>	<u>100 ft.</u>	<u>200 ft.</u>	<u>300 ft.</u>	<u>400 ft.</u>
6	5:40	5:40	5:40	5:42
8	7:34	7:34	7:36	10:08
10	9:26	9:26	11:52	15:49
12	11:20	11:24	17:05	22:47
15	14:10	17:48	26:42	35:36
18	17:00	25:38	38:27	51:16
21	19:50	34:54	52:21	69:48
24	22:47	45:34	68:22	91:10

8. In areas where groundwater is known to exist, the Contractor shall install a 1/2-inch diameter capped pipe nipple, approximately 10-inches long, through the manhole wall adjacent to one of the sewer lines entering the manhole. This shall be done at the time the line is installed. Immediately prior to the performance of the Line Acceptance Test, the groundwater shall be determined by removing the pipe cap, blowing air through the pipe nipple into the ground so as to clear it, and then connecting a clear plastic tube to the nipple. The hose shall be held vertically and a measurement of the height in feet of water over the invert of the pipe shall be taken after the water has stopped rising in this plastic tube. The height in feet shall be divided by 2.3 to establish the pounds of pressure that will be added to all readings. (For example, if the height of water is 11-1/2 feet, then the added pressure will be 5 psig. This increases the 3.5 psig to 8.5 psig, and the 2.5 psig to 7.5 psig. The allowable drop of one pound and the timing remain the same). In no case shall the starting pressure exceed 9.0 psig.
9. If the Contractor is unable to pass a pressure test because lines are "live", the Contractor shall perform closed circuit television inspections of the lines at no additional cost to the Owner. The Engineer must be able to witness the tests and must be provided with a video recording of each test for further inspection.

E. Test Failure

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1. If the section of pipe fails to pass the leakage and pressure test, or if there is any visible leakage, the Contractor shall locate, uncover and repair or replace the defective pipe fitting or joint and retest all at his own expense. Pipe will be considered passing only when the leakage does not exceed the above standard. Passing the test does not absolve the Contractor from his responsibility if leaks develop later within the period of warranty.

PART 4 – COMPENSATION

Item 2622.1 - Pipe – PVC (Gravity) 6-inch Perforated Underdrain

METHOD OF MEASUREMENT:

Measurement for payment for Pipe – PVC (Gravity) 6-inch Perforated Underdrain will be based on the actual feet of pipe installed at all depths, tested, and accepted, complete as shown on the Contract Drawings or as required by the Engineer and as measured by the Engineer along the centerline of the pipe from the inside face of structures to inside face of structures or to the points of connection with existing pipes.

Pipe installed but not successfully tested and accepted shall be paid for at a maximum of 95 percent of the unit prices bid under this item. The remaining 5 percent shall be paid upon receipt of successful test results by the Engineer. All reductions in payment due to unsuccessful testing shall be made prior to normal retainage.

BASIS OF PAYMENT / INCLUSIONS:

Payment for Pipe – PVC (Gravity) 6-inch perforated underdrain will be based on the unit price bid for this item in the proposal. Under the unit price for each pipe item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required to install 6-inch perforated PVC pipe, complete as shown on the Contract Drawings or at the requirements of the Engineer. The work includes; saw cutting bituminous and cement concrete; excavation; construction dewatering; furnishing and placing backfill per one of the approved methods; furnish, install, and compact gravel road sub-base; furnish and install filter fabric sock as required; install, grade, compaction; compaction testing; temporary excavation support furnished and installed complete, left in place, and cut off below grade where required or required; furnishing, placing and compacting bedding; furnish and install PVC pipe, fittings, couplings, appurtenances and joints; connections to existing and proposed pipes and structures; coring and providing watertight seal for connections existing and proposed structures; flushing/cleaning and testing; and all incidental work not specifically included for payment elsewhere.

SPECIAL NOTES/EXCLUSIONS:

The following items are not included for payment under this item but are included for separate payment elsewhere under unclassified excavation; removal of concrete slab and railroad rail and ties.

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Item 2622.3 - Pipe – PVC (Gravity) 10-inch

METHOD OF MEASUREMENT:

Measurement for payment for Pipe – PVC (Gravity) 10-in will be based on the actual feet of pipe installed at all depths, tested, and accepted, complete as shown on the Contract Drawings or as required by the Engineer and as measured by the Engineer along the centerline of the pipe from the inside face of structures to inside face of structures or to the points of connection with existing pipes.

Pipe installed but not successfully tested and accepted shall be paid for at a maximum of 95 percent of the unit prices bid under this item. The remaining 5 percent shall be paid upon receipt of successful test results by the Engineer. All reductions in payment due to unsuccessful testing shall be made prior to normal retainage.

BASIS OF PAYMENT / INCLUSIONS:

Payment for Pipe – PVC (Gravity) 10-in will be based on the unit price bid for this item in the proposal. Under the unit price for each pipe item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required to install 10-in PVC pipe, complete as shown on the Contract Drawings or at the requirements of the Engineer. The work includes; saw cutting bituminous and cement concrete; excavation; construction dewatering; furnishing and placing backfill per one of the approved methods; furnish, install, and compact gravel road sub-base; furnish and install filter fabric as required; install, grade, compaction; compaction testing; temporary excavation support furnished and installed complete, left in place, and cut off below grade where required or required; furnishing, placing and compacting bedding; furnish and install PVC pipe, fittings, couplings, appurtenances and joints; connections to existing and proposed pipes and structures; flushing/cleaning and testing; and all incidental work not specifically included for payment elsewhere.

SPECIAL NOTES/EXCLUSIONS:

The following items are not included for payment under this item but are included for separate payment elsewhere under unclassified excavation; removal of concrete slab and railroad rail and ties.

Item 2622.3 - Pipe – PVC (Gravity) 12-inch

METHOD OF MEASUREMENT:

Measurement for payment for Pipe – PVC (Gravity) 12-in will be based on the actual feet of pipe installed at all depths, tested, and accepted, complete as shown on the Contract Drawings or as required by the Engineer and as measured by the Engineer along the centerline of the pipe from the inside face of structures to inside face of structures or to the points of connection with existing pipes.

Pipe installed but not successfully tested and accepted shall be paid for at a maximum of 95 percent of the unit prices bid under this item. The remaining 5 percent shall be paid upon

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receipt of successful test results by the Engineer. All reductions in payment due to unsuccessful testing shall be made prior to normal retainage.

BASIS OF PAYMENT / INCLUSIONS:

Payment for Pipe – PVC (Gravity) 12-in will be based on the unit price bid for this item in the proposal. Under the unit price for each pipe item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required to install 12-in PVC pipe, complete as shown on the Contract Drawings or at the requirements of the Engineer. The work includes; saw cutting bituminous and cement concrete; excavation; construction dewatering; furnishing and placing backfill per one of the approved methods; furnish, install, and compact gravel road sub-base; furnish and install filter fabric as required; install, grade, compaction; compaction testing; temporary excavation support furnished and installed complete, left in place, and cut off below grade where required or required; furnishing, placing and compacting bedding; furnish and install PVC pipe, fittings, couplings, appurtenances and joints; connections to existing and proposed pipes and structures; flushing/cleaning and testing; and all incidental work not specifically included for payment elsewhere.

SPECIAL NOTES/EXCLUSIONS:

The following items are not included for payment under this item but are included for separate payment elsewhere under unclassified excavation; removal of concrete slab and railroad rail and ties.

Item 2622.4 - Pipe – PVC (Gravity) 15-inch

METHOD OF MEASUREMENT:

Measurement for payment for Pipe – PVC (Gravity) 15-in will be based on the actual feet of pipe installed at all depths, tested, and accepted, complete as shown on the Contract Drawings or as required by the Engineer and as measured by the Engineer along the centerline of the pipe from the inside face of structures to inside face of structures or to the points of connection with existing pipes.

Pipe installed but not successfully tested and accepted shall be paid for at a maximum of 95 percent of the unit prices bid under this item. The remaining 5 percent shall be paid upon receipt of successful test results by the Engineer. All reductions in payment due to unsuccessful testing shall be made prior to normal retainage.

BASIS OF PAYMENT / INCLUSIONS:

Payment for Pipe – PVC (Gravity) 15-in will be based on the unit price bid for this item in the proposal. Under the unit price for each pipe item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required to install 15-in PVC pipe, complete as shown on the Contract Drawings or at the requirements of the Engineer. The work includes; saw cutting bituminous and cement concrete; excavation; construction dewatering; furnishing and placing backfill per one of the approved methods; furnish, install, and compact gravel road sub-base; furnish and install filter fabric as required; install, grade, compaction; compaction testing; temporary excavation support furnished

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and installed complete, left in place, and cut off below grade where required or required; furnishing, placing and compacting bedding; furnish and install PVC pipe, fittings, couplings, appurtenances and joints; connections to existing and proposed pipes and structures; flushing/cleaning and testing; and all incidental work not specifically included for payment elsewhere.

SPECIAL NOTES/EXCLUSIONS:

The following items are not included for payment under this item but are included for separate payment elsewhere under unclassified excavation; removal of concrete slab and railroad rail and ties.

Item 2622.5 - Pipe – PVC (Gravity) 18-inch

METHOD OF MEASUREMENT:

Measurement for payment for Pipe – PVC (Gravity) 18-in will be based on the actual feet of pipe installed at all depths, tested, and accepted, complete as shown on the Contract Drawings or as required by the Engineer and as measured by the Engineer along the centerline of the pipe from the inside face of structures to inside face of structures or to the points of connection with existing pipes.

Pipe installed but not successfully tested and accepted shall be paid for at a maximum of 95 percent of the unit prices bid under this item. The remaining 5 percent shall be paid upon receipt of successful test results by the Engineer. All reductions in payment due to unsuccessful testing shall be made prior to normal retainage.

BASIS OF PAYMENT / INCLUSIONS:

Payment for Pipe – PVC (Gravity) 18-in will be based on the unit price bid for this item in the proposal. Under the unit price for each pipe item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required to install 18-in PVC pipe, complete as shown on the Contract Drawings or at the requirements of the Engineer. The work includes; saw cutting bituminous and cement concrete; excavation; construction dewatering; furnishing and placing backfill per one of the approved methods; furnish, install, and compact gravel road sub-base; furnish and install filter fabric as required; install, grade, compaction; compaction testing; temporary excavation support furnished and installed complete, left in place, and cut off below grade where required or required; furnishing, placing and compacting bedding; furnish and install PVC pipe, fittings, couplings, appurtenances and joints; connections to existing and proposed pipes and structures; flushing/cleaning and testing; and all incidental work not specifically included for payment elsewhere.

SPECIAL NOTES/EXCLUSIONS:

The following items are not included for payment under this item but are included for separate payment elsewhere under unclassified excavation; removal of concrete slab and railroad rail and ties.

Item 2622.6 - Pipe – PVC (Gravity) 21-inch

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METHOD OF MEASUREMENT:

Measurement for payment for Pipe – PVC (Gravity) 21-in will be based on the actual feet of pipe installed at all depths, tested, and accepted, complete as shown on the Contract Drawings or as required by the Engineer and as measured by the Engineer along the centerline of the pipe from the inside face of structures to inside face of structures or to the points of connection with existing pipes.

Pipe installed but not successfully tested and accepted shall be paid for at a maximum of 95 percent of the unit prices bid under this item. The remaining 5 percent shall be paid upon receipt of successful test results by the Engineer. All reductions in payment due to unsuccessful testing shall be made prior to normal retainage.

BASIS OF PAYMENT / INCLUSIONS:

Payment for Pipe – PVC (Gravity) 21-in will be based on the unit price bid for this item in the proposal. Under the unit price for each pipe item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required to install 21-in PVC pipe, complete as shown on the Contract Drawings or at the requirements of the Engineer. The work includes; saw cutting bituminous and cement concrete; excavation; construction dewatering; furnishing and placing backfill per one of the approved methods; furnish, install, and compact gravel road sub-base; furnish and install filter fabric as required; install, grade, compaction; compaction testing; temporary excavation support furnished and installed complete, left in place, and cut off below grade where required or required; furnishing, placing and compacting bedding; furnish and install PVC pipe, fittings, couplings, appurtenances and joints; connections to existing and proposed pipes and structures; flushing/cleaning and testing; and all incidental work not specifically included for payment elsewhere.

SPECIAL NOTES/EXCLUSIONS:

The following items are not included for payment under this item but are included for separate payment elsewhere under unclassified excavation; removal of concrete slab and railroad rail and ties.

Item 2622.7 - Pipe – PVC (Gravity) 24-inch

METHOD OF MEASUREMENT:

Measurement for payment for Pipe – PVC (Gravity) 24-in will be based on the actual feet of pipe installed at all depths, tested, and accepted, complete as shown on the Contract Drawings or as required by the Engineer and as measured by the Engineer along the centerline of the pipe from the inside face of structures to inside face of structures or to the points of connection with existing pipes.

Pipe installed but not successfully tested and accepted shall be paid for at a maximum of 95 percent of the unit prices bid under this item. The remaining 5 percent shall be paid upon

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receipt of successful test results by the Engineer. All reductions in payment due to unsuccessful testing shall be made prior to normal retainage.

BASIS OF PAYMENT / INCLUSIONS:

Payment for Pipe – PVC (Gravity) 24-in will be based on the unit price bid for this item in the proposal. Under the unit price for each pipe item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required to install 24-in PVC pipe, complete as shown on the Contract Drawings or at the requirements of the Engineer. The work includes; saw cutting bituminous and cement concrete; excavation; construction dewatering; furnishing and placing backfill per one of the approved methods; furnish, install, and compact gravel road sub-base; furnish and install filter fabric as required; install, grade, compaction; compaction testing; temporary excavation support furnished and installed complete, left in place, and cut off below grade where required or required; furnishing, placing and compacting bedding; furnish and install PVC pipe, fittings, couplings, appurtenances and joints; connections to existing and proposed pipes and structures; flushing/cleaning and testing; and all incidental work not specifically included for payment elsewhere.

SPECIAL NOTES/EXCLUSIONS:

The following items are not included for payment under this item but are included for separate payment elsewhere under unclassified excavation; removal of concrete slab and railroad rail and ties.

Item 2622.8 – Reconnect, Repair, or Relocate Existing Sanitary Sewer and Storm Drain Laterals

METHOD OF MEASUREMENT:

Measurement for payment for Reconnect, Repair, or Relocate Existing Sanitary Sewer and Storm Drain Laterals will be based on the actual linear feet of pipe installed, tested, and accepted, regardless of size or depth, complete as shown on the Contract Drawings or as required by the Engineer and as measured by the Engineer along the centerline of the pipe from the centerline of the mainline to the connection with the existing service.

BASIS OF PAYMENT / INCLUSIONS:

Payment for Reconnect, Repair, or Relocate Existing Sanitary Sewer and Storm Drain Laterals will be based on the unit price bid for this item in the proposal. Under the unit price for each pipe item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required to relocate existing sanitary or storm drain services which are in conflict with the proposed Work or to reconnect existing storm drain or sanitary services to the new storm drain or sanitary sewer main, regardless or size or depth, complete as shown on the Contract Drawings or at the requirements of the Engineer. The work includes; saw cutting bituminous and cement concrete; excavation; construction dewatering; furnishing and placing backfill per one of the approved methods; furnish, install, and compact gravel road sub-base; furnish and install filter

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GRAVITY PIPE

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fabric as required; compaction; compaction testing; temporary excavation support furnished and installed complete, left in place, and cut off below grade where required or required; furnishing, placing and compacting bedding; removal and disposal of existing pipe; furnish and install PVC or DI pipe, fittings, couplings, appurtenances and joints; connections to existing and proposed pipes and structures; flushing/cleaning and testing; and all incidental work not specifically included for payment elsewhere.

SPECIAL NOTES/EXCLUSIONS:

The following items are not included for payment under this item but are included for separate payment elsewhere under unclassified excavation; removal of concrete slab and railroad rail and ties. Relocations required to facilitate the Contractor's means and methods or where broken by the Contractor are not included for payment herein but are to be considered incidental to the Contract and to be carried by the Contractor in his Total Bid Price. Reconnection to CIPP sections is not included for payment herein.

END OF SECTION 02622

SECTION 02623

CENTRIFUGALLY CAST FIBERGLASS-REINFORCED
POLYMER MORTAR PIPE (FRP)

2623.1	PIPE- FRP (GRAVITY) 36-INCH	LINEAR FOOT
2623.2	PIPE- FRP (GRAVITY) 48-INCH	LINEAR FOOT
2623.3	PIPE -FRP (GRAVITY) 36-INCH AND RELATED PIPELINE WORK AT HARVARD STEAM TUNNEL CROSSING	LUMP SUM

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The work covered under this Section includes the furnishing of all plant, labor, equipment, appliances and materials providing Centrifugally Cast Fiberglass Reinforced Polymer Mortar (FRP) Pipe as indicated and specified, complete and operable and in conformance with the Contract Documents.

1.2 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

- A. ASTM D 3262 - Standard Specification for Reinforced Plastic Mortar Sewer Pipe.
- B. ASTM D 3754 - Standard Specification for "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Sewer and Industrial Pressure Pipe.
- C. ASTM D 3681 - Method for Determining Chemical Resistance of Reinforced Thermosetting Resin Pipe in Deflected Condition.
- D. ASTM D 4161 - Specification for "Fiberglass" (Glass-Fiber-Reinforced Thermosetting Resin) Pipe Joints Using Flexible Elastomeric Seals.
- E. ASTM F 477 - Standard Specification for Elastomeric Seals (Gaskets) Joining Plastic Pipe.
- F. ASTM D 2412 - Standard Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading.
- G. ASTM D638 - Test Method for Tensile Properties of Plastics.
- H. Section 02210 - EXCAVATION, BACKFILL, FILL AND GRADING

CENTRIFUGALLY CAST FIBERGLASS-REINFORCED
POLYMER MORTAR PIPE (FRP)

1.3 SUBMITTALS

- A. Conform to requirements of Section 01300 - SUBMITTALS.
- B. Product data submittals shall include the following, as a minimum:
 - 1. Details of the proposed pipe.
 - 2. Properties and strengths of the pipe.
 - 3. Details of pipe joint.
 - 4. Pipe design analysis.
 - 5. Instruction on storage, handling, transporting, and installation.
 - 6. Standard catalog sheets.
- C. Test Reports: Provide test reports upon request, certifying that the pipe has been tested in accordance with and exceeds minimum requirements of ASTM D 3262 and ASTM D 3681.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Preapproved manufacturer for centrifugal cast fiberglass pipe is Hobas Pipe USA, Inc. or approved equivalent.

2.2 MATERIALS

- A. Resin Systems: The manufacturer shall use only polyester resin systems with a proven history of performance in this particular application. The historical data shall have been collected from applications of a composite material of similar construction and composition as the proposed product.
- B. Glass Reinforcements: The reinforcing glass fibers used to manufacture the components shall be of highest quality commercial grade glass filaments with binder and sizing compatible with impregnating resins.
- C. Fillers: Silica sand or other suitable materials may be used.
- D. Additives: Resin additives, such as pigments, dyes, and other coloring agents, if used, shall in no way be detrimental to the performance of the product nor shall they impair visual inspection of the finished products.

CENTRIFUGALLY CAST FIBERGLASS-REINFORCED POLYMER MORTAR PIPE (FRP)

- E. Rubber Gaskets: Supply from an approved gasket manufacturer in accordance with ASTM F 477, when no contaminant is identified and suitable for the service intended. Gaskets shall either be affixed to the pipe by means of a suitable adhesive or shall be installed in such a manner so as to prevent the gasket from rolling out of the pre-cut groove in the pipe or sleeve coupling. When pipe is to be installed in potentially contaminated areas, especially where free product is found near the elevation of the proposed combined sewer, provide the following gasket materials for the noted contaminants.

<u>CONTAMINANT</u>	<u>GASKET MATERIAL REQUIRED</u>
Petroleum (diesel, gasoline)	Nitrile Rubber
Other Contaminant	As recommended by the pipe manufacturer

- F. The internal liner resin shall be suitable for service as sewer pipe, and shall be highly resistant to exposure to sulfuric acid as produced by biological activity from hydrogen sulfide gases. Pipe shall meet or exceed requirements of ASTM D 3681.

2.3 MANUFACTURE AND CONSTRUCTION

- A. Pipes
1. Furnish pipes in the diameters specified and within the tolerances specified below.
 2. Manufacture pipe by the centrifugal casting process to result in a dense, nonporous, corrosion-resistant, consistent composite structure to meet the operating conditions as shown on the Drawings.
 3. Do not use stiffening ribs or rings.
- B. Couplings: Unless otherwise specified, the pipe shall be field connected with fiberglass sleeve couplings that utilize elastomeric sealing gaskets as the sole means to maintain joint watertightness. The joints must meet the performance requirements of ASTM D 4161.
1. For slip-line applications, couplings shall be flush joint type where required to maintain clearance for installation within host pipe or conduit. CONTRACTOR shall verify interior dimensions in the field prior to performing the work. Spacers or other means as

CENTRIFUGALLY CAST FIBERGLASS-REINFORCED POLYMER MORTAR PIPE (FRP)

recommended by the manufacturer shall be used for slip-line installation without damaging the pipe.

- C. Fittings: Flanges, elbows, reducers, tees, and other fittings shall be capable of withstanding operating conditions when installed. They may be contact molded or manufactured from mitered sections of pipe joined by glass fiber reinforced overlays.

2.4 DIMENSIONS

- A. Diameters: The nominal pipe dimensions shall be as follows:

Nominal Pipe Size:	36"
Nominal Pipe Inside Diameter	34.3"
Nominal Pipe Outer Diameter	38.3"
Minimum Wall Thickness	1.85"
Nominal Outside Dimension at Coupling	39.3"
Minimum Pipe Stiffness	46 (psi)

Nominal Pipe Size:	48"
Nominal Pipe Inside Diameter	46.4"
Nominal Pipe Outer Diameter	50.8"
Minimum Wall Thickness	2.03 "
Nominal Outside Dimension at Coupling	51.9"
Minimum Pipe Stiffness	46 (psi)

- B. Lengths: Pipe shall be supplied in nominal lengths of 10 or 20 feet. Actual laying length shall be nominal +1, -4 inches.
- C. Stiffness class of FRP pipe shall satisfy design requirements, but shall not be less than SN46.
- D. End Squareness: Pipe ends shall be squared to the pipe axis with a maximum tolerance of 1/8".

2.5 TESTING

- A. Pipes shall be tested in accordance with ASTM D 3262 or ASTM D 3754, as applicable, except that the factory hydrostatic pressure testing is not required.
- B. Joints: Coupling joints shall meet the requirements of ASTM D 4161.
- C. Coupling: The coupling is to be a structural filament wound and mechanically locked to an internal full-face elastomeric membrane. The

CENTRIFUGALLY CAST FIBERGLASS-REINFORCED POLYMER MORTAR PIPE (FRP)

sealing design must include both lip and compression elements. The coupling is to be factory assembled to one end of each pipe.

- D. Stiffness: Minimum pipe stiffness when tested in accordance with ASTM D2412 shall be 46 psi.
- E. Strain Corrosion: The extrapolated 50-year strain corrosion value shall not be less than 0.9% as determined in accordance with ASTM D3681 and D3262.

2.6 INSPECTION

- A. Acceptance of pipe shall be made on the basis of certificates of compliance that the pipe meets all material specifications.
- B. The quality of all materials, the process of manufacture, and the finished pipe may be subject to the inspection and approval of the Owner. Such inspection may be made at the place of manufacture or on the work after delivery, or at both places, and the pipe shall be subject to rejection at any time on account of failure to meet any of the specification requirements even though sample pipe may have been accepted as satisfactory. The Owner reserves the right to apply such tests as deemed necessary. All pipe will be inspected upon delivery prior to and after installation of the pipelines, and pipe which has been damaged or which does not meet the requirements of these Specifications will be rejected and shall be immediately removed from the site and replaced with sound pipe meeting specification requirements at no additional expense to the Owner. Furnish such labor and assistance to the Owner as he may require for inspection purposes.

2.7 PACKAGING, HANDLING, AND SHIPPING

- A. Packing, handling, and shipping should be done in accordance with the manufacturer's instructions.

2.8 INTERNAL HYDRAULIC PRESSURE

- 1. All pipe, joints, gaskets, fittings, connections and work associated with the fabrication, design, and construction of Centrifugally Cast Fiberglass Pipe shall be capable of withstanding internal hydraulic pressures of 10 psi.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. The installation of pipe and fittings shall be in accordance with the Drawings.
- B. Install FRP pipe in accordance with manufacturer's recommendation.

PART 4 – COMPENSATION

Item 2623.1 --- Pipe-FRP (Gravity) 36-inch

METHOD OF MEASUREMENT:

Measurement for payment for Pipe-FRP (Gravity) 36-inch will be based on the actual linear feet of pipe installed, tested, and accepted, complete as shown on the Contract Drawings or as directed by the Engineer and as measured by the Engineer along the centerline of the pipe from the inside face of structures to inside face of structures or to the points of connection with existing pipes.

Pipe installed but not successfully tested and accepted shall be paid for at a maximum of 95 percent of the unit prices bid under this item. The remaining 5 percent shall be paid upon receipt of successful test results by the Engineer. All reductions in payment due to unsuccessful testing shall be made prior to normal retainage.

BASIS OF PAYMENT:

Payment for Pipe-FRP (Gravity) 36-inch will be based on the unit price bid for this item in the proposal. Under the unit price for each pipe item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required to install FRP (Gravity) 36-inch complete as shown on the Contract Drawings or at the request of the Engineer. The work includes, but is not limited to; excavation; placing backfill; preparation of subgrade; furnish and install filter fabric as required; compaction; compaction testing; temporary excavation support furnished and installed complete, left in place, and cut off below grade as per the Contract Specifications; furnishing and installing bedding; furnishing and installing centrifugally cast fiberglass pipe, fittings, couplings and appurtenances; connections to existing and proposed pipes and structures; testing; construction dewatering; flow bypass and all incidental work not specifically included for payment elsewhere.

SPECIAL NOTES ON EXCEPTIONS:

Items not included for payment herein include, but are not limited to; flow bypass, furnishing and installation of FRP within conduit beneath steam tunnel; and removal of concrete slab and railroad rail and ties which is paid elsewhere.

CENTRIFUGALLY CAST FIBERGLASS-REINFORCED POLYMER MORTAR PIPE (FRP)

Item 2623.2 ---Pipe- FRP (Gravity) 48-inch

METHOD OF MEASUREMENT:

Measurement for payment for Pipe-FRP (Gravity) 48-inch will be based on the actual linear feet of pipe installed, tested, and accepted, complete as shown on the Contract Drawings or as directed by the Engineer and as measured by the Engineer along the centerline of the pipe from the inside face of structures to inside face of structures or to the points of connection with existing pipes.

Pipe installed but not successfully tested and accepted shall be paid for at a maximum of 95 percent of the unit prices bid under this item. The remaining 5 percent shall be paid upon receipt of successful test results by the Engineer. All reductions in payment due to unsuccessful testing shall be made prior to normal retainage.

BASIS OF PAYMENT:

Payment for FRP (Gravity) 48-inch will be based on the unit price bid for this item in the proposal. Under the unit price for each pipe item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required to install FRP (Gravity) 48-inch complete as shown on the Contract Drawings or at the request of the Engineer. The work includes, but is not limited to; excavation; placing backfill; preparation of subgrade; furnish and install filter fabric as required; compaction; compaction testing; temporary excavation support furnished and installed complete, left in place, and cut off below grade as per the Contract Specifications; furnishing and installing bedding; furnishing and installing centrifugally cast fiberglass pipe, fittings, couplings and appurtenances; connections to existing and proposed pipes and structures; testing; construction dewatering; flow bypass and all incidental work not specifically included for payment elsewhere.

SPECIAL NOTES ON EXCEPTIONS:

Items not included for payment herein include, but are not limited to; flow bypass and removal of concrete slab and railroad and ties which is paid elsewhere.

Item 2623.3 – Pipe-FRP (Gravity) 36-Inch and Related Pipeline Work at Harvard Steam Tunnel Crossing.

METHOD OF MEASUREMENT:

Payment for Modifications to Pipe-FRP (Gravity) 36-Inch and Related Pipeline Work at Harvard Steam Tunnel Crossing shall be based on the Lump Sum Price bid in the proposal. Measurement for payment shall be based on the Schedule of Values for complete and functional FRP (Gravity) 36-Inch and Related Pipeline Work at Harvard Steam Tunnel Crossing as shown on the Contract Drawings or as directed by the Owner or Engineer, and as measured by the Owner or Engineer.

BASIS OF PAYMENT / INCLUSIONS:

Under the Unit Price bid for this item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required for the complete procurement, installation,

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cleaning, and leakage testing/inspection of FRP (Gravity) 36-Inch and Related Pipeline Work at Harvard Steam Tunnel Crossing complete as indicated on the Contract Drawings and Specifications, or as directed by the Owner or Engineer. This work shall include furnishing, installing, and/or performing the following: removal of wood formwork and other loose debris within sewer conduit; selective demolition work as shown on the Contract Drawings; temporary redirection and permanent reconnection of steam tunnel sump pump discharge; FRP pipes, DI deflection segments, FRP end caps and all other pipeline appurtenances between manholes adjacent to steam tunnel; CDF encasement of FRP pipes as shown on the Contract Drawings; all coordination with Harvard University; protection in place of existing steam tunnel structure; pavement or sidewalk sawcutting; excavation of bituminous concrete roadway; excavation; transporting material to/from soil staging area; temporary excavation support consisting of trench boxes, or timber or steel sheeting left in place and cut off below grade as per the Contract Specifications; dewatering operations; bedding, including compaction; placing and compacting suitable backfill soil; compaction testing; connections to manholes; and all incidental work.

SPECIAL NOTES ON EXCLUSIONS

The following item(s) are not included for payment under this item and are included for payment elsewhere: removal of existing brick manhole; sedimentation and erosion control in roadways; disposal of construction debris; flow bypass; removal of concrete slab and railroad and ties; bulkhead of existing pipes.

END OF SECTION 02623

SECTION 02630

DUCTILE-IRON PIPE AND FITTINGS

2630.1	PIPE – DI (WATER) 4-INCH	LINEAR FOOT
2630.2	PIPE – DI (WATER) 6-INCH	LINEAR FOOT
2630.3	PIPE – DI (WATER) 8-INCH	LINEAR FOOT
2630.4	PIPE – DI (WATER) 10-INCH	LINEAR FOOT
2630.5	PIPE – DI (WATER) 12-INCH	LINEAR FOOT
2630.6	PIPE – DI (WATER) 16-INCH	LINEAR FOOT
2630.7	PIPE – DI (WATER) 20-INCH	LINEAR FOOT

PART 1 - GENERAL

1.1 SUMMARY

- A. This section includes the following:
 - 1. Furnishing and installing ductile-iron pipe and fittings, as indicated and specified.
- B. Options:
 - 1. For joints in buried exterior pipelines, provide push-on joint. All fittings and valves shall be mechanical joint.
- C. Related sections includes the following:
 - 1. Section 02210 – EARTH EXCAVATION, BACKFILL, FILL AND GRADING
 - 2. Section 02640 – VALVES AND APPURTENANCES
 - 3. Section 02645 – HYDRANTS
 - 4. Section 02675 – DISINFECTION OF WATER MAINS
 - 5. Section 02660 – WATER SERVICES

6. Section 02704 – PIPELINE PRESSURE AND LEAKAGE TESTING
7. Section 02685 – TEMPORARY BY-PASS PIPING AND SERVICE CONNECTIONS

1.3 SUBMITTALS

- A. Shop Drawings: Submit the following in accordance with Section 01300 - SUBMITTALS:
 1. Submit shop drawings or descriptive literature, or both, showing dimensions, joint and other details for each type and class of pipe, fitting and restraint system to be furnished for the project. All materials furnished under the Contract shall be manufactured only in accordance with the Specifications. Submittals shall include material information, dimensions, pipe class information, weights, coating and lining system data.
 2. Submit manufacturer's literature stating that the ductile iron pipe and fittings have been manufactured and tested in accordance with AWWA/ANSI specifications.
 3. Submit a detailed description of proposed testing, flushing and disinfection procedures to be used for this project. The description shall contain the name of the person responsible for the testing, flushing and disinfection work, equipment to be used, chemical to be used, method of measuring flow during flushing procedures and the name of the laboratory to be used for analysis. Review of the description shall not be construed as approval of any methods to be used, the Contractor shall be fully responsible for achieving the specified test results.

1.4 QUALITY ASSURANCE

- A. Provide in accordance with Section 01400 – QUALITY CONTROL and as specified.
- B. Owner reserves right to inspect and test by independent service at manufacturer's plant or elsewhere at his own expense.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Provide in accordance with Section 01600 – PRODUCTS, MATERIALS AND EQUIPMENT.

PART 2 - PRODUCTS

2.1 PIPE

A. Ductile Iron:

1. Ductile iron pipe shall be that of a United States manufacturer who can demonstrate at least 5 years of successful experience in manufacturing ductile iron pipe. The pipe shall be equipped with push-on joints.
2. All ductile iron pipe shall conform to ANSI A21.50 (1976) (AWWA C150) and ANSI A21.51 (AWWA C151).
3. The ductile iron pipe shall be Class 52 and furnished in nominal 18-foot lengths, with Push-on Joints as manufactured by U.S. Pipe and Foundry Company, American Ductile Iron Pipe, Griffin Pipe Co., or equal with gaskets conforming to AWWA C111 ANSI A21.11 "Rubber Gasket Joints".
4. The ductile iron pipe shall be at least 8-inches diameter, double cement lined inside and then asphalt seal coated on the outside and inside approximately 1 mil. thick. The cement lining shall conform to AWWA C104 ANSI A21.4. The pipe shall be furnished along with necessary materials and equipment recommended by the manufacturer for use in joining pipe lengths and fittings.

2.2 FITTINGS

A. Ductile iron fittings shall be used and be cement lined. Fittings are required to be equipped with a mechanical joint restraint unless otherwise specified by the CWD. Mechanical joint fittings in sizes 4-inch through 12-inch shall be ductile iron compact fittings and rated for 350 psi working pressure. Fittings shall be of the same material and have the same lining and coating as the pipe specified above. All fittings shall be marked with the weight and shall have distinctly cast upon them the pressure rating, the manufacturer's identification, nominal diameter of openings and the number of degrees or fraction of the circle on all bends. All nuts and bolts shall be of a type equal to ductile iron or Kor-10 steel T-bolts and nuts.

1. Hydrant tees shall have a rotatable mechanical joint gland on the 6-inch plain end branch to provide positive valve restraint, unless otherwise allowed by the Engineer.
2. Caps and plugs installed in all new work as indicated on the drawings shall be provided with a threaded corporation or bleeder valve so that air and water pressure can be relieved prior to future connection.

3. Solid sleeves shall be ductile iron with 350 psi rating. Sleeves shall conform to ANSI/AWWA C110.

2.3 JOINTS

- A. Provide mechanical joint or push-on joint pipe with necessary accessories, conforming to ANSI A21.11.
 1. Provide gasket composition suitable for exposure to liquid within pipe.
 2. Provide gasket composition suitable for exposure to potable water.
 3. Provide mechanical joint gaskets with copper tips to provide electrical continuity.
 4. Provide serrated brass wedges for push-on joints to provide electrical continuity; two per joint for pipe 12-in. and smaller and four per joint for larger pipe.
- B. Provide pipe flanges and accessories conforming to ANSI A21.15.
 1. Provide flat faced flanges.
 2. Provide 1/8 in. thick, full faced gaskets suitable for exposure to liquid within pipe.
- C. Restrained joints shall be furnished for installation on all fittings, sleeves, hydrants and valves. Restraints for mechanical joints shall be Megalug Series 1100 as manufactured by Ebaa Iron Co., MJ Field Lok by US Pipe Company, Uni-flanged Series 1400 Mechanical Joint Restraint or approved equivalent. Restraints for push-on joints shall be Series 1700 as manufactured by Ebaa Iron Co., Series 1390 as manufactured by Uni-Flange, or Ford Series 1450 Uni-Flange for Push-on pipe joint, or approved equivalent.
- D. Restraint systems for push-on pipe utilizing steel-wedge gaskets will be acceptable.

2.4 COUPLINGS

- A. Pressure rating at least equal to that of related pipeline with a minimum rating of 150 psi.
- B. Couplings shall be of a type equal to Smith Blair, Style 441; Dress, Style 153; 360 or Romac Style 501 or an approved equivalent. Couplings shall be

provided with plain, Grade 27, rubber gaskets and with black steel, track-head bolts with nuts. Couplings shall be manufactured in the United States of America.

- C. Where long-style sleeve couplings are indicated, couplings shall measure 16 inches long for differential settlement of structures.
- D. Insulating couplings are required for all piping connections where two dissimilar metals are to be connected in order to prevent corrosion. Both ends of the coupling shall be provided with a wedge-shaped gasket which assembles over a sleeve of an insulating compound material compatible with the fluid service in order to obtain insulation of coupling metal parts from the pipe.

2.5 FILLING RINGS

- A. Provide where necessary.
- B. Materials, workmanship, facing, and drilling, conforming to 125-lb. ANSI Standard.
- C. Suitable length with nonparallel faces and corresponding drilling, if necessary, for correct assembly of adjoining piping or equipment.

2.6 CONNECTIONS - TAPPED

- A. Provide watertight joint with adequate strength against pullout. Use only tapered thread taps.
- B. Maximum size of taps in pipe or fittings without bosses not to exceed that listed in appropriate table of Appendix to ANSI A21.51 based on:
 - 1. 2 full threads for ductile iron.
- C. Where size of connection exceeds that given above for pipe, provide boss on pipe barrel or use tapping saddle. Make tap in flat part of intersection of run and branch of tee or cross, or connect by means of tapped tee, branch fitting and tapped plug or reducing flange, or tapping tee and tapping valve, as indicated or permitted.

2.7 STANDARD LINING AND COATING

- A. Inside of pipe and fittings: Provide double thickness cement lining and bituminous seal coat conforming to ANSI A21.4.
- B. Outside of pipe and fittings within structures: Clean and apply one shop coat of Koppers Pug Primer made by Koppers Co., Inc., Pittsburgh, PA; Chem-

Prime 37-77 made by Tnemec Co., North Kansas City, MD; 13-R-50 Chromax Primer made by Valspar Corp. Short Hills, NJ; or acceptable equivalent.

2.8 GASKETS, BOLTS, AND NUTS

- A. Provide ring rubber gaskets with cloth insertion for flanged joints, neoprene faced phenolic for insulating gaskets.
 - 1. Gaskets 12 in. in diameter and smaller, 1/16 in. thick.
 - 2. Larger than 12 in., 1/8 in. thick.
- B. Make flanged joints with:
 - 1. Bolts.
 - 2. Bolt studs with nut on each end.
 - 3. Studs with nuts where flange is tapped.
 - 4. Plastic bolt sleeves and washers for insulating joints.
- C. Number and size of bolts conform to same ANS as flanges.
- D. Provide bolts and nuts, except as specified or indicated, Grade B, ASTM A307.
- E. Provide bolt studs and studs of same quality as machine bolts.
- F. Flanged joints for wall castings flush with masonry made up with Type 316 stainless steel stud bolts and nuts.
- G. Submerged flanged joints made up with Type 316 stainless steel bolts and nuts.

2.9 POLYETHYLENE PIPE ENCASEMENT

- A. Material: Virgin polyethylene conforming to ANSI/ASTM D1248.
- B. Thickness: Minimum nominal thickness of 8 mils.
- C. Material and installation methods to conform to requirements of AWWA C105.

2.10 INSULATION

- A. Insulation shall be manufactured by Thermal Pipe Systems, Braintree, Massachusetts, Atlas Insulation, Ayer, Massachusetts or Insulated Piping Systems, Inc., Canton, Massachusetts, or equivalent. Insulation shall be factory formed-in-place polyurethane foam insulation having nominal thickness of 3", with an in-place density of 2.5 pcf, and a "K" factor of 0.14 BUT/in./hr/deg./F/sq. ft. Straight joints between insulated pipe lengths, and the end section of non-insulated pipe shall be 20-gauge corrugated aluminum performed to be fastened with stainless steel screws and bands. Jackets shall have expansion joints at 25-foot intervals. Sections of jacket shall have 2-inch minimum at all seams.
- B. Jacket shall have one layer of one (1) mil polyethylene film with a protective coat of 40-lb. virgin draft paper to act as a moisture and galvanic corrosion barrier.

2.11 THRUST BLOCKING

- A. Concrete thrust blocks shall be installed at all proposed fittings, bends, and other locations as required by the Engineer. Concrete thrust blocks shall be furnished with Portland Cement as specified in Section 03300- CONCRETE. The blocks will be poured against undisturbed original ground and shall be so placed that the pipe joints will be accessible for any possible future repairs. The other means of restraint may either be of an interlocking type or mechanical joint restraint as specified by the Cambridge Water Department (CWD) and shall be installed in addition to thrust blocks as required by the CWD.

PART 3 - EXECUTION

3.1 ALIGNMENT AND PLACEMENT OF PIPE

- A. Fittings and valves shall be restrained for the minimum lengths listed on the following table:

MINIMUM RESTRAINED LENGTHS

<u>FITTING</u>	<u>RESTRAINT LENGTH</u>
12" – 45° Bend	13-feet in each Direction
8" – 45° Bend	9-feet in each Direction
6" - 45° Bend	7-feet in each Direction
12" – 22-1/2° Bend	6-feet in each Direction
10" - 45° Bend	11-feet in each Direction
8" - 90° Bend	23-feet in each Direction
8" – 22-1/2° Bend	4-feet in each Direction
8" – 11-1/4° Bend	2-feet in each Direction
6" – 22-1/2° Bend	3-feet in each Direction
6" – 11-1/4° Bend	2-feet in each Direction
12" – 11-1/4° Bend	3-feet in each Direction
12" Vertical Offset	
Upper 45° Bend	27-feet in each Direction
Lower 45° Bend	12-feet in each Direction
8" Vertical Offset	
Upper 45° Bend	19-feet in each Direction
Lower 45° Bend	8-feet in each Direction
6" Vertical Offset	
Upper 45° Bend	14-feet in each Direction
Lower 45° Bend	6-feet in each Direction
12" x 12" x 12" Tee	42-feet in Branch
12" x 12" x 10" Tee	29-feet in Branch
12" x 12" x 8" Tee	16-feet in Branch
12" x 12" x 6" Tee	1-foot in Branch
8" x 8" x 8" Tee	25-feet in Branch
8" x 8" x 6" Tee	10-feet in Branch
8" x 8" x 4" Tee	1-foot in Branch
6" x 6" x 6" Tee	15-feet in Branch
6" x 6" x 4" Tee	1-foot in Branch
16" x 12" Reducer	32-feet Larger Direction only
12" x 10" Reducer	28-feet Larger Direction only
12" x 8" Reducer	31-feet Larger Direction only
12" x 6" Reducer	42-feet Larger Direction only
8" x 6" Reducer	17-feet Larger Direction only
8" x 4" Reducer	29-feet Larger Direction only
6" x 4" Reducer	16-feet Larger Direction only
12" Valve or Dead-end	58-feet in each Direction
10" Valve or Dead-end	49-feet in each Direction
8" Valve or Dead-end	41-feet in each Direction
6" Valve or Dead end	31-feet in each Direction
4" Valve or Dead-end	22-feet in each Direction
2" Valve or Dead-end	18-feet in each Direction

3.2 INSTALLATION

A. Piping Support:

1. Furnish and install supports to hold piping at lines and grades indicated or specified.
2. Support pipe and appurtenances connected to equipment to prevent any strain imposed on equipment.

B. Pipe and Fittings:

1. Remove and replace defective pieces.
2. Clear of all debris and dirt before installing and keep clean until accepted.
3. Lay accurately to lines and grades indicated or required. Provide accurate alignment, both horizontally and vertically.
4. Provide firm bearing along entire length of buried pipelines.
5. All water mains and service pipe shall be laid in a trench separate from any other utility. The horizontal distance between water mains or service pipe and any other utility shall be at a minimum of no less than four (4) feet of cover or no more than seven (7) feet of cover unless otherwise approved by the CWD, vertical distance shall be no less than 18 inches with the water pipe always above the sewer pipe, and no less than ten (10) feet from a sanitary sewer or surface water drain. DEP regulation #310CMR22.19 distribution system requirements.

C. Temporary Plugs: When pipe laying not in progress, close open ends of pipe with temporary watertight plugs. If water in trench, do not remove plug until danger of water entering pipe passed.

D. Appurtenances: Set valves, fittings and appurtenances as indicated.

3.3 JOINTS AND COUPLINGS

A. Push-on Joints:

1. Insert gasket into groove bell. Apply thin film of nontoxic gasket lubricant over inner surface of gasket in contact with spigot end.
2. Insert chamfered end into gasket. Force pipe past it until it seats against socket bottom.

3. Where required, install restraint and secure push-on joint restraint in accordance with manufacturer's instructions.

B. Mechanical Joints:

1. Wire brush surfaces in contact with gasket and clean gasket.
2. Lubricate gasket, bell, and spigot with soapy water.
3. Slip gland and gasket over spigot, and insert spigot into bell until seated.
4. Seat gasket and press gland firmly against gasket.
5. After bolts inserted and nuts made finger-tight, tighten diametrically opposite nuts progressively and uniformly around joint by torque wrench. Torque bolts to values specified above.

C. Sleeve-Type Coupling:

1. Clean pipe ends for distance of 8 in.
2. Use soapy water as gasket lubricant.
3. Slip follower and gasket over each pipe to a distance of 6 in. from end and place middle ring on pipe end until centered over joint.
4. Insert other pipe end into middle ring and bring to proper position in relation to pipe laid.
5. Press gaskets and followers into middle ring flares.
6. After bolts inserted and nuts made fingertight, tighten diametrically opposite nuts by use of torque wrench of size and torque specified below:

3.4 TESTING

- A. Clean of all dirt, dust, oil, grease and other foreign material, before conducting pressure and leakage tests.
- B. Pressure and Leakage Tests. Refer to Section 02704 for requirements.

3.5 DISINFECTING AND FLUSHING

- A. Disinfect potable water lines using procedures and materials conforming to AWWA C651.
- B. Refer to Section 02675 for additional requirements.

3.6 CONTRACT CLOSEOUT

- A. Provide in accordance with Section 01701.

PART 4 – COMPENSATION

Item 2630.2 - Pipe – DI (Water) 4-inch

METHOD OF MEASUREMENT:

Measurement for payment for Pipe – DI (Water) 4-inch will be based on the actual linear feet of pipe installed, tested, and accepted, complete as shown on the Contract Drawings or as required by the Engineer and as measured by the Engineer along the centerline of the pipe with no reduction for fittings, valves, or hydrants.

Pipe installed but not successfully tested and accepted shall be paid for at a maximum of 95 percent of the unit prices bid under this item. The remaining 5 percent shall be paid upon receipt of successful test results by the Engineer. All reductions in payment due to unsuccessful testing shall be made prior to normal retainage.

BASIS OF PAYMENT:

Payment for Pipe – DI (Water) 4-inch will be based on the unit price bid for this item in the proposal. Under the linear foot price for the item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required to install each pipe complete as shown on the Contract Drawings or at the requirements of the Engineer. The work includes, but is not limited to; saw cutting bituminous and cement; excavation; construction dewatering; furnishing and placing backfill per one of the approved methods; furnish, install and compact gravel road sub-base; furnish and install filter fabric as required; compaction; compaction testing; furnish and install temporary water lines for individual services; installing temporary bypass valves; locating, excavating, where required and connecting to the temporary service lines to all users whose water service will be disrupted for more than 4-hours; providing temporary fire protection at all hydrants which will be out of service for more than 4-hours; constructing necessary trenches across streets and driveways to protect temporary water line; connections to existing hydrants where required; removing and disposing of all temporary water lines, and for restoring all property damaged or altered in the course of providing temporary water; clean up; temporary excavation support furnished and installed complete, left in place, and cut off below grade where required or required; furnish, install, and compact bedding; furnish and install ductile iron pipe, couplings, fittings, adaptors, mechanical joint restraints, thrust blocks, transitions, gaskets and appurtenances; connections to existing and proposed pipes and structures including hydrants; blow-offs; corporation

stops for chlorination, testing, and flushing; disinfection and chlorination, flushing and testing; sampling; laboratory analyses, disposal of testing materials; furnish and install pipe encasement or insulation as necessary; cleaning protective coating; and all work incidental to the installation of Ductile Iron Water Pipe, not specifically included for payment elsewhere.

SPECIAL NOTES/EXCLUSIONS:

The following items are not included for payment under this item but are included for separate payment elsewhere under unclassified excavation; removal of concrete slab and railroad rail and ties.

Item 2630.2 - Pipe – DI (Water) 6-inch

METHOD OF MEASUREMENT:

Measurement for payment for Pipe – DI (Water) 6-inch will be based on the actual linear feet of pipe installed, tested, and accepted, complete as shown on the Contract Drawings or as required by the Engineer and as measured by the Engineer along the centerline of the pipe with no reduction for fittings, valves, or hydrants.

Pipe installed but not successfully tested and accepted shall be paid for at a maximum of 95 percent of the unit prices bid under this item. The remaining 5 percent shall be paid upon receipt of successful test results by the Engineer. All reductions in payment due to unsuccessful testing shall be made prior to normal retainage.

BASIS OF PAYMENT:

Payment for Pipe – DI (Water) 6-inch will be based on the unit price bid for this item in the proposal. Under the linear foot price for the item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required to install each pipe complete as shown on the Contract Drawings or at the requirements of the Engineer. The work includes, but is not limited to; saw cutting bituminous and cement; excavation; construction dewatering; furnishing and placing backfill per one of the approved methods; furnish, install and compact gravel road sub-base; furnish and install filter fabric as required; compaction; compaction testing; furnish and install temporary water lines for individual services; installing temporary bypass valves; locating, excavating, where required and connecting to the temporary service lines to all users whose water service will be disrupted for more than 4-hours; providing temporary fire protection at all hydrants which will be out of service for more than 4-hours; constructing necessary trenches across streets and driveways to protect temporary water line; connections to existing hydrants where required; removing and disposing of all temporary water lines, and for restoring all property damaged or altered in the course of providing temporary water; clean up; temporary excavation support furnished and installed complete, left in place, and cut off below grade where required or required; furnish, install, and compact bedding; furnish and install ductile iron pipe, couplings, fittings, adaptors, mechanical joint restraints, thrust blocks, transitions, gaskets and appurtenances; connections to existing and proposed pipes and structures including hydrants; blow-offs; corporation stops for chlorination, testing, and flushing; disinfection and chlorination, flushing and testing; sampling; laboratory analyses, disposal of testing materials; furnish and install pipe encasement or insulation as necessary; cleaning protective coating; and all work incidental to the installation of Ductile Iron Water Pipe, not specifically included for payment elsewhere.

SPECIAL NOTES/EXCLUSIONS:

The following items are not included for payment under this item but are included for separate payment elsewhere under unclassified excavation; removal of concrete slab and railroad rail and ties.

Item 2630.3 - Pipe – DI (Water) 8-inch

METHOD OF MEASUREMENT:

Measurement for payment for Pipe – DI (Water) 8-inch will be based on the actual linear feet of pipe installed, tested, and accepted, complete as shown on the Contract Drawings or as required by the Engineer and as measured by the Engineer along the centerline of the pipe with no reduction for fittings, valves, or hydrants.

Pipe installed but not successfully tested and accepted shall be paid for at a maximum of 95 percent of the unit prices bid under this item. The remaining 5 percent shall be paid upon receipt of successful test results by the Engineer. All reductions in payment due to unsuccessful testing shall be made prior to normal retainage.

BASIS OF PAYMENT:

Payment for Pipe – DI (Water) 8-inch will be based on the unit price bid for this item in the proposal. Under the linear foot price for the item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required to install each pipe complete as shown on the Contract Drawings or at the requirements of the Engineer. The work includes, but is not limited to; saw cutting bituminous and cement; excavation; construction dewatering; furnishing and placing backfill per one of the approved methods; furnish, install and compact gravel road sub-base; furnish and install filter fabric as required; compaction; compaction testing; furnish and install temporary water lines for individual services; installing temporary bypass valves; locating, excavating, where required and connecting to the temporary service lines to all users whose water service will be disrupted for more than 4-hours; providing temporary fire protection at all hydrants which will be out of service for more than 4-hours; constructing necessary trenches across streets and driveways to protect temporary water line; connections to existing hydrants where required; removing and disposing of all temporary water lines, and for restoring all property damaged or altered in the course of providing temporary water; clean up; temporary excavation support furnished and installed complete, left in place, and cut off below grade where required or required; furnish, install, and compact bedding; furnish and install ductile iron pipe, couplings, fittings, adaptors, mechanical joint restraints, thrust blocks, transitions, gaskets and appurtenances; connections to existing and proposed pipes and structures including hydrants; blow-offs; corporation stops for chlorination, testing, and flushing; disinfection and chlorination, flushing and testing; sampling; laboratory analyses, disposal of testing materials; furnish and install pipe encasement or insulation as necessary; cleaning protective coating; and all work incidental to the installation of Ductile Iron Water Pipe, not specifically included for payment elsewhere.

SPECIAL NOTES/EXCLUSIONS:

The following items are not included for payment under this item but are included for

separate payment elsewhere under unclassified excavation; removal of concrete slab and railroad rail and ties.

Item 2630.4 - Pipe – DI (Water) 10-inch

METHOD OF MEASUREMENT:

Measurement for payment for Pipe – DI (Water) 10-inch will be based on the actual linear feet of pipe installed, tested, and accepted, complete as shown on the Contract Drawings or as required by the Engineer and as measured by the Engineer along the centerline of the pipe with no reduction for fittings, valves, or hydrants.

Pipe installed but not successfully tested and accepted shall be paid for at a maximum of 95 percent of the unit prices bid under this item. The remaining 5 percent shall be paid upon receipt of successful test results by the Engineer. All reductions in payment due to unsuccessful testing shall be made prior to normal retainage.

BASIS OF PAYMENT:

Payment for Pipe – DI (Water) 10-inch will be based on the unit price bid for this item in the proposal. Under the linear foot price for the item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required to install each pipe complete as shown on the Contract Drawings or at the requirements of the Engineer. The work includes, but is not limited to; saw cutting bituminous and cement; excavation; construction dewatering; furnishing and placing backfill per one of the approved methods; furnish, install and compact gravel road sub-base; furnish and install filter fabric as required; compaction; compaction testing; furnish and install temporary water lines for individual services; installing temporary bypass valves; locating, excavating, where required and connecting to the temporary service lines to all users whose water service will be disrupted for more than 4-hours; providing temporary fire protection at all hydrants which will be out of service for more than 4-hours; constructing necessary trenches across streets and driveways to protect temporary water line; connections to existing hydrants where required; removing and disposing of all temporary water lines, and for restoring all property damaged or altered in the course of providing temporary water; clean up; temporary excavation support furnished and installed complete, left in place, and cut off below grade where required or required; furnish, install, and compact bedding; furnish and install ductile iron pipe, couplings, fittings, adaptors, mechanical joint restraints, thrust blocks, transitions, gaskets and appurtenances; connections to existing and proposed pipes and structures including hydrants; blow-offs; corporation stops for chlorination, testing, and flushing; disinfection and chlorination, flushing and testing; sampling; laboratory analyses, disposal of testing materials; furnish and install pipe encasement or insulation as necessary; cleaning protective coating; and all work incidental to the installation of Ductile Iron Water Pipe, not specifically included for payment elsewhere.

SPECIAL NOTES/EXCLUSIONS:

The following items are not included for payment under this item but are included for separate payment elsewhere under unclassified excavation; removal of concrete slab and railroad rail and ties.

Item 2630.5 - Pipe – DI (Water) 12-inch

METHOD OF MEASUREMENT:

Measurement for payment for Pipe – DI (Water) 12-inch will be based on the actual linear feet of pipe installed, tested, and accepted, complete as shown on the Contract Drawings or as required by the Engineer and as measured by the Engineer along the centerline of the pipe with no reduction for fittings, valves, or hydrants.

Pipe installed but not successfully tested and accepted shall be paid for at a maximum of 95 percent of the unit prices bid under this item. The remaining 5 percent shall be paid upon receipt of successful test results by the Engineer. All reductions in payment due to unsuccessful testing shall be made prior to normal retainage.

BASIS OF PAYMENT:

Payment for Pipe – DI (Water) 12-inch will be based on the unit price bid for this item in the proposal. Under the linear foot price for the item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required to install each pipe complete as shown on the Contract Drawings or at the requirements of the Engineer. The work includes, but is not limited to; saw cutting bituminous and cement; excavation; construction dewatering; furnishing and placing backfill per one of the approved methods; furnish, install and compact gravel road sub-base; furnish and install filter fabric as required; compaction; compaction testing; furnish and install temporary water lines for individual services; installing temporary bypass valves; locating, excavating, where required and connecting to the temporary service lines to all users whose water service will be disrupted for more than 4-hours; providing temporary fire protection at all hydrants which will be out of service for more than 4-hours; constructing necessary trenches across streets and driveways to protect temporary water line; connections to existing hydrants where required; removing and disposing of all temporary water lines, and for restoring all property damaged or altered in the course of providing temporary water; clean up; temporary excavation support furnished and installed complete, left in place, and cut off below grade where required or required; furnish, install, and compact bedding; furnish and install ductile iron pipe, couplings, fittings, adaptors, mechanical joint restraints, thrust blocks, transitions, gaskets and appurtenances; connections to existing and proposed pipes and structures including hydrants; blow-offs; corporation stops for chlorination, testing, and flushing; disinfection and chlorination, flushing and testing; sampling; laboratory analyses, disposal of testing materials; furnish and install pipe encasement or insulation as necessary; cleaning protective coating; and all work incidental to the installation of Ductile Iron Water Pipe, not specifically included for payment elsewhere.

SPECIAL NOTES/EXCLUSIONS:

The following items are not included for payment under this item but are included for separate payment elsewhere under unclassified excavation; removal of concrete slab and railroad rail and ties.

Item 2630.6 - Pipe – DI (Water) 16-inch

METHOD OF MEASUREMENT:

Measurement for payment for Pipe – DI (Water) 16-inch will be based on the actual linear feet of pipe installed, tested, and accepted, complete as shown on the Contract Drawings or as required by the Engineer and as measured by the Engineer along the centerline of the pipe with no reduction for fittings, valves, or hydrants.

Pipe installed but not successfully tested and accepted shall be paid for at a maximum of 95 percent of the unit prices bid under this item. The remaining 5 percent shall be paid upon receipt of successful test results by the Engineer. All reductions in payment due to unsuccessful testing shall be made prior to normal retainage.

BASIS OF PAYMENT:

Payment for Pipe – DI (Water) 16-inch will be based on the unit price bid for this item in the proposal. Under the linear foot price for the item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required to install each pipe complete as shown on the Contract Drawings or at the requirements of the Engineer. The work includes, but is not limited to; saw cutting bituminous and cement; excavation; construction dewatering; furnishing and placing backfill per one of the approved methods; furnish, install and compact gravel road sub-base; furnish and install filter fabric as required; compaction; compaction testing; furnish and install temporary water lines for individual services; installing temporary bypass valves; locating, excavating, where required and connecting to the temporary service lines to all users whose water service will be disrupted for more than 4-hours; providing temporary fire protection at all hydrants which will be out of service for more than 4-hours; constructing necessary trenches across streets and driveways to protect temporary water line; connections to existing hydrants where required; removing and disposing of all temporary water lines, and for restoring all property damaged or altered in the course of providing temporary water; clean up; temporary excavation support furnished and installed complete, left in place, and cut off below grade where required or required; furnish, install, and compact bedding; furnish and install ductile iron pipe, couplings, fittings, adaptors, mechanical joint restraints, thrust blocks, transitions, gaskets and appurtenances; connections to existing and proposed pipes and structures including hydrants; blow-offs; corporation stops for chlorination, testing, and flushing; disinfection and chlorination, flushing and testing; sampling; laboratory analyses, disposal of testing materials; furnish and install pipe encasement or insulation as necessary; cleaning protective coating; and all work incidental to the installation of Ductile Iron Water Pipe, not specifically included for payment elsewhere.

SPECIAL NOTES/EXCLUSIONS:

The following items are not included for payment under this item but are included for separate payment elsewhere under unclassified excavation; removal of concrete slab and railroad rail and ties.

Item 2630.7 - Pipe – DI (Water) 20-inch

METHOD OF MEASUREMENT:

Measurement for payment for Pipe – DI (Water) 20-inch will be based on the actual linear

feet of pipe installed, tested, and accepted, complete as shown on the Contract Drawings or as required by the Engineer and as measured by the Engineer along the centerline of the pipe with no reduction for fittings, valves, or hydrants.

Pipe installed but not successfully tested and accepted shall be paid for at a maximum of 95 percent of the unit prices bid under this item. The remaining 5 percent shall be paid upon receipt of successful test results by the Engineer. All reductions in payment due to unsuccessful testing shall be made prior to normal retainage.

BASIS OF PAYMENT:

Payment for Pipe – DI (Water) 20-inch will be based on the unit price bid for this item in the proposal. Under the linear foot price for the item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required to install each pipe complete as shown on the Contract Drawings or at the requirements of the Engineer. The work includes, but is not limited to; saw cutting bituminous and cement; excavation; construction dewatering; furnishing and placing backfill per one of the approved methods; furnish, install and compact gravel road sub-base; furnish and install filter fabric as required; compaction; compaction testing; furnish and install temporary water lines for individual services; installing temporary bypass valves; locating, excavating, where required and connecting to the temporary service lines to all users whose water service will be disrupted for more than 4-hours; providing temporary fire protection at all hydrants which will be out of service for more than 4-hours; constructing necessary trenches across streets and driveways to protect temporary water line; connections to existing hydrants where required; removing and disposing of all temporary water lines, and for restoring all property damaged or altered in the course of providing temporary water; clean up; temporary excavation support furnished and installed complete, left in place, and cut off below grade where required or required; furnish, install, and compact bedding; furnish and install ductile iron pipe, couplings, fittings, adaptors, mechanical joint restraints, thrust blocks, transitions, gaskets and appurtenances; connections to existing and proposed pipes and structures including hydrants; blow-offs; corporation stops for chlorination, testing, and flushing; disinfection and chlorination, flushing and testing; sampling; laboratory analyses, disposal of testing materials; furnish and install pipe encasement or insulation as necessary; cleaning protective coating; and all work incidental to the installation of Ductile Iron Water Pipe, not specifically included for payment elsewhere.

SPECIAL NOTES/EXCLUSIONS:

The following items are not included for payment under this item but are included for separate payment elsewhere under unclassified excavation; removal of concrete slab and railroad rail and ties.

END OF SECTION 02630

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SECTION 02640

VALVES AND APPURTENANCES

2640.1	2-INCH GATE VALVE AND GATE BOX	EACH
2640.2	4-INCH GATE VALVE AND GATE BOX	EACH
2640.3	6-INCH GATE VALVE AND GATE BOX	EACH
2640.4	8-INCH GATE VALVE AND GATE BOX	EACH
2640.5	10-INCH GATE VALVE AND GATE BOX	EACH
2640.6	12-INCH GATE VALVE AND GATE BOX	EACH
2640.7	16-INCH BUTTERFLY VALVE AND BOX	EACH
2640.8	20-INCH BUTTERFLY VALVE AND BOX	EACH
2640.9	WATER GATE ADJUSTED	EACH

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section including the following:
 - 1. Providing exterior valves, at the locations indicated and/or as required, complete in place in accordance with the drawings and specifications.
 - 2. Valves shall be restrained mechanical joint.

1.3 SUBMITTALS

- A. Shop Drawings: Submit the following in accordance with Section 01300 - SUBMITTALS:

1. Submit shop drawings and descriptive literature, showing valve dimensions and other details for each type and class of valve to be furnished.

1.4 QUALITY ASSURANCE

- A. Provide in accordance with Section 01400 and as specified.
- B. All valves furnished under the Contract shall be manufactured only in accordance with the Specifications and the approved drawings.

PART 2 - PRODUCTS

2.1 RESILIENT GATE VALVES AND VALVE BOXES

- A. Resilient gate valves shall be iron body, bronze mounted, resilient seated type. The valves shall be designed for 250 psi working pressure and 300 psi test pressure. Valves shall have corrosion resistant fusion - bonded interior and exterior coatings.
- B. Valves are to have O-ring seals and a rising stem. Valves shall have a 2-inch operating nut. Bolts on the bonnet and stuffing box shall be stainless steel (304 stainless steel). Valves shall open right.
- C. Resilient gate valves shall meet the most recent version of the AWWA standard specification AWWA C509.
- D. Resilient wedge valves shall have mechanical joint ends and shall be equal to ANSI/AWWA C11/A21.11.
- E. Valves shall be as manufactured by Clow Corporation Model R/W, Mueller Resilient Seat, American-Darling, U.S. Pipe Metroseal 250, Kennedy Ken-Seal or approved equal.
- F. Valve boxes shall be provided for each gate valve and tapping sleeve and valve.
- G. Valve boxes shall be cast iron, tar coated, sliding, heavy pattern type, consisting of three (3) pieces; a flanged bottom piece, a flanged top piece, and a cover with two (2) lifting holes and the word "water" cast on the top. A minimum 6-inch overlap is required between sliding sections. The inside diameter of boxes shall be at least 5-1/4-inches and lengths shall be as necessary to suit ground elevation.
- H. The restraining mechanism shall consist of individually actuated wedges that increase their resistance to pull out as pressure or external forces increase.

The device shall be capable of full mechanical joint deflection during assembly.

2.2 SAMPLE LINE AND TAPS

- A. Sample line pipe shall be copper tubing, Type K for buried service as required and shall be U.S. made.
- B. Service boxes shall be Erie style, American manufactured, of a telescopic type with a length from four (4) to five (5) feet. The cover shall be made of extra grade gray iron. The arch shall accommodate up to a 1-inch curb stop. The upper section shall be a telescopic pipe made of steel. The cover shall be counter sunk with a brass pentagonal plug that features a course “rope” thread to enable quick and easy removal.
- C. Required brass goods shall include Corporation Cocks, Curb Stops, and Misc. Couplings and Fittings. Castings shall be sufficiently heavy to meet all service conditions without springing or leaking and be clean and free from roughness both inside and out. Waterways shall be smooth, full size and free from obstruction. All threads shall be cut sharp, clean and true. Curb stops shall be Mueller Mark II Oriseal, Ford Meter Box Company, McDonald, or approved equivalent and corporation cocks shall be Mueller 110, H15008, or approved equivalent by Ford Meter Box Company or McDonald.
- D. Washers shall be of cast bronze containing not less than 85 percent copper finished on both sides of true faces.
- E. All curb cocks shall be subjected to a sustained hydraulic pressure of 200 pounds and tested in both the open and closed position.
- F. All brass goods shall be individually wrapped to protect threads during shipment. Corporation cocks and curb cocks shall be of the compression type.
- G. Compression fittings for jointing copper tubing shall conform with AWWA C800 and ASTM B-62 and be manufactured by Dresser, Mueller, McDonald, or Ford Meter Box Company.
- H. The proper use of tapping equipments, corporations and Polytetra Fluoroethylene (Teflon) thread sealant tape shall be used. Do not use liquid thread sealants.

2.3 VALVE INSULATION

- A. The valve shall be insulated as required by the Engineer and as detailed on the drawings. Insulation shall be a noncombustible cellular glass insulation that conforms to the requirements of ASTM C 552, and shall not include

binder and/or fillers. The cellular glass insulation shall be covered with seamless flexible jacketing that consists of a heat-sealable multiply laminate. The jacket shall be applied over the cellular glass insulation with a heat gun. The system shall be designed and installed in accordance with manufacturer's recommendations for outside temperature variations from - 40 degrees F to +120 degrees F.

PART 3 - EXECUTION

3.1 CLEANING AND PRIME COATING VALVES AND APPURTENANCES

- A. Prior to shop prime coating, all surfaces of the valves and appurtenances shall be thoroughly clean, dry, and free from all mill-scale, rust, grease, dirt, paint and other foreign substances to the satisfaction of the Engineer.
- B. All ferrous surfaces shall be sand blasted or pickled according to SSPC-SP6 or SSPC-SP8, respectively.
- C. All gears, bearing surfaces and other surfaces not to be painted shall be given a heavy coat of grease or other suitable rust resistant coating unless otherwise specified herein. This coating shall be maintained as required to prevent corrosion during any period of storage and installation and shall be satisfactory to the Engineer through the time of final acceptance.

3.2 INSTALLATION

- A. All valves and appurtenances shall be installed in the location shown on the drawings or where required by the Engineer. Valves shall be true to alignment and rigidly supported. Any damaged items shall be replaced before they are installed.
- B. Care shall be taken to prevent damage to valves and appurtenances during handling and installation. All materials shall be carefully inspected for defects in workmanship and materials, all debris and foreign material cleaned out of valve openings, and all operating mechanisms operated to check their proper functioning, and all nuts and bolts checked for tightness. Valves and other equipment which do not operate easily, or are otherwise defective, shall be repaired or replaced.
- C. Restraints shall be installed as per manufacturer's instructions.

3.3 SHOP PAINTING VALVES AND APPURTENANCES

- A. Interior and exterior surfaces of all valves which are not factory epoxy coated shall be given two coats of shop finish of an asphalt varnish conforming to AWWA C504 for Varnish Asphalt. The pipe connection openings shall be

capped to prevent the entry of foreign matter prior to application.

3.4 BURIED VALVES

- A. Buried valves and boxes shall be set with the operating stem vertically aligned in the center of the valve box. Valves shall be set on a firm foundation and supported by tamping selected excavated material under and at the sides of the valve.

3.5 VALVE BOXES

- A. Valve boxes shall be installed vertically, centered over the operating nut, and the elevation of the top shall be adjusted to conform with the finished surface of roadway or other surface at the completion of the contract. Valve box aligners shall be used in the alignment process.

3.6 VALVE BOX ALIGNERS

- A. Valve box aligners shall be installed by removing the operating nut of the valve and sliding it over the valve stem. Care shall be maintained to adequately support system during backfilling to maintain vertical alignment.

3.7 CONTRACT CLOSEOUT

- A. Provide in accordance with Section 01701

PART 4 – COMPENSATION

2640.1 --- 2-Inch Gate Valve and Gate Box

METHOD OF MEASUREMENT:

Measurement for payment for 2-inch Gate Valves and Gate Boxes, will be based on the actual number of valves and boxes installed, complete as shown on the Contract Drawings or as required by the Engineer and as measured by the Engineer.

BASIS OF PAYMENT:

Payment for 2-inch Gate Valves and Gate Boxes, will be based on the unit price bid for this item in the proposal. Under the per each unit price bid for the item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required to install each gate valve and box complete as shown on the Contract Drawings or at the requirements of the Engineer. The work includes, but is not limited to; saw cutting bituminous and cement concrete; excavation; construction dewatering; furnish and install gate valve; furnishing and placing backfill by one of the approved methods; furnish and install filter fabric as required; compaction; compaction testing; temporary excavation support furnished and installed complete; furnishing, installing and compacting bedding; furnish and install gate valve and gate box, mechanical joint restraints, gaskets and appurtenances; connections to existing and

proposed pipes and structures; chlorination, flushing and testing; disposal of testing materials; concrete setting bed for the gate box; furnish and install encasement or insulation as necessary; protective coating; support of gate valve during installation; adjustment to final grade requiring adjustments up to 4-inches; and all incidental work required for the installation of 2-in gate valves and boxes not specifically included for payment elsewhere.

SPECIAL NOTES ON EXCLUSIONS:

The following items are not included for payment under this item but are included for separate payment elsewhere under unclassified excavation; removal of concrete slab and railroad rail and ties.

2640.2 --- 4-Inch Gate Valve and Gate Box

METHOD OF MEASUREMENT:

Measurement for payment for 4-inch Gate Valves and Gate Boxes, will be based on the actual number of valves and boxes installed, complete as shown on the Contract Drawings or as required by the Engineer and as measured by the Engineer.

BASIS OF PAYMENT:

Payment for 4-inch Gate Valves and Gate Boxes, will be based on the unit price bid for this item in the proposal. Under the per each unit price bid for the item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required to install each gate valve and box complete as shown on the Contract Drawings or at the requirements of the Engineer. The work includes, but is not limited to; saw cutting bituminous and cement concrete; excavation; construction dewatering; furnish and install gate valve; furnishing and placing backfill by one of the approved methods; furnish and install filter fabric as required; compaction; compaction testing; temporary excavation support furnished and installed complete; furnishing, installing and compacting bedding; furnish and install gate valve and gate box, mechanical joint restraints, gaskets and appurtenances; connections to existing and proposed pipes and structures; chlorination, flushing and testing; disposal of testing materials; concrete setting bed for the gate box; furnish and install encasement or insulation as necessary; protective coating; support of gate valve during installation; adjustment to final grade requiring adjustments up to 4-inches; and all incidental work required for the installation of 4-in gate valves and boxes not specifically included for payment elsewhere.

SPECIAL NOTES ON EXCLUSIONS:

The following items are not included for payment under this item but are included for separate payment elsewhere under unclassified excavation; removal of concrete slab and railroad rail and ties.

2640.3 --- 6-Inch Gate Valve and Gate Box

METHOD OF MEASUREMENT:

Measurement for payment for 6-inch Gate Valves and Gate Boxes, will be based on the actual number of valves and boxes installed, complete as shown on the Contract Drawings or as required by the Engineer and as measured by the Engineer.

BASIS OF PAYMENT:

Payment for 6-inch Gate Valves and Gate Boxes, will be based on the unit price bid for this item in the proposal. Under the per each unit price bid for the item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required to install each gate valve and box complete as shown on the Contract Drawings or at the requirements of the Engineer. The work includes, but is not limited to; saw cutting bituminous and cement concrete; excavation; construction dewatering; furnish and install gate valve; furnishing and placing backfill by one of the approved methods; furnish and install filter fabric as required; compaction; compaction testing; temporary excavation support furnished and installed complete; furnishing, installing and compacting bedding; furnish and install gate valve and gate box, mechanical joint restraints, gaskets and appurtenances; connections to existing and proposed pipes and structures; chlorination, flushing and testing; disposal of testing materials; concrete setting bed for the gate box; furnish and install encasement or insulation as necessary; protective coating; support of gate valve during installation; adjustment to final grade requiring adjustments up to 4-inches; and all incidental work required for the installation of 6-in gate valves and boxes not specifically included for payment elsewhere.

SPECIAL NOTES ON EXCLUSIONS:

The following items are not included for payment under this item but are included for separate payment elsewhere under unclassified excavation; removal of concrete slab and railroad rail and ties.

2640.4 --- 8-Inch Gate Valve and Gate Box

METHOD OF MEASUREMENT:

Measurement for payment for 8-inch Gate Valves and Gate Boxes, will be based on the actual number of valves and boxes installed, complete as shown on the Contract Drawings or as required by the Engineer and as measured by the Engineer.

BASIS OF PAYMENT:

Payment for 8-inch Gate Valves and Gate Boxes, will be based on the unit price bid for this item in the proposal. Under the per each unit price bid for the item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required to install each gate valve and box complete as shown on the Contract Drawings or at the requirements of the Engineer. The work includes, but is not limited to; saw cutting bituminous and cement concrete; excavation; construction dewatering; furnish and install gate valve; furnishing and placing backfill by one of the approved methods; furnish and install filter fabric as required; compaction; compaction testing; temporary excavation support furnished and installed complete; furnishing, installing and compacting bedding; furnish and install gate valve and gate box, mechanical joint restraints, gaskets and appurtenances; connections to existing and proposed pipes and structures; chlorination, flushing and testing; disposal of testing materials; concrete setting bed for the gate box; furnish and install encasement or insulation as necessary; protective coating; support of gate valve during installation; adjustment to final grade requiring adjustments up to 4-inches; and all incidental work required for the installation of 8-in gate valves and boxes not specifically included for payment elsewhere.

SPECIAL NOTES ON EXCLUSIONS:

The following items are not included for payment under this item but are included for separate payment elsewhere under unclassified excavation; removal of concrete slab and railroad rail and ties.

2640.5 --- 10-Inch Gate Valve and Gate Box

METHOD OF MEASUREMENT:

Measurement for payment for 10-inch Gate Valves and Gate Boxes, will be based on the actual number of valves and boxes installed, complete as shown on the Contract Drawings or as required by the Engineer and as measured by the Engineer.

BASIS OF PAYMENT:

Payment for 10-inch Gate Valves and Gate Boxes, will be based on the unit price bid for this item in the proposal. Under the per each unit price bid for the item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required to install each gate valve and box complete as shown on the Contract Drawings or at the requirements of the Engineer. The work includes, but is not limited to; saw cutting bituminous and cement concrete; excavation; construction dewatering; furnish and install gate valve; furnishing and placing backfill by one of the approved methods; furnish and install filter fabric as required; compaction; compaction testing; temporary excavation support furnished and installed complete; furnishing, installing and compacting bedding; furnish and install gate valve and gate box, mechanical joint restraints, gaskets and appurtenances; connections to existing and proposed pipes and structures; chlorination, flushing and testing; disposal of testing materials; concrete setting bed for the gate box; furnish and install encasement or insulation as necessary; protective coating; support of gate valve during installation; adjustment to final grade requiring adjustments up to 4-inches; and all incidental work required for the installation of 10-in gate valves and boxes not specifically included for payment elsewhere.

SPECIAL NOTES ON EXCLUSIONS:

The following items are not included for payment under this item but are included for separate payment elsewhere under unclassified excavation; removal of concrete slab and railroad rail and ties.

2640.6 --- 12-Inch Gate Valve and Gate Box

METHOD OF MEASUREMENT:

Measurement for payment for 12-inch Gate Valves and Gate Boxes, will be based on the actual number of valves and boxes installed, complete as shown on the Contract Drawings or as required by the Engineer and as measured by the Engineer.

BASIS OF PAYMENT:

Payment for 12-inch Gate Valves and Gate Boxes, will be based on the unit price bid for this item in the proposal. Under the per each unit price bid for the item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required to install each gate valve and box complete as shown on the Contract Drawings or at the requirements of the Engineer. The work includes, but is not limited to; saw cutting bituminous and cement

concrete; excavation; construction dewatering; furnish and install gate valve; furnishing and placing backfill by one of the approved methods; furnish and install filter fabric as required; compaction; compaction testing; temporary excavation support furnished and installed complete; furnishing, installing and compacting bedding; furnish and install gate valve and gate box, mechanical joint restraints, gaskets and appurtenances; connections to existing and proposed pipes and structures; chlorination, flushing and testing; disposal of testing materials; concrete setting bed for the gate box; furnish and install encasement or insulation as necessary; protective coating; support of gate valve during installation; adjustment to final grade requiring adjustments up to 4-inches; and all incidental work required for the installation of 12-in gate valves and boxes not specifically included for payment elsewhere.

SPECIAL NOTES ON EXCLUSIONS:

The following items are not included for payment under this item but are included for separate payment elsewhere under unclassified excavation; removal of concrete slab and railroad rail and ties.

2640.7 --- 16-Inch Butterfly Valve and Box

METHOD OF MEASUREMENT:

Measurement for payment for 16-inch Butterfly Valve and Box, will be based on the actual number of valves and boxes installed, complete as shown on the Contract Drawings or as required by the Engineer and as measured by the Engineer.

BASIS OF PAYMENT:

Payment for 16-inch Gate Butterfly Valve and Box, will be based on the unit price bid for this item in the proposal. Under the per each unit price bid for the item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required to install each gate valve and box complete as shown on the Contract Drawings or at the requirements of the Engineer. The work includes, but is not limited to; saw cutting bituminous and cement concrete; excavation; construction dewatering; furnish and install butterfly valve and box; furnishing and placing backfill by one of the approved methods; furnish and install filter fabric as required; compaction; compaction testing; temporary excavation support furnished and installed complete; furnishing, installing and compacting bedding; mechanical joint restraints, gaskets and appurtenances; connections to existing and proposed pipes and structures; chlorination, flushing and testing; disposal of testing materials; concrete setting bed for the gate box; furnish and install encasement or insulation as necessary; protective coating; support of butterfly valve during installation; adjustment to final grade requiring adjustments up to 4-inches; and all incidental work required for the installation of 16-in butterfly valves and boxes not specifically included for payment elsewhere.

2640.8 --- 20-Inch Butterfly Valve and Box

METHOD OF MEASUREMENT:

Measurement for payment for 20-inch Butterfly Valve and Box, will be based on the actual number of valves and boxes installed, complete as shown on the Contract Drawings or as required by the Engineer and as measured by the Engineer.

BASIS OF PAYMENT:

Payment for 20-inch Gate Butterfly Valve and Box, will be based on the unit price bid for this item in the proposal. Under the per each unit price bid for the item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required to install each gate valve and box complete as shown on the Contract Drawings or at the requirements of the Engineer. The work includes, but is not limited to; saw cutting bituminous and cement concrete; excavation; construction dewatering; furnish and install butterfly valve and box; furnishing and placing backfill by one of the approved methods; furnish and install filter fabric as required; compaction; compaction testing; temporary excavation support furnished and installed complete; furnishing, installing and compacting bedding; mechanical joint restraints, gaskets and appurtenances; connections to existing and proposed pipes and structures; chlorination, flushing and testing; disposal of testing materials; concrete setting bed for the gate box; furnish and install encasement or insulation as necessary; protective coating; support of butterfly valve during installation; adjustment to final grade requiring adjustments up to 4-inches; and all incidental work required for the installation of 20-in butterfly valves and boxes not specifically included for payment elsewhere.

SPECIAL NOTES ON EXCLUSIONS:

The following items are not included for payment under this item but are included for separate payment elsewhere under unclassified excavation; removal of concrete slab and railroad rail and ties.

2640.9 --- Water Gate Adjusted

METHOD OF MEASUREMENT:

Measurement for Water Gate Adjusted shall be based on the each of water gate requiring adjustments greater than 4-inches to final grade, as shown on the Contract Drawings or as required by the Engineer.

BASIS OF PAYMENT / INCLUSIONS:

Payment for Water Gate Adjusted shall be based on each adjusted water gate complete for this item in the proposal requiring the adjustment to final grade greater than 4-inches. Under the Unit Price for this item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required to adjust gate box to final grade; grout; concrete; and all incidental work not specifically included for payment elsewhere.

SPECIAL NOTES ON EXCLUSIONS:

Adjustment of water gates requiring adjustments to final grade equal to or less than 4-inches are not included in this elsewhere but are considered incidental to other items in this Contract. Contractor shall not be paid for more than one adjustment to a water gate.

END OF SECTION 02640

SECTION 02645

HYDRANTS

2645.1	HYDRANT	EACH
2645.2	REMOVE AND DISPOSE EXISTING HYDRANT	EACH

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Providing hydrants, gate valves and boxes and appurtenant work, complete in accordance with the drawings and specifications.

1.3 SUBMITTALS

- A. Shop Drawings: Submit the following in accordance with Section 01300 - SUBMITTALS:
 - 1. Submit shop drawings and manufacturers descriptive literature, showing hydrant dimensions and features.

1.4 QUALITY ASSURANCE

- A. Provide in accordance with Section 01400 – QUALITY CONTROL and as specified.
- B. All hydrants furnished under the Contract shall be manufactured only in accordance with the Specifications and the drawings.

PART 2 - PRODUCTS

2.1 HYDRANTS

- A. Hydrants shall conform to the "standard for Dry-Barrel Fire Hydrants" ANSI/AWWA C502-85. Hydrants shall be designed for 150 psi service and

for installation in a trench with 5 foot cover (5-1/2 feet bury hydrant). Hydrant barrel extensions shall be furnished and installed as necessary to achieve correct bury depth. The length of the hydrant barrel shall be such that when installed with the proper depth of cover on the branch pipeline, the hydrant will be set with the normal ground line of the barrel within 3-inches of the actual ground grade surface elevation.

- B. Hydrants shall be fabricated to manufacturer's standard pattern and size and shall have one 4-1/2 inch steamer and two 2-1/2 inch hose nozzles all with National Standard Thread (NST). Hydrant inlet opening on shoe shall have mechanical joints for accepting 6-inch ductile or cast iron pipe.
- C. Hydrants shall open clockwise and shall be marked with an arrow and word "OPEN" to indicate the direction of turn of the stem to open the hydrant.
- D. Hydrants shall have a compression type main valve, opening against and closing with water pressure. The main valve opening at the base of the hydrant shall have a minimum diameter of 5¼ inches. Each hydrant shall have "traffic" type ground line construction (breakaway bolts not acceptable) and permit 360-degree movement of the upper barrel to allow for any alignment without shutting down service and/or removing flange bolts and nuts. Hydrant operating nut shall be 1-1/2 inches, flat to point, pentagonal. Connecting pipe and pipe nipples between the main line tee and hydrant shall be 6-inch ductile iron conforming to the requirements for ductile iron pipe.
- E. Hydrants shall be hydrostatically tested as specified in AWWA C502.
- F. Hydrant tees shall be anchor type. The branch shall have a plain end with an integral gland and rotating mechanical joint restraints. Every hydrant shall be equipped with a 6-inch shut-off valve, bolted or anchored to the hydrant tee.

2.2 SAFETY FLANGE REPAIR KITS

- A. Safety flange repair kits shall come complete with stem coupling, safety flange, flange gasket, replacement bolts and nuts and hydrant lubricating oil.
- B. Safety flange repair kits shall be compatible with hydrant furnished.

2.3 EXTENSION KITS

- A. Extension kits shall come complete with extension barrel, extension stem, stem coupling and hardware, flange, flange gasket, 8 bolts and nuts and hydrant lubricating oil.
- B. Extension kits shall be compatible with hydrant furnished.

2.4 RESTRAINTS

- A. Hydrants, valves and pipe shall be restrained with EBAA Mega-Lug, Uni-Flange Series 1400 or approved equivalent.

PART 3 - EXECUTION

3.1 HYDRANTS

- A. Hydrants shall be installed in conformance to AWWA C600, Section 11, latest revision using tie rods and anchored joints.
- B. Hydrants shall be set to the bury line at the locations shown on the Drawings or as designated by the Engineer and shall be bedded on a firm foundation. A 5 cubic foot minimum drainage pit shall be filled with ½-inch crushed stone and satisfactorily compacted. During backfilling, crushed stone shall be brought up around, and 6-inch over, the drain ports.
- C. Each hydrant shall be set in true vertical alignment and shall be properly braced.
- D. Restraints shall be installed in accordance with manufacturer's requirements. Hydrants shall be flow tested, cleaned, finish painted to match City of Cambridge color scheme, and touched up after installation.
- E. Hydrants set too high or too low shall be excavated and reset to the proper depth as indicated by the bury line. Hydrant extensions shall be installed where required to maintain proper depth.
- F. Remove and stack existing hydrants at as shown on the Drawings or as required by the Engineer. Removed hydrants shall be delivered to the Owner's storage facility. The existing branch line shall be capped and the hydrant branch valve closed and the box removed.
- G. All new hydrants installed by Contractor for the City shall be flow tested by the Contractor in coordination with the City of Cambridge Water Department (CWD). All new hydrants shall be color coded accordingly:
 - 1. Blue/Silver – 1500 gpm or more
 - 2. Green/Silver – 1000 -1499 gpm
 - 3. Orange/Silver – 500-999 gpm
 - 4. Red/Silver – 400-500 gpm
 - 5. Black/Silver – 400 gpm or less

3.2 CONTRACT CLOSEOUT

- A. Provide in accordance with Section 01701.

PART 4 – COMPENSATION

Item 2645.1 –Hydrant

METHOD OF MEASUREMENT:

Measurement for payment for Hydrant will be based on the actual number of hydrants installed, as shown on the Contract Drawings or as required by the Engineer and as measured by the Engineer.

BASIS OF PAYMENT:

Payment for Hydrant will be based on the bid for this item in the proposal. Under the the unit price for the item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required to furnish and install each new hydrant as shown on the Contract Drawings or at the requirements of the Engineer. The work includes, but is not limited to; saw cutting bituminous and cement concrete; excavation; furnish and install backfill per one of the approved methods; furnish and install filter fabric as required; furnish and install gravel pavement sub-base; compaction; compaction testing; coordination with Cambridge Fire Department and Cambridge Water Department; temporary excavation support furnished and installed complete, furnish and install the hydrant; furnish and install all fittings and mechanical joint restraints; all permits and fees; testing of hydrants; and all incidental work required for the providing and the installation of a new hydrant not included for payment elsewhere.

Item 2645.2 – Remove and Dispose Existing Hydrant

METHOD OF MEASUREMENT:

Measurement for payment for Remove and Dispose Existing Hydrant will be based on the actual number of hydrants removed and disposed, as shown on the Contract Drawings or as directed by the Engineer and as measured by the Engineer.

BASIS OF PAYMENT:

Payment for Remove and Dispose Existing Hydrant will be based on the unit price bid for this item in the proposal. Under the per each unit price bid for the item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required to remove and dispose each hydrant as shown on the Contract Drawings or at the request of the Engineer. The work includes, but is not limited to; saw cutting; excavation; furnish and install backfill; furnish and install filter fabric as required; install, grade, and compact gravel pavement sub-base; compaction; compaction testing; coordination with Cambridge Fire Department and Cambridge Water Department; temporary excavation support furnished and installed complete, removal of the hydrant; dispose of or remove and salvage existing hydrant as requested by the Owner or Engineer; transportation of salvaged hydrant to the Cambridge Water Department or other location in Cambridge as required by the Owner or Engineer; all permits and fees; and all incidental work required for the removal and disposal of an existing hydrant not included for payment elsewhere.

END OF SECTION 02645

SECTION 02647

CONNECTION TO EXISTING WATER MAINS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This section includes the following:
 - 1. Connecting to existing mains.
- B. Related sections includes the following:
 - 1. Section 02210 - EARTH EXCAVATION, BACKFILL, FILL AND GRADING
 - 2. Section 02615 - DUCTILE IRON PIPE FOR SANITARY AND STORM DRAIN GRAVITY
 - 3. Section 02630 – DUCTILE IRON PIPE AND FITTINGS.

PART 2 - PRODUCTS

- A. Tapping valves shall be flanged by mechanical joint and be as specified in Section 02640.
- B. Tapping sleeves shall be ductile iron with a split horizontal flange. Contractor shall verify existing pipe materials and diameter pipe prior to ordering sleeves.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verification of Conditions: The Contractor shall verify field conditions by test pits or other methods prior to construction.

3.2 INSTALLATION

- A. The Contractor shall make all connections to the existing mains as indicated in the Contract Documents.
- B. The Contractor shall develop a program for the construction and putting into service of the new work subject to the approval of the Engineer. All work involving cutting into and connecting to the existing water mains shall be planned so as to interfere with operation of the existing facilities for the shortest possible time.
- C. The Contractor shall have all preparatory work done prior to making the connection and shall provide all labor, tools, material, and equipment required to do the work in one continuous operation.
- D. The Contractor shall have no claim for additional compensation, by reason of delay or inconvenience, for adapting his operations to the requirements of the Owner.
- E. Under no circumstances shall any customer be without water for a period of more than 4 hours without prior written approval of the Owner. Should it appear that any customer will be without water for more than 4 hours, the Contractor shall install temporary water service at no additional cost to the Owner.
- F. The Owner does not guarantee a tight shut-off for existing local community water valves. No damages shall be claimed by the Contractor for delays in dewatering pipelines nor shall any damages be claimed because of water leaking through closed valves after dewatering is completed. It shall be the responsibility of the Contractor to provide the means to dewater the excavation if required when making connections.
- G. The Contractor shall be responsible for the following restrictions on shutdown of water mains:
 - 1. Distribution system valves, curb stops, and hydrants to be operated only by City of Cambridge Water Department personnel.
 - 2. One week advance notice for shutdown request shall be given to Cambridge Water Department.
- H. The Contractor shall apply for and receive all necessary permits with the City of Cambridge Water Department prior to making any connections to the existing water system.

3.3 APPLICATION:

A. Special Techniques: Tapping Connections:

1. Tap connections to existing mains shall be made with service pressure in the main, using tapping sleeve and valve and a suitable tapping machine.
2. Other connections to existing mains shall be made with the main out of service, unless otherwise required by the Engineer.

3.4 CLEANING

- A. Contractor shall clean the existing main with wire brush and wash the pipe surface and the tapping sleeve and valve interior with 5% hypochlorite (bleach) solution.

3.5 TESTING

- A. Valve and sleeve shall be leak free. Any visible leakage shall be corrected at no additional cost to the owner.

3.6 CONTRACT CLOSEOUT

- A. Provide in accordance with Section 01701.

PART 4 – COMPENSATION (Not Used)

END OF SECTION 02647

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SECTION 02660

WATER SERVICES

2660.1	1/2-IN TO 3-IN WATER SERVICE REPLACEMENT, RECONNECTION, AND EXTENSION	LINEAR FOOT
2660.2	2-INCH PVC SLEEVE FOR 1-INCH DIAMETER SERVICES ON NORTH SIDE OF WESTERN AVENUE	LINEAR FOOT
2660.3	3-INCH PVC SLEEVE FOR 1 ½-INCH TO 2-INCH DIAMETER SERVICES ON NORTH SIDE OF WESTERN AVENUE	LINEAR FOOT

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes the following:

1. Provide new water services from the new water main to the property line and connect to existing services, including corporation stops, curb stops and boxes, as shown on the drawings or as required by the Engineer. In general, a service shall be brought to each developed parcel of property along the water main route.
2. Provide PVC sleeves for water services that are being replaced to existing curb stop or to property line on north side of Western Avenue.
3. A Water Services Log indicating size and material of service are included in an Appendix to these Specifications. This list was obtained from the Cambridge Water Department's database and record information. Contractor to verify size and material type of each service connected to water mains installed under this project.

1.2 SUBMITTALS

A. Shop Drawings: Submit the following in accordance with Section 01300 - SUBMITTALS:

1. Submit manufacturer's technical product data or descriptive literature, or both, showing services, corporation stops, curb stops, fittings and other details for each type of service to be furnished for

the project.

2. For informational purposes only, submit manufacturer's written installation instructions.

1.3 QUALITY ASSURANCE

- A. Provide in accordance with Section 01400 – QUALITY CONTROL and as specified.
- B. Manufacturer's Qualifications: Firms regularly engaged in manufacture of potable water services materials and products, of types and sizes required, whose products have been in satisfactory use in similar service for not less than five years.

PART 2 - PRODUCTS

2.1 SERVICES

- A. Unless otherwise specified, all pipe for services and 3-inch mains shall be copper tubing, type K, drawn temper. Type K hard-temper in sizes larger than 1-inch and Type K soft-temper for smaller sizes.
- B. Copper type shall conform to ASTM B42.
- C. Fittings shall be cast bronze for copper pipe and cast bronze or copper stream-lined fittings for copper tubing conforming to ASTM B16.18.
- D. Unions shall be bronze with ground joints and shall be semi-finished.
- E. Joints for copper fittings shall be made with solder composed of 95 percent tin and five percent antimony. Connections to ductile iron fittings and pressure reducing valves within valve vaults shall be threaded.
- F. PVC Sleeves for services on north side of Western Avenue shall be PVC schedule 40.

2.2 CORPORATIONS, CURB STOPS AND SADDLES

- A. The corporation stops shall meet the most recent revision of the AWWA standard "Threads for Underground Service Line Fittings" (AWWA C800). Corporations for 1-inch installations shall be heavy pattern, solid plug, easy turning, and be Ford FB 1000 series or approved equal. The inlet shall be an AWWA (CC) thread. The outlet shall be a compression joint for copper. The 1 ½ -inch and 2-inch corporations shall be of a ball valve type which incorporates Teflon seats to assure self-centering of a Teflon coated bronze

ball. The corporations shall be easy turning and non-binding. The inlet shall be AWWA (CC) thread. The outlet for 1 ½-inch and 2-inch corporations shall be a compression joint for copper. Corporations shall be subject to a sustained hydraulic pressure of 200 psi and tested in both the open and closed positions for leakage and ease of turning.

- B. Curb stops shall be Mueller H15219 Mark II Oriseal, Ford FGB-44 Series, or approved equivalent. The curb stop shall have a quarter turn stop with check, solid tee head, and no waste. No curb stops with plugged solid waste shall be accepted.
- C. Curb stop boxes shall be cast iron Buffalo type with recessed lid with pentagon bolt, adjustable sliding type.
- D. Service saddles for 2-inch taps shall be Smith-Blair 313 Double Strap, Mueller DB2A, JCM 402 Double Strap, or approved equivalent. Bodies shall be ductile iron and straps shall be electrogalvanized carbon steel. Units shall be complete with Nitrile, Buna-N gaskets or approved equivalent.

2.3 FITTINGS

- A. Unless otherwise approved, only compression type fittings manufactured by Dresser, Mueller Inc. Ford Meter Box Company, McDonald, or approved equivalent, shall be used.
- B. Mueller brass tees shall be used to provide 1-inch services off of 2-inch polyethylene tubing.
- C. Adapters required to allow connection to existing services shall be provided.

PART 3 - EXECUTION

3.1 CONSTRUCTION

- A. After successful testing and chlorination, water services shall be installed as a "wet" tap as shown on the drawings, specified, or required by the Engineer. Exact locations of services shall be located in the field by the Engineer. A service shall be provided to the property line of parcels of property along the water main route. All services shall be installed to a minimum depth of 4'-6" unless specifically shown or directed otherwise by the Engineer.
- B. Water service trenches shall be excavated and backfilled in accordance with Section 02210 of this Specification and in conformance to the details. Services to be installed beneath paved roadways shall be driven beneath the pavement utilizing a pneumatically driven device.

- C. Each service shall be flushed thoroughly and the end closed with duct tape prior to backfilling.
- D. Connections to the existing services shall be thoroughly flushed prior to connecting. Contractor shall coordinate and assist Water Department personnel in removal of the household meter and filters and flushing the entire service line to prevent scale-debris from blocking fixtures and appliances.
- E. Contractor shall verify in field each service that is connected to new water main. Material and size of water main shall be verified at the main and within the building that the service connects to. All lead and/or ¾" water services shall be replaced to the property line.

3.2 CONTRACT CLOSEOUT

- A. Provide in accordance with Section 01701.

PART 4 – COMPENSATION

Item 2660.1 – ½-in to 3-in Water Service Replacement, Reconnection, and Extension

METHOD OF MEASUREMENT:

Measurement for payment for ½-in to 3-in Water Service Replacement, Reconnection and Extension shall be based on the actual linear feet of pipe installed, tested, and accepted, from ½-in to 3-in diameter, at all depths, complete as shown on the Contract Drawings or as required by the Engineer and as measured by the Engineer along the centerline of the pipe from the centerline of the mainline to the connection with the existing service.

BASIS OF PAYMENT / INCLUSIONS:

Payment for ½-in to 3-in Water Service Replacement, Reconnection, and Extension shall be based on the unit price bid for this item in the proposal. Under the unit price for each pipe item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required to replace, relocate, extend, and/or reconnect existing water services between ½-in and 3-in in diameter, which are in elevation or alignment conflict with the proposed Work or which are existing lead services, at all depths, complete as shown on the Contract Drawings or as required by the Engineer. The work includes; saw cutting bituminous or cement concrete; excavation; construction dewatering; furnishing and placing backfill per one of the approved methods; furnish, install, and compact gravel road sub-base; furnish and install filter fabric as required; install, grade, and compact gravel pavement sub-base; compaction; compaction testing; temporary excavation support furnished and installed complete, left in place, and cut off below grade where required or directed; furnishing, placing and compacting bedding; furnish and install type k water service pipe or ductile iron pipe, water service taps, corporation stops, fittings, couplings, curb stops, appurtenances and joints; connections to existing and proposed pipes; chlorination; flushing/cleaning and testing; verifying at main and in house material and size of main; and all incidental work not

specifically included for payment elsewhere.

SPECIAL NOTES/EXCLUSIONS:

This item also includes the replacement of lead water services encountered during construction, where required by the Owner or Engineer, or where indicated in the Contract Documents. The following items are not included for payment under this item but are included for separate payment elsewhere under unclassified excavation; removal of concrete slab and railroad rail and ties.

Item 2660.2 – 2-Inch PVC Sleeve for 1-inch Diameter on North Side of Western Avenue

METHOD OF MEASUREMENT:

Measurement for payment for 2-inch PVC Sleeve for 1-inch Diameter on North Side of Western Avenue shall be based on the actual linear feet of 2-inch PVC Sleeve installed, at all depths, complete as indicated in the Contract Documents or as required by the Engineer and as measured by the Engineer along the centerline of the pipe from the centerline of the mainline to the connection with the existing service.

BASIS OF PAYMENT / INCLUSIONS:

Payment for 2-inch PVC Sleeve for 1-inch Diameter on North Side of Western Avenue shall be based on the unit price bid for this item in the proposal. Under the unit price for each pipe item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required to furnish and install 2-inch PVC sleeves for water mains that are replaced to the existing curb stop or the property line on the north side of Western Avenue as shown on the Contract Drawings or as required by the Engineer. The work includes; furnish and install, PVC sleeve; fittings, couplings, appurtenances and joints; excavation, backfill, and compaction as required; and all incidental work not specifically included for payment elsewhere.

Item 2660.3 – 3-Inch PVC Sleeve for 1 1/2-inch to 2-inch Diameter on North Side of Western Avenue

METHOD OF MEASUREMENT:

Measurement for payment for 3-inch PVC Sleeve for 1 1/2-inch to 2-inch Diameter on North Side of Western Avenue shall be based on the actual linear feet of 3-inch PVC Sleeve installed, at all depths, complete as indicated in the Contract Documents or as required by the Engineer and as measured by the Engineer along the centerline of the pipe from the centerline of the mainline to the connection with the existing service.

BASIS OF PAYMENT / INCLUSIONS:

Payment for 3-inch PVC Sleeve for 1 1/2-inch to 2-inch Diameter on North Side of Western Avenue shall be based on the unit price bid for this item in the proposal. Under the unit price for each pipe item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required to furnish and install 3-inch PVC sleeves for water mains that are replaced to the existing curb stop or the property line on the north side of Western Avenue as shown on the Contract Drawings or as required by the

Engineer. The work includes; furnish and install, PVC sleeve; fittings, couplings, appurtenances and joints; excavation, backfill, and compaction as required; and all incidental work not specifically included for payment elsewhere.

END OF SECTION 02660

SECTION 02675

DISINFECTION OF WATER MAINS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This section includes the following:

- 1. Flushing and Disinfection of pipelines.

- B. Related section include the following:

- 1. Section 02615 - DUCTILE IRON PIPE FOR SANITARY AND STORM DRAIN GRAVITY.
 - 2. Section 02630 – DUCTILE IRON PIPE AND FITTINGS.
 - 3. Section 02704 - PIPELINE PRESSURE AND LEAKAGE TESTING.

1.3 SYSTEM DESCRIPTION

- A. Disinfect all water main installed under this contract. Disinfection shall occur subsequent to the installation of the new pipe in accordance with Section 02615 and 02630.

- B. The location of new main line is shown on the Drawings.

- C. Pipeline disinfection shall be performed in conjunction with the related work items of dewatering, testing, flushing and discharge of water with high concentrations of chlorine, prior to placing newly installed water main in service. The Engineer will develop the particulars of the "work plan" to accomplish the above tasks, however, the Contractor's responsibility shall include:

- 1. Provision of the chlorine product for disinfection at the rate and dose specified shall be in accordance with AWWA standards.

2. Provision of pipeline taps for dosing and testing of chlorinated water, as necessary.
 3. Installation and removal of bulkheads required for testing.
 4. Labor and equipment necessary to dispense the dose chlorine at points and rates as required by the Engineer and the City of Cambridge Water Department (CWD).
 5. Labor and equipment to operate newly installed mainline valves, air release valves, and blowoff valves as necessary and required by the Engineer. CWD only is to operate all new valves that are connected common with the existing distribution water system.
- D. The Contractor shall be responsible for disinfecting and putting into service new water mains that shall become the property of the CWD. The CWD requires all new water mains and hydrant laterals to be certified bacteria free by a state licensed laboratory.
- E. Contractor shall be responsible for coordinating all activities with the CWD if it is intended to use City hydrants or water for disinfection purposes.

1.4 PROJECT/SITE CONDITIONS

- A. All flushing water shall be discharged in accordance with local, state and federal regulations. The DPW shall be contacted prior to flushing. Dechlorination facilities shall be used as required.

1.5 SEQUENCING AND SCHEDULING

- A. Coordinate operation of existing valves, timing and duration of shut-down of existing mains, and disinfecting, flushing and re-energizing of the water main with the Engineer and where applicable with the City of Cambridge Water Department including notification of the following prior to the stated work:
1. Valve Operations: Notify Engineer and CWD three (3) days prior to stated work.
 - a. The opening and closing of existing valves shall be performed by CWD personnel only.
 2. Disinfecting and Flushing: Notify Engineer and the City of Cambridge Water Department three (3) days prior to stated work. The Cambridge Water Department laboratory shall perform all bacteriological testing. The Contractor shall coordinate with the City of Cambridge Water Department.

3. Notification shall include location of work, length and diameter of the pipe and other pertinent information.

1.6 SUBMITTALS

- A. Contractor to submit written disinfection plan to Engineer for review. Plan to include chemical data, feed rates, and disposal methods.
- B. Submit data on DEP-certified laboratory to be used for sample collection and testing.
- C. Written laboratory analysis reports.
- D. Test results for chlorine residuals for times as specified in the method of disinfection shall be submitted to the CWD.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Calcium hypochlorite shall conform to AWWA B300.
 1. Granules with 70 percent available chlorine.
- B. Liquid sodium hypochlorite shall conform to AWWA B300.
- C. Owner-approved backflow preventer devices.
- D. Line purge dechlorinator with dechlorination tablets. Dechlorinator shall have 2-1/2 inch NPT coupling and capacity flow rates of up to 1,600 GPM. Dechlorination tablets shall be sodium sulfite or sodium thiosulfate, capable of dechlorinating the flushed water. Dechlorinator shall be Model LPD-250 as manufactured by J. Pollard Co., Hyde Park, NY or approved equivalent.

2.2 LABORATORY

- A. Contractor shall employ the City of Cambridge Water Department laboratory to collect samples and perform bacteriological tests.

PART 3 - EXECUTION

3.1 PREPARATION

- A. General:

1. Perform disinfection and flushing in accordance with AWWA C651.
2. The Engineer and City of Cambridge Water Department will review disinfection procedure, designate dosage and will perform necessary water quality tests to verify that disinfection has been accomplished according to public health standards.
3. If connections are made to municipal water systems, City of Cambridge Water Department-approved backflow preventer shall be installed in the line to prevent backflow or siphonage of water into the municipal system.

B. Flushing:

1. Prior to chlorination, mains shall be properly flushed by the Contractor. In general, flushing shall be performed at a flow rate required to achieve a minimum velocity of 2.5 feet per second (approximately 1600 GPM in a 16-inch main, 900 GPM in a 12-inch diameter main, 400 GPM in 8-inch diameter main and 220 GPM in a 6-inch main, and 30 GPM in a 2-inch main). Flushing shall be performed for a sufficient period of time to allow for a minimum of 3 volume changes of water in the main (approximately 20 minutes per 1000-foot of main at the above flow rate).

C. Discharge:

1. Following disinfection, water with high concentrations of chlorine shall be discharged as required by the Owner or the Owner's Representative.
 - a. The Contractor shall notify the Engineer of the specific location where chlorinated water will be discharged at least one week in advance of proposed discharge. The Engineer will then inform the Owner.
2. Water with high concentrations of chlorine shall be dechlorinated prior to its discharge to storm drains or natural bodies of water.

3.2 INSTALLATION

A. Calcium Hypochlorite:

1. Use only as a solution.
2. Pump into pipe with a suitable chemical feed pump.

3.3 APPLICATION

A. Special Techniques:

1. Disinfect pipes by the continuous feed or slug method.
 - a. Continuous feed method:
 - (1) Feed chlorine into pipe so water entering contains at least 25 mg/l of available chlorine.
 - (2) Apply chlorine continuously until entire pipe is filled with chlorine solution.
 - (3) Retain treated water in pipe for at least 24 hours.
 - (4) Ensure that chlorine residual at end of test is at least 10 mg/l.
 - (5) Operate all valves and hydrants to insure disinfection. Manipulate valves to prevent super chlorinated water from entering existing distribution system.
 - b. Slug Method:
 - (1) Slowly feed through the main a slug of water having a chlorine concentration of 100 mg/l so that all parts of the main and appurtenances are exposed to the highly concentrated solution for a period of at least three (3) hours.
 - (2) Water from existing distribution system or other approved supply source shall be made to flow at a constant measured rate, into the new main.
 - (3) At a point not more than ten (10) feet downstream from the beginning of the new main, water entering the new main shall receive a constant dose of free chlorine having a concentration of 100 mg/l.
 - (4) The free chlorine shall be measured as it moves through the main. If the level drops below 50 mg/l, flow shall be stopped chlorination equipment shall be relocated to the head of the slug and as flow is resumed, chlorine shall be applied to restore the free available level to 100 mg/l.
 - (5) Valves and hydrants shall be operated as the chlorinated water flows past them to insure disinfection occurs.
2. Ensure that appurtenances are fully disinfected.

3.4 FIELD QUALITY CONTROL

A. Tests:

1. Bacteriological test samples shall be collected by the City of Cambridge Water Department laboratory or a state certified testing laboratory for the Contractor after the chlorine solution has been flushed out of the pipe.
2. Disinfection shall be repeated, as necessary, to produce satisfactory bacteriological samples.
3. Twenty-four (24) hours after the main has been flushed of chlorinated water, bacteriological samples shall be taken. Water samples shall be taken from corporation stops along the length of the water main as designated by the Engineer and the City of Cambridge Water Department. The Contractor shall be responsible for coordinating all necessary bacteriological sampling work with the City of Cambridge Water Department or a state certified testing laboratory and shall include the cost for sampling and analysis in his bid price. The results of the tests on these samples will determine the acceptance of the work and allow these new mains to be connected to the City of Cambridge Water Department's system. The failure of any sample to pass the laboratory tests shall require the Contractor to re-flush and rechlorinate the mains and re-sample and test the water until acceptable results are obtained, all at no additional cost to the City of Cambridge Water Department.

B. Main Activation:

1. Upon receipt of satisfactory bacteria sample test results and successful pressure tests, Contractor shall notify the City of Cambridge Water Department to have the City of Cambridge Water Departments' personnel operate all valves required to place mains in service.
2. Contractor shall note that work under this Contract shall not be considered completed until satisfactory installation and testing of the water mains have been completed.

3.5 CONTRACT CLOSEOUT

- #### A. Provide in accordance with Section 01701.

PART 4 – COMPENSATION (Not Used)

END OF SECTION 02675

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SECTION 02685

TEMPORARY BY-PASS PIPING AND SERVICE CONNECTIONS FOR WATER MAINS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.2 SUMMARY

- A. This Section includes furnishing all labor, materials, equipment and appurtenant work to satisfactorily maintain water service to customers connected to pipelines being replaced complete in place, in accordance with the Drawings and Specifications.

1.3 SUBMITTALS

- A. Submit the following in accordance with Section 01300 – SUBMITTAL PROCEDURES:
 - 1. Submit to the Engineer, the Owner and the Cambridge Fire Department for review, prior to providing temporary service, a complete by-pass piping layout including specific by-pass pipe diameter to be used in specific locations and types of temporary fire hydrants.
 - 2. Submit to the Engineer for review Shop Drawings detailing pipe, hose and temporary fire hydrants to be furnished and utilized for use in conjunction with the temporary by-pass pipe and connections to services and laterals.
 - 3. Submit to the Engineer for review, descriptive literature detailing disinfection procedures relating to the by-pass piping prior to its use.

PART 2 - PRODUCTS

2.1 PIPE AND MATERIALS

- A. Piping and materials to be used by the Contractor shall be PVC or steel and have been previously reviewed by the Engineer and shall be fully adequate to withstand the distribution system pressures in the vicinity of project.
- B. All by-pass piping connected to fire hydrants must be provided with a tee and valve for each hose connection so as to maintain sufficient fire protection during the course of the work.

PART 3 - EXECUTION

3.1 TEMPORARY WATER SERVICE MAINTENANCE

- A. All Pipe and fittings shall be watertight and shall be disinfected prior to being put into service. Disinfection and testing shall be performed by the Contractor and shall comply with Sections 02675 and 02704 of the specifications.
- B. Temporary by-pass facilities shall include hoses and necessary outlets and fittings to each service connection. The Contractor shall furnish, install, and maintain the temporary lines in a safe and operative condition at all times. After service has been restored to a section of water main, the Contractor shall remove the temporary by-pass and related facilities and shall leave the work site in its original condition.
- C. Temporary piping shall be installed adjacent to the roadways where it will cause the least obstruction and where it will be least susceptible to damage. At street intersections or access ways, the pipe shall be installed in a shallow trench to be overlaid with temporary bituminous pavement. At driveways, pipe crossings shall be provided utilizing cold patch cover or other method acceptable to the Engineer.
- D. Contractor to provide 24-hour emergency service personnel to fix and repair any damage to temporary by-pass piping. Contractor to furnish Owner with name and telephone number of person assigned to emergency repair service. Said person shall be capable of arriving at site within 1-hour of notification and providing necessary tools, equipment, and labor to repair damaged by-pass line. If emergency personnel fail to arrive, Owner's forces shall be authorized to take corrective actions, and all costs for labor, materials and equipment shall be backcharged to the Contractor. Minimum charge for Owner's forces shall be two (2) men at 4 hours minimum, overtime rate, plus materials and equipment costs. All backcharges shall be deducted from payments due the Contractor for work performed under this contract.

- E. Water for temporary servicing shall be taken from the nearest available fire hydrant, or as required by the Engineer and the Owner. If hydrants are unavailable, below ground taps for by-pass connection will be installed by the Contractor under the supervision of the Engineer and the Owner.
- F. All dwellings, whether occupied at the time of the project or not, shall be provided with temporary water service. Prior to activating the service, the Contractor shall disinfect and flush the piping. The Engineer shall review the temporary piping system prior to placing in service.
- G. Prior to installing and activating the temporary service, the Contractor shall notify the Engineer and the Owner in advance to allow the Owner to notify all customers accordingly.
- H. The Contractor shall operate all valves with an Owner's representative present. All necessary safety precautions, including traffic cones and highway safety barriers, shall be provided by the Contractor while operating valves in roadways.
- I. When replacing defective sideline valves, temporary by-pass piping shall not be used for the sole purpose of feeding customers affected by the temporary shut down of service. The shut down shall be coordinated with the Owner and the defective valve shall be replaced.
- J. Temporary fire hydrants shall be furnished, installed and maintained by the Contractor and shall be placed adjacent to existing hydrants while they are out of service procedures. Temporary hydrants shall be maintained by the Contractor until the existing hydrants are restored to service.
- K. Restoration of service to the customer, including disconnection from the by-pass system and reconnection to the new pipeline, is the Contractor's responsibility and shall be performed at his expense.
- L. Contractor shall be responsible for restoring adjacent properties to original condition. All paved roadways, access ways and driveways shall be repaired and repaved to original condition.

3.2 CONTRACT CLOSEOUT

- A. Provide in accordance with Section 01700.

PART 4 – COMPENSATION (Not Used)

END OF SECTION 02685

TEMPORARY BY-PASS PIPING
AND SERVICE CONNECTIONS
02685-3

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SECTION 02704

PIPELINE PRESSURE AND LEAKAGE TESTING

PART 1 - GENERAL

1.1 SUMMARY

- A. This section includes the following:
 - 1. Perform field hydrostatic pressure and leakage testing of water distribution pipes.
- B. Related section includes the following:
 - 1. Section 02630 – DUCTILE IRON PIPE AND FITTINGS

1.2 DEFINITIONS

- A. Leakage - Leakage is defined as total amount of water introduced into pipe during leakage test to maintain test pressure.

1.3 SYSTEM DESCRIPTION

- A. The working pressure of the pipeline ranges between 20 psi and 70 psi.

1.4 SUBMITTALS

- A. Shop Drawings: Submit the following in accordance with Section 01300 - SUBMITTALS:
 - 1. Testing schedule and test procedure.
 - a. Indicate proposed time and sequence of testing on schedule.
 - b. Indicated test procedure requirements as follows:
 - (1) Limits of each pipe tested.
 - (2) Position of all valves during testing.
 - (3) Location of temporary bulkheads.
 - (4) Meter calibration data.
 - (5) Pressure gauge calibration data.
 - (6) A report containing calculations and documentation pertaining to the pressure and leakage testing shall be submitted to the Cambridge Department of Public

Works and the Engineer.

1.5 SEQUENCING AND SCHEDULING

- A. Complete pressure and leakage testing of pipes prior to final cleaning and disinfection; Engineer shall be present during all testing.
 - 1. Notify the City of Cambridge Water Department and the Engineer of time and place of testing at least 3 days prior to commencement of work.

PART 2 – PRODUCTS

2.1 GENERAL

- A. Provide test equipment as follows: Piping connections between pipe tested and water source; Equipment, materials, and facilities required to perform specified tests including but not limited to the following:
 - 1. Pumping equipment
 - 2. Calibrated water meter
 - 3. Calibrated pressure gauges
- B. Sectionalizing devices required including but not limited to the following:
 - 1. Flanges
 - 2. Valves
 - 3. Bulkheads
 - 4. Bracing
 - 5. Blocking

PART 3 – EXECUTION

3.1 PREPARATION

- A. Provide blocks, anchors, and supports for pipe before test pressure is applied.

3.2 INSTALLATION

A. Water:

1. Schedule filling of line through the City of Cambridge Water Department and the Engineer at least three (3) days in advance of testing. Do not allow water to enter other parts of the pipeline, not subject to testing, unless approved by the Engineer and the City of Cambridge Water Department (CWD). Dispose of test water in a manner approved by the Engineer. CED personnel only are to operate all new valves connected in common with the existing distribution water system.

B. Venting:

1. Ensure that air release valves and other venting devices are properly installed and placed in open position when filling pipe with water. Do not close hand-operated vent valves until water flows in an uninterrupted stream from each valve.

3.3 APPLICATION

A. Pressure Testing:

1. All pipe and appurtenances installed shall be hydrostatically tested in accordance with ANSI/AWWA C600, latest version unless stated otherwise herein.
2. Test pressure, expressed in terms of feet of water, applied at any point in pipe equals arithmetic difference between specified test pressure plane elevation and elevation of horizontal center line of pipe at selected location. Multiply value by 0.433 to obtain pounds per square inch. Ensure pressure gauges are accurately calibrated. Do not attempt pressure testing until all air has been vented from the mains.
3. All ductile iron pipe shall be pressure tested at 150 psi for a continuous period of two hours.

B. Leakage Testing:

1. Conduct leakage testing in conjunction with pressure tests. Ensure that joints in piping are watertight and free from visible leaks during leakage test.

2. Leakage Test Pressure: Maintain specified normal operating line pressure for pressure testing of reach during leakage test. Maintain hydrostatic pressure within plus or minus 5 psi during entire time of leakage measurements.
3. Leakage Measurement: Do not attempt measurement of leakage until trapped air has been vented and constant test pressure has been established. Measure leakage by means of an approved water meter installed in the pressure piping on discharge of the pump. Ensure that water meter is accurately calibrated.
4. Allowable Leakage: Ensure that pipe reach does not exceed the allowable leakage rate. Calculate allowable leakage with following formula:

$Q = 0.0075 \text{ DLN}$ where
 Q = allowable leakage in gallons per hour
 D = nominal diameter of pipe in inches
 L = length of section tested in thousand feet (304.8 meters)
 N = square root of avg test pressure in psi (12.25 kgs/sq. meter)
5. Calculate allowable leakage separately for each diameter and add resulting allowable leakage rates to obtain total allowable leakage for entire reach.

3.4 FIELD QUALITY CONTROL

- A. Inspection: Locate defective joints and pipe materials during pressure testing.
- B. Locate and repair leaking joints and other defective items of work to reduce pipe leakage to an amount acceptable to Engineer, or where applicable, the City of Cambridge Water Department's requirements. All repairs shall be performed at no additional cost to the City of Cambridge Water Department.

PART 4 – COMPENSATION (Not Used)

END OF SECTION 02704

PIPELINE PRESSURE AND
LEAKAGE TESTING
02704 - 4

SECTION 02715

PRECAST REINFORCED CONCRETE BOX CULVERT AND FLARED END HEADWALL

PART 1 – GENERAL

1.1 DESCRIPTION

A. This section includes the following:

1. Furnish all plant, labor, materials and equipment required to construct precast reinforced concrete box culvert complete in place, within the limits and to the lines and grades indicated.
2. Provide design certification, prepared by a Massachusetts Registered Structural Engineer, for the box culverts.

1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section.
- B. Section 02140 – Dewatering
- C. Section 02160 – Temporary Excavation Support Systems
- D. Section 02210 - Earth Excavation, Backfill, Fill, and Grading.
- E. Section 02252 – Manholes
- F. Section 03300 – Cast-In-Place Concrete
- G. Section 03315 – Grout
- H. Section 03410 – Plant-Precast Structural Concrete
- I. Section 07160 – Bituminous Dampproofing

1.3 SUBMITTALS

- A. Shop Drawings: Submit the following in accordance with Section 01300 – SUBMITTALS:

1. Submit, prior to fabrication of the box culvert sections, Shop Drawings, a schedule of section lengths and key information. All precast sections furnished under this Contract shall be fabricated in full accordance with the approved Shop Drawings.
2. Submit, prior to fabrication of the box culvert sections, the manufacturer's installation instructions.
3. Prior to fabrication of the precast box culvert submit, design drawings and calculation stamped by a professional structural engineer registered in the Commonwealth of Massachusetts to the Engineer for review and approval.

1.4 REFERENCE STANDARDS AND DIRECTORATES

- A. ASTM C33 – Standard Specification for Concrete Aggregates.
- B. ASTM C150 – Standard Specification for Portland Cement.
- C. ASTM C789 – Standard Specification for Precast Reinforced Concrete Box Sections for Culverts, Storm Drains and Sewers.
- D. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.5 QUALITY ASSURANCE

- A. **Installer Qualifications:** An experienced installer who has completed three (3) similar, projects within the past five (5) years , involving the design and construction precast structural concrete work similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- B. **Fabricator Qualifications:** A firm that complies with the following requirements and is experienced in manufacturing precast structural concrete units similar to those indicated for this Project and with a record of successful in-service performance.
- C. Assumes responsibility for engineering precast structural concrete units to comply with performance requirements. This responsibility includes preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.

- D. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of precast structural concrete that are similar to those indicated for this Project in material, design, and extent.
- E. Participates in PCI's Plant Certification program and is designated a PCI-certified plant for Group C, Category C1.
- F. Has sufficient production capacity to produce required units without delaying the Work.
- G. Testing Agency Qualifications: An independent testing agency, acceptable to the Engineer, qualified according to ASTM C 1077 and ASTM E 329 to conduct the testing indicated, as documented according to ASTM E 548.
- H. Design Standards: Comply with ACI 318 (ACI 318M) and the design recommendations of PCI MNL 120, "PCI Design Handbook--Precast and Prestressed Concrete."
- I. Quality-Control Standard: For manufacturing procedures and testing requirements, quality-control recommendations, and camber and dimensional tolerances for types of units required, comply with PCI MNL 116, "Manual for Quality Control for Plants and Production of Precast and Prestressed Concrete Products."
- J. Product Options: Drawings indicate size, profiles, and dimensional requirements of precast concrete units and are based on the specific types of units indicated. Other fabricators' precast concrete units complying with requirements may be considered. Refer to Division 1 Section "Substitutions."
- K. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel"; and AWS D1.4, "Structural Welding Code--Reinforcing Steel."
- L. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Meetings."

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver precast structural concrete units to Project site in such quantities and at such times to ensure continuity of installation. Store units at Project

site to prevent cracking, distorting, warping, staining, or other physical damage, and so markings are visible.

- B. Lift and support units only at designated lifting and supporting points as shown on Shop Drawings.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Precast Box Culvert and precast Flared End Headwall

1. The precast reinforced box culvert and flared end headwall shall be made up of sections of monolithically cast concrete.
2. The box sections and flared end headwall shall have internal dimensions as indicated and shall have a male and female end. Joints shall be sealed by a 1" x 1" close cell neoprene sponge gasket material which is factory applied to the male or female end of the culvert section. Box sections shall be manufactured with a grooved end to accept a manhole riser tongue end as a tongue and groove joint for the sections indicated on the Contract Drawings.
3. All precast concrete sections shall conform to ASTM C789 and shall be designed for a minimum of AASHTO HS20 live loading and earth loading. Lateral earth pressure shall be taken as 60 psf/ft above the design ground water level El. 13.0 and 90 psf/ft below the ground water level. Design shall include a traffic surcharge of 200 psf at the ground surface level and seismically induced earth pressure as required by code.
4. Non-air-entraining Portland cement conform to ASTM C150, Type II or III shall be used. Water reducing admixture shall be used. Xypex or equal water proofing admixture shall be used for continuously submerged box culvert and flared end headwall sections. The use of other admixtures will not be permitted.
5. Fine aggregate shall consist of washed inert natural sand conforming to the requirements of ASTM C33, except for gradation, with a maximum loss of 8.0 percent when subjected to 5 cycles of the soundness test using magnesium sulfate.
6. Coarse aggregate shall consist of well-graded crushed stone or washed gravel conforming to the requirements of ASTM C33,

except for gradation, with a maximum loss of 8.0 percent when subjected to 5 cycles of the soundness test using magnesium sulfate.

7. The 28-day compressive strength of the concrete, as indicated by cores cut from the culvert and headwalls shall not be less than 5000 psi. The concrete mass shall be dense and uniform. Minimum reinforcement in the box culvert shall be as required by ASTM C789.
8. The quality of all materials and the finished culvert shall be subject to inspection and approval by the Engineer. Such inspection may be made at the place of manufacturer, or on the Work after delivery or at both places and the culvert shall be subject to rejection at any time on account of failure to meet any of the specification requirements, even though sample culverts may have been accepted as satisfactory at the place of manufacture. Units rejected after delivery shall be marked for identification and shall be removed from the job at once and replaced at no additional cost to the Owner. The Contractor shall require the manufacturer's cooperation in these inspections.
9. The Engineer shall have the right to cut cores from the finished culvert for inspection and testing. Cores shall be obtained, capped and sealed in conformity with ASTM C789. Core drilling and filling shall be performed by the precast manufacturer at no additional cost to the Owner.
10. The Contractor shall inspect all precast sections for quality and compliance with ASTM C789 and with the approved manufacturer's drawings. The Contractor shall inspect all joints for uniformity and ends for squareness and provide a notarized affidavit stating all precast sections meet the requirements of ASTM C789, this Section and the joint design with respect to square ends and uniform joint surfaces.
11. Pits, blisters, rough spots, breakage and other imperfections shall be repaired at no additional cost to the Owner, subject to the approval of the Engineer, after demonstration that strong and permanent repairs result. Repairs shall be carefully inspected before final approval. Non-shrink cement mortar used for repairs shall have a minimum compressive strength of 4000 psi at the end of 7 days and 6000 psi at the end of 28 days, when tested in 3-inch cylinders.

12. Unsatisfactory or damaged precast sections will be permanently rejected. Only the culverts conforming to the specifications and accepted will be listed for approval and shipment. Approved materials will be so stamped or stenciled on the inside before it is shipped. All materials which have been damaged after delivery will be rejected and if such materials have already been installed, they shall be removed and replaced, at no additional cost to the Owner. Culverts will be rejected for any non compliance to ASTM C789.
13. The precast box culvert and flared end headwall shall be placed on a 24-inch bed of crushed stone. The crushed stone shall be spread upon the prepared subgrade and compacted to the required thickness by rollers, crawler tractors or mechanical tampers subject to the approval of the Engineer. Compaction shall continue until the surface is even and true to the proposed lines and grades.
14. Joints for concrete box culvert shall conform to ASTM C789 and be watertight. The ends of the box sections shall be so formed that when the sections are laid together they will make a continuous line of box sections with a smooth interior free of appreciable irregularities in the flow line.
15. Joint sealant shall conform to Fed. Spec. SS-S-00210. All joints shall be parged with non-shrink cement mortar mixed with Xypex waterproofing chemical additive or equal.
16. Dampproofing shall be used in conformance with Section 07160 for box culvert sections not containing Xypex or equal waterproofing admixture.

PART 3 – EXECUTION

3.1 HANDLING

- A. All sections which have been damaged after delivery, and manhole sections installed in the work which are found to be damaged will be rejected and shall be removed and replaced by the Contractor with new, sound and approved material, at no additional expense to the Owner. At the time of inspection, the surfaces of the sections shall be dense and close-textured. Cores shall serve as a basis for rejection of manhole sections if poor bond or reinforcement is exposed.

- B. Each section shall be handled into its position in the trench only in such manner and by such means as recommended by the manufacturer of the sections, and as approved. Provide all necessary slings, straps and other devices for the safe and satisfactory handling and support of the manhole sections during lifting, installation and final positioning of the sections. Lifting holes may be permitted provided suitable rubber or concrete stopper or other approved devices are provided for plugging and sealing the holes and watertight, all as approved.

3.2 INSTALLATION

- A. Sections shall be installed level and plumb and in accordance with the manufacturer's recommendations. Temporary Excavation Support Systems shall be installed per Section 02160.
- B. Sections shall be constructed on a 24-inch compacted crushed stone or gravel base as indicated.
- C. Water shall not be permitted to rise over newly made joints until after inspection as to their acceptability. All jointing shall be done in a manner to insure watertight joints. Joints shall be parged externally on three sides and internally along the bottom with joint sealant.
- D. The manhole risers and frames and covers shall be set in accordance with Section 02252 and be sealed to the tongue and groove box culvert sections with a neoprene gasket.
- E. Openings in precast box culvert sections indicated on the drawings to receive entering pipes shall be made at the place of the manufacturer. Depending upon the type of pipe seals to be furnished, pipe openings shall be provided with seals of proper sizes to accommodate pipe sizes and shall be cast into the box culvert at the time of manufacture. When openings are made in the field, the openings for entering pipes shall be of a size to provide a uniform annular space between the outside of pipe wall and the opening in the manhole section of 3/4 inch (19.05 mm), and after the pipe is in position the annular space shall be solidly filled with non shrink mortar. Care shall be taken to assure that the openings are made to permit setting of the entering pipe at its correct elevation as indicated or directed. Openings which are cut in the manhole sections in the field shall be carefully made so as not to damage the sections; damaged sections will be rejected and shall be replaced at no additional expense to the Owner. All field cuts shall be reviewed with the manufacturer prior to completion to insure the field cut will not damage the structural integrity of the box culvert.

- F. The box culvert invert shall cast by the manufacturer as shown on the Contract Drawings.

3.3 BACKFILLING

- A. Conduct backfill operations of open cut trenches closely following laying, jointing, and bedding of pipe, and after initial inspection and testing are completed, all in accordance with Section 02210 - EARTH EXCAVATION, BACKFILL, FILL, AND GRADING.

3.4 INSPECTION AND TESTING

- A. All precast sections will be inspected upon delivery; precast sections which do not conform to specification requirements will be rejected and shall be removed immediately from the site by the Contractor at no additional cost to the Owner. The Contractor shall furnish all labor and facilities necessary to assist the Owner in inspecting the material.
- B. The quality of all materials, processes of manufacture, and the finished precast sections shall be subject to inspection and approval of the Owner. Such inspection may be made at the place of manufacture and/or on the site, and the precast sections shall be subject to rejection at any time because of failure to meet any of the specification requirements, even though sample manhole sections may have been accepted as satisfactory.
- C. Acceptance of precast reinforced concrete sections will be made on the basis of plant tests, material tests, and inspection of the completed product, in accordance with the requirements of ASTM C478, latest revision, with the following modifications.
- D. Sections shall not be shipped for at least five days after manufacture when cured by subjecting them to thoroughly saturated steam at a temperature between 100 and 150 degrees F for a period of not less than 8 hours, or when necessary, for such additional time as may be required to enable the sections to meet specification requirements.
- E. Leakage Tests
 - 1. The box culvert drain lines, flared end headwall, and appurtenant structures connected thereto shall be made as nearly watertight as practicable.
 - 2. Leakage into or from the piping and structures will be determined respectively by CCTV inspection and as directed. Any leaks observed shall be repaired.

3. Locate, repair, or replace defective joints and work in a manner satisfactory to the Owner and reinspect with CCTV at no additional cost to the Owner.

PART 4 – COMPENSATION (Not Used)

END OF SECTION 02715

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SECTION 02760

PIPELINE CLEANING AND INTERNAL INSPECTION

2760.1	CCTV PIPE INSPECTION – MWRA 48-INCH SEWER AND MET SEWER	LINEAR FOOT
2760.2	CCTV PIPE INSPECTION – NCRS 10'-4" X 4'-1" SEWER	LINEAR FOOT

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Furnishing all plant, labor, equipment and materials, as well as performing all operations associated with pipeline cleaning within the pipelines indicated on the Drawings in accordance with these Specifications.
2. Furnishing all plant, labor, equipment and materials, as well as performing all operations associated with pre and post construction closed-circuit television inspection of the pipelines indicated on the Drawings in accordance with these Specifications.
3. Performing the work in a sequence that is the least disruptive to vehicular and pedestrian traffic and in a manner that shall protect the public from damage to persons and property.
4. Prior to performing work adjacent to the existing MWRA 48-Inch Sewer between the existing NCRS overflow structure at Sta 3+89 and the existing SMH at Sta 2+20, R at the intersection of Memorial Drive and Western Ave, the Contractor shall conduct cleaning and CCTV inspection for review by the Engineer. The Contractor shall complete a post CCTV inspection of the pipe after subsurface construction is completed. Contractor shall be paid for each inspection prior to and after construction.
5. Prior to performing work adjacent to the existing MWRA MET 40'-2" x 46" Sewer that crosses Western Ave at approximately Sta 3+98, the Contractor shall conduct cleaning and CCTV inspection for review by the Engineer. Access to the MET can be obtained from a structure on Hingham Street and at the NCRS overflow structure at Sta 3+98. The Contractor shall complete a post CCTV inspection of

the pipe after subsurface construction is completed. Contractor shall be paid for each inspection prior to and after construction.

6. Prior to performing work on Memorial Drive, the Contractor shall perform cleaning and CCTV inspection of the existing NCRS 10'-4"X 4'-1" Sewer. Access to the NCRS Sewer can be obtained at an existing sewer manhole on Memorial Drive south of the intersection of Western Ave and Memorial Drive and an existing sewer manhole on Memorial Drive near the intersection with Hingham Street. The Contractor shall complete a post CCTV inspection of the pipe after subsurface construction is completed. Contractor shall be paid for each inspection prior to and after construction.

B. Related Sections include the following:

1. Section 02761 – FLOW BYPASS

1.3 SUBMITTALS

A. General: Submit each item in this article according to the conditions of the Contract and Division 1, SECTION 01300 – SUBMITTALS:

1. Shop drawings and/or manufacturer's descriptive literature indicating materials, equipment and methods to complete pipeline cleaning operations.
2. Shop drawings and/or manufacturer's descriptive literature indicating materials, equipment and methods to complete internal inspection operations to complete internal inspection operations.
3. A representative sample DVD showing the quality of work obtained by the assembly prior to internal inspection and cleaning.
4. Two copies of inspection reports for both pre and post construction internal inspections.
5. Confined Space Entry certifications for all personnel entering pipeline or access structures.

B. Contractor shall submit complete documentation of qualifications as specified herein.

1.4 QUALITY ASSURANCE

- A. Provide in accordance with Section 01400 – QUALITY CONTROL and as specified herein.
- B. The Contractor cleaning and internally inspecting the pipeline shall have completed at least three projects of similar size and complexity as this project in the United States within the past three years. Contractor may employ the services of a subcontractor that specializes in this work to fulfill this requirement.
- C. Rejection of any subcontractor and/or manufacturer by the Engineer due to insufficient qualifications shall not be grounds for modifications to the Contract Documents such as change in scope, time of completion or contract amount.
- D. All Contractor's personnel entering pipeline or access structures shall be Confined Space Entry trained per OSHA, Title 29 CFR 1910.46 and shall have a copy of their certification available on site at all times.

1.5 PRODUCTS, MATERIALS AND EQUIPMENT

- A. Provide in accordance with Section 01600 – PRODUCTS, MATERIALS, AND EQUIPMENT.

PART 2 - PRODUCTS

2.1 CLEANING

- A. Contractor shall use mechanical, hydraulically-propelled, and/or high-velocity cleaning equipment, which does not exert internal pressures great enough to damage the pipelines and associated structures. Selection of the cleaning equipment shall be based on the condition of the pipeline at the time work is scheduled to commence.
- B. Equipment shall include the following systems:
 - 1. High pressure water of sufficient capacity and volume to remove debris from the pipe and structure walls as approved by the Engineer.
 - 2. Motorized equipment complete with belt booster clutch, overload clutch or other means or devices that shall prevent damage to the pipeline and associated structures. Direct drive shall not be permitted.
 - 3. Standard mechanical equipment including a combination of rodding machines, boring machines, bucket machines, hydraulic balls, B-

liners, cones, ferrets or similar equipment. Direct drive shall not be permitted.

4. High pressure, hydraulically-propelled equipment and chemical compounds as approved by the Engineer.
5. Mechanical cutting devices suitable for the removal of roots, gaskets, protruding services, etc.
6. Footage metering devices for location of all equipment, devices and points of reference on measuring target that is known at all times at the ground level.

2.2 CLOSED CIRCUIT TELEVISION INSPECTION

A. Camera and vehicle assembly:

1. Industry standard for internally inspecting pipelines within the range of diameters applicable to this project.
2. Remote-controlled, robotic assembly capable of view 360° of pipeline interiors. At areas of interest, camera shall be capable of rotating its lens to obtain a more direct viewing angle.
3. Capable of operation in 100 percent humidity conditions.
4. Capable of being moved through the pipeline in either direction at a slow rate by means of manual cable winches or motorized mechanical equipment of indirect drive type.
5. Capable of slowing down and stopping at areas of interest.
6. Provide high intensity light feature for recording purposes.
7. Capable of measuring the camera's position within the pipeline accurate 0.10 feet.

B. During the internal inspection of pipelines, the Owner and the Engineer shall have the ability to view the pipe interior as it is being inspected on a TV monitor set up in a command center.

C. DVD:

1. DVD recordings shall, by electronic means, display continuously and simultaneously generated transparent digital information to include the

date, time, pipeline section number, corresponding station numbers and direction of camera relative to flow.

Example: Time: 4:14:08 PM
 Date: 5/7/02

ELM ST.
MH #2 to MH #3 (Downstream)
STATION 2+50.7

2. Inspections shall be documented on DVD formatted discs. The DVD shall be in color and capable of being played on a DVD player.

PART 3 – EXECUTION

3.1 GENERAL

- A. Contractor shall perform all work in accordance with municipal, state and federal requirements including OSHA.
- B. Contractor shall obtain all permits required to perform work prior to the commencement of construction at no additional cost to the Owner.
- C. Contractor shall locate and uncover all manholes and/or access structures required to complete the work in accordance with this Section.
- D. Contractor shall maintain existing flows around the work during cleaning operations in accordance with Section 02761 – FLOW BYPASS.

3.2 PIPELINE CLEANING

- A. Contractor shall clean the pipeline to facilitate inspection and construction.
- B. Contractor shall protect the pipeline from damage that could be inflicted by use of cleaning equipment. Any damage inflicted, regardless of technique, shall be repaired by the Contractor to the requirements of the Owner, at no additional cost to the Owner.
- C. All sludge, dirt, sand, rocks, grease, and other solid or semi-solid materials that may cause an obstruction or impede the inspection and/or construction shall be removed and disposed off site during cleaning operations in

watertight containers in conformance with all applicable federal, state and municipal laws and regulations, at no additional cost to the Owner. All materials that will not cause an obstruction or impede the inspection and/or construction shall be flushed downstream.

- D. Contractor shall manage, transport and dispose of waste materials collected and removed from the pipeline during cleaning operations in accordance with Section 02080 – SOIL AND WASTE MANAGEMENT and Section 02095 – TRANSPORTATION AND DISPOSAL OF SOIL AND FILL MATERIAL.
- E. If during cleaning operations an obstruction is encountered, the Contractor shall prosecute cleaning operations and supplement with either high pressure water or needle hammer to remove. Contractor shall limit the amount of water pressure used to prevent any structural damage to the existing pipelines and structures. Should the obstruction prevent the pipeline from being cleaned, the Engineer shall be notified immediately. If, in the opinion of the Engineer, a point repair is required to facilitate cleaning, Contractor shall perform the repair and clean through said repair upon its completion. No additional compensation shall be paid to the Contractor for any portion of the pipe which requires re-cleaning after successful completion of the repair.
- F. Contractor shall limit the use of water from hydrants to operations pertaining only to pipeline cleaning or other operations allowed in these Specifications. If water from fire hydrants is deemed necessary by the Contractor to avoid delay in normal work procedures, the water shall be conserved.
- G. No fire hydrants shall be obstructed at any time, nor shall a hydrant be used for the work described in these Contract Documents, unless a reduced pressure backflow preventor is furnished and installed by the Contractor and prior approvals have been obtained from the Owner and Municipal Fire Department. The Contractor shall be responsible for all related charges for the set-up, including the water usage bill.
- H. Contractor shall re-clean the pipeline, if in the opinion of the Engineer, materials have washed into the pipeline after acceptance of the cleaning and prior to construction at no additional cost to the Owner.

3.3 CLOSED CIRCUIT TELEVISION INSPECTION

- A. Contractor shall stop and focus the camera at locations where one or more of the following points of interest are observed:
 - 1. Inflow/Infiltration sources.
 - 2. Construction defects, discolorations, wrinkles, etc.

3. Structural defects including broken pipe, collapsed pipe, cracks or abnormalities.
 4. Abnormal joint conditions such as root intrusion, protruding lateral connections, in-line pipe size changes and/or material changes.
 5. Mineral deposits, grease, obstructions, etc.
 6. Lateral connections; plugged or open.
 7. Offset joints or misalignments:
 8. Manholes, access structures, etc.
 9. Any other locations where the conditions may affect construction operations.
 10. Any other location as required by the Engineer.
- B. If, in the opinion of the Engineer, certain conditions may impede construction, Contractor shall perform a point repair.
- C. The Contractor shall provide and maintain access to the system, including inflow control and dewatering within pipelines and associated structures as well as all other work required to perform the internal inspections to the satisfaction of the Engineer.

3.4 INSPECTION REPORTS

- A. At the conclusion of each internal inspection, the Contractor shall provide a summary report highlighting results of the investigations and summarizing conditions and points of interest as specified herein. All documentation shall be cross-referenced by stationing to enable the reviewer to identify a particular location.
- B. The pre construction inspection report shall detail and document areas requiring point repairs. Recommendations for repairs as described by the Contractor shall be submitted to the Engineer.
- C. The post construction inspection report shall detail the condition of constructed items and describe recommendations for repairs of any defects.
1. All areas where the construction is defective due to workmanship, chemical deterioration, or other, shall be identified by the Contractor.

2. If repairs are required, the Contractor shall produce a second post construction inspection report.

3.5 ACCEPTANCE

- A. Acceptance of the pipeline cleaning shall be made upon the successful completion of the television inspection. If, in the opinion of the Engineer, cleaning has not been completed in accordance with these Specifications, the Contractor shall be required to re-clean and re-inspect the pipe until the cleaning is shown to be satisfactory, at no additional cost to the Owner.
- B. Internal inspection operations, both pre and post construction, shall be considered for acceptance upon receipt by the Engineer of the following:
 1. Two copies of the internal inspection reports
 2. Two copies of the DVD discs showing pipelines and associated structures inspections.

3.6 PROJECT CLOSEOUT

- A. Provide in accordance with SECTION 01701.

PART 4 – COMPENSATION

Item 2760.1 --- CCTV Inspection - MWRA 48-inch Sewer and MET Sewer

METHOD OF MEASUREMENT:

Measurement for payment for CCTV Inspection- MWRA 48-Inch Sewer and MET Sewer shall be based on the actual length of sewer cleaned and inspected from centerline of manhole to centerline of manhole. Verification of adequate cleaning shall be made by television inspection.

BASIS OF PAYMENT:

Payment for Cleaning and CCTV Inspection- MWRA 48-Inch Sewer and MET will be based on the unit price bid for this item in the proposal. Under the linear foot price for CCTV Inspection – MWRA 48-Inch Sewer and MET, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required to clean and CCTV the existing 42'-2" x 46" and 48-Inch sewer as the location specified. The work includes, but is not limited to; heavy and light cleaning sewer, use of mechanical cleaning equipment, by-pass pumping, plugging or blocking of sewer flow, water for cleaning of sewer, television inspection work; digital video recordings; CCTV inspection report; grease removal, and the storage, transportation, and disposal of any material retrieved from sewer cleaning. All digital recordings and CCTV inspection reports shall be given to the Owner upon completion of the project.

SPECIAL NOTES ON EXCEPTIONS:

Payment for pre and post CCTV inspection for cured-in-place pipelining activities and work beneath steam tunnel shall be paid for elsewhere.

Item 2760.2 --- CCTV Inspection - NCRS 10'-4"X 4'-1" Sewer

METHOD OF MEASUREMENT:

Measurement for payment for CCTV Inspection- NCRS 10'-4"X 4'-1" Sewer shall be based on the actual length of sewer cleaned and inspected from centerline of manhole to centerline of manhole. Verification of adequate cleaning shall be made by television inspection.

BASIS OF PAYMENT:

Payment for Cleaning and CCTV Inspection- NCRS 10'-4"X 4'-1" Sewer will be based on the unit price bid for this item in the proposal. Under the linear foot price for CCTV Inspection – MWRA 48-Inch Sewer, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required to clean and CCTV the existing NCRS 10'-4"X 4'-1" sewer as the location specified. The work includes, but is not limited to; heavy and light cleaning sewer, use of mechanical cleaning equipment, by-pass pumping, plugging or blocking of sewer flow, water for cleaning of sewer, television inspection work; digital video recordings; CCTV inspection report; grease removal, and the storage, transportation, and disposal of any material retrieved from sewer cleaning. All digital recordings and CCTV inspection reports shall be given to the Owner upon completion of the project.

SPECIAL NOTES ON EXCEPTIONS:

Payment for pre and post CCTV inspection for cured-in-place pipelining activities and work beneath the steam tunnel shall be paid for elsewhere.

END OF SECTION 02760

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SECTION 02761

FLOW BYPASS

2761.1

FLOW BYPASS

LUMP SUM

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Furnishing all plant, labor, equipment and materials, as well as performing all operations associated with handling bypass flows from the existing system around the work indicated on the Drawings in accordance with these Specifications.
2. Maintaining flow from main pipelines without interruption of service, and maintaining flow in lateral connections with minimal interruption of service.
3. Performing the work in a sequence that is the least disruptive to vehicular and pedestrian traffic and in a manner that shall protect the public from damage to persons and property.

B. Related Sections include the following:

1. Section 01500 - TEMPORARY FACILITIES AND CONTROLS

C. Contractor shall design the bypass flow handling system.

1.2 SUBMITTALS

A. General: Submit each item in This Article according to the Conditions of the Contract and Division 1, SECTION 01300 – SUBMITTALS:

1. Shop drawings and/or manufacturer's descriptive literature indicating materials, equipment and methods to complete bypass flow handling operations.
2. Work plan including the following items:
 - a. Location, configuration and routing of bypass flow handling pipes and hoses.
 - b. Staging area(s) for pumps and other equipment.

- c. Upstream flow collection location and/or bulkheads.
 - d. Downstream discharge location.
 - e. Method of protecting structures that accept discharge flows.
 - f. Traffic management plan.
 - g. Roadway crossing details including hose ramps or trench details.
 - h. Noise pollution abatement plan.
3. List of 24-hour emergency telephone numbers at which the Contractor may be reached.
- B. Contractor shall submit a Certificate of Design (refer to SECTION 01300 – SUBMITTALS) for the bypass flow handling system and shall be responsible for the design of the following system components:
1. Gravity Bypass
 2. Pumps.
 2. Generators and power sources.
 3. Suction and discharge piping.
 4. Temporary pipe supports and anchoring.
 5. Pipe plugging and bulkheads.
 6. Noise control equipment.
 7. Calculation of average and maximum daily flows.
 8. Calculations of static lift, friction losses, flow velocity and flow rate.
 9. Systems testing and start-up.
 10. Maintenance of system for off-construction hours.
 11. Contingency plan and equipment for system failures.

- C. Contractor shall submit complete documentation of qualifications as specified herein.

1.3 QUALITY ASSURANCE

- A. Provide in accordance with Section 01400 – QUALITY CONTROL and as specified.
- B. The Contractor designing and installing the bypass flow handling system shall have completed at least five projects of similar size and complexity as this project in the United States within the past three years. Contractor may employ the services of a subcontractor that specializes in this work to fulfill this requirement.
- C. Rejection of any subcontractor and/or manufacturer by the Engineer due to insufficient qualifications shall not be grounds for modifications to the Contract Documents such as change in scope, time of completion or contract amount.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Provide in accordance with Section 01600 – PRODUCTS, MATERIALS, AND EQUIPMENT.

PART 2 - PRODUCTS

2.1 EQUIPMENT

- A. The bypass flow handling equipment shall be of sufficient size and material to convey existing flows from one access structure to the designated discharge downstream of the work without overflow, spillage or discharge to the surrounding environment.
- B. Contractor shall be fully equipped to operate and respond to any repair or replacement of the system (24 hours per day and 7 days per week) while the bypass flow handling system is in use.
- C. The Contractor shall have adequate standby equipment available and ready for immediate operation and use in the event of emergency or breakdown. One standby pump for each size pump utilized.
- D. Contractor shall incorporate noise reduction equipment to minimize impact on the surrounding environment. Such measures shall include insulated enclosures, hospital grade silencers or mufflers, equipment modifications and/or

special equipment to limit noise to 80 dBA at seven feet or 60 dBA at the nearest residence or business.

2.2 DESIGN CRITERIA

- A. Contractor shall verify flow conditions in the existing system prior to the commencement of construction. The Contractor shall have no claim for additional compensation by reason of delay or inconvenience in adapting its operations to the need for maintaining existing flows.
- B. Estimated flows are as follows. Flows are estimated from hydraulic models. Actual flows might vary and shall be verified by the Contractor.
 - 1. Average Daily Flow (dry weather): 2 MGD
 - 2. 3 Month Storm Event: 10 MGD
 - 3. 10-Year Storm Event: 32 MGD

PART 3 – EXECUTION

3.1 PREPARATIONS

- A. Contractor shall perform all work in accordance with municipal, state and federal requirements.
- B. Contractor shall obtain all permits required to perform work prior to the commencement of construction at no additional cost to the Owner.
- C. Prior to the commencement of construction, Contractor shall perform all possible preparatory work. The Contractor shall, at all times, conduct operations to interfere as little as possible with existing flows.
- D. Prior to start-up of bypass flow handling system, Contractor shall notify, in writing each property owner whose service shall be shutdown albeit temporarily. Contractor shall prepare notifications in accordance with Owner's requirements.
- E. The Contractor shall protect water resources, wetlands and other natural resources.

3.2 GENERAL

- A. Contractor shall design the layout and routing of the bypass flow handling system to minimize disturbance to public and private land and to maintain access for pedestrians and traffic. Traffic shall be maintained throughout the bypass operations according to applicable standards and local requirements.

- B. If excavation is required across roadways, all work shall be performed in accordance with municipal and/or state requirements.
- C. Contractor shall furnish, install, maintain and operate all temporary facilities such as dams, pumping equipment, conduits and all other labor and equipment necessary to intercept the flow before it reaches points where it would interfere with the work.
- D. Contractor may utilize pipelines in an existing parallel system as an alternative to installing a full bypass flow handling system pending approval by the Engineer and the Owner. Contractor shall submit a Certificate of Design prior to utilizing the parallel system and shall restore the parallel system to pre-construction conditions upon completion of construction.
- E. Contractor shall design, furnish and install individual bypass flow handling systems for flowing lateral connections or high occupancy buildings.
- F. The Contractor shall protect existing facilities from damage, during pumping activities.
- G. Plugging or blocking of flows shall incorporate a primary and secondary plugging device. When plugging is no longer required for performance of the work, it is to be removed in a manner that permits flows to slowly return to normal without surge, surcharge or other major disturbance.

3.3 CONTRACT CLOSEOUT

- A. Provide in accordance with Section 01701.

PART 4 – COMPENSATION

Item 2761.1 --- Flow Bypass

METHOD OF MEASUREMENT:

Measurement for payment for Flow Bypass will be based on a percent of the Lump Sum bid calculated by dividing the elapsed time to date by the original Contractual construction time limit as approved by the Engineer.

BASIS OF PAYMENT:

Payment for Flow Bypass will be based on the unit price bid for this item in the proposal. Under the Lump Sum price for Flow Bypass, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required to furnish, install, move, maintain and remove gravity or pumped flow bypasses complete as required to handle existing flows while completing the required elements of the Work at all locations. The work

includes, but is not limited to; design of the bypass systems; pumps; suction hoses; discharge hoses; generators; install and remove temporary bulkheads; gravity bypasses including furnishing and installing pipe of all sizes at all depths; excavation for buried hoses or pipe; furnish and placing backfill around buried hoses and pipe; preparation of subgrade; temporary pavement over buried hoses or pipe; ramps; protection of bypass measures; emergency service during non-work hours; manning pumps or other bypasses as may be required; fittings, couplings and appurtenances; connections to existing and proposed pipes and structures; protection of discharge locations; and all incidental work not specifically included for payment elsewhere required to bypass existing flows in all storm drain, combined sewer or sanitary sewer.

SPECIAL NOTES ON EXCEPTIONS:

Items not included for payment herein include, but are not limited to; permanent bulkheads; bypass for CIPP sections of pipe, and water main bypasses.

END OF SECTION 02761

SECTION 02767

CURED-IN-PLACE PIPELINING

2767.1 FULL LENGTH CURED-IN PLACE PIPELINING-42"x48" LINEAR FOOT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:

1. Inspecting and measuring the interior of the pipe to be lined.
2. Grout sealing of leaks which may interfere with installation and/or curing of the lines. Sealing shall include all required materials including packers.
3. Furnishing all plant, labor, equipment and materials as well as performing all operations associated with the installation of cured-in-place pipelining (CIPP) inside the existing pipeline where indicated on the Drawings and in accordance with municipal, state and federal requirements, including OSHA, and these Specifications.
5. Performing the work in a sequence that is the least disruptive to vehicular and pedestrian traffic and in a manner that shall protect the public from damage to persons and property within the limits and the duration of the work.
6. Handling and disposal of discharge water from CIPP curing operation.

- B. Related Sections include the following:

1. Section 01060 –PERMITS AND REGULATORY REQUIREMENTS

2. Section 02760 –PIPELINE CLEANING AND INTERNAL INSPECTION
3. Section 02761 – FLOW BYPASS

1.3 SUBMITTALS

- A. Submit the following in accordance with Section 01300 – SUBMITTAL PROCEDURES:
 1. Shop drawings and/or manufacturer’s descriptive literature indicating materials, equipment and methods to complete CIPP operations.
 - a. Details and description of construction methods, materials, equipment, and process description, including on-site and off-site tube wet out, insertion procedure, curing and cool down procedure, access structures and lateral connection details, method of cutting lateral connections, method for sealing ends of liner and lateral cut-outs, water sources and method of cure-water/steam discharge.
 - b. Material Safety Data Sheets (MSDS’s) for all materials used during preparation and installation.
 - c. Certification stating that the Contractor is fully licensed by the CIPP manufacturer (if different).
 - d. Method(s) and equipment for repairs of any uncured areas, defects, test sample section repairs or other deformities in the completed product.
 - e. Certified copies of all test reports on the properties of the selected resin by the material manufacturer indicating that the supplied materials conform with the design criteria.
 - f. Description of odors anticipated as a result of the curing process and methods to mitigate odors to prevent migration outside of the pipeline.
 - g. Confined Space Entry Certifications for all Contractor’s personnel entering pipeline or access structures.
- B. Contractor shall submit design calculations. The submittal shall provide documentation supporting the basis of the values used in the design calculations. The calculations shall be prepared and stamped by a Professional Engineer registered in the Commonwealth of Massachusetts.

For pulled-in systems, the Contractor shall submit design calculations for the maximum allowable pulling force on tube as well as the type of equipment and monitoring provisions to measure such forces during installation.

- C. Contractor shall submit curing logs within 24 hours of cool-down completion for each inversion indicating temperature readings at sensors in intervals of at least 1/2 hour.
- D. Contractor shall submit final CIPP testing reports as specified herein.
- E. Contractor shall submit a work plan to include the following items:
 - 1. Name, business address and telephone number of the CIPP installer and/or manufacturer (if different from the Contractor).
 - 2. List of names and phone numbers of all supervisory personnel involved with the CIPP installation.
 - 3. Description of the method and any intended variances from the specified methods.
 - 4. Description of surface activities including access structures, staging and inversion locations.
 - 5. Construction method(s) and equipment used to penetrate blockages and/or partially collapsed sections of the existing pipeline.
 - 6. Method(s) of repair for each location requiring a point repair.
 - 7. Description of techniques used to determine purpose and source of all lateral connections using such methods as smoke testing, dye testing, internal inspection and/or building investigation.
 - 8. Detailed action plan and description of techniques and equipment used in the event of odor migration into public and/or private property (indoors as well as outdoors).
 - 9. Traffic and pedestrian management plan.
 - 10. Plan for bypass flow handling per specification Section 02761.
 - 11. Supervisory personnel resume. Resume information shall include, at a minimum, educational background, the number of years in a supervisory capacity and a list of completed projects within the past five (5) years, including project description, responsibilities, complexity, and contract value amounts.

- F. Contractor shall provide a certification stating that the sources of all lateral connections identified during internal inspection have been investigated within the pipeline as well as in adjacent buildings and structures and that the Contractor has secured these connections to prevent the migration of odors.
- G. Contractor shall submit complete documentation of qualifications as specified herein.
- H. The Contractor shall submit a written description of curing water disposal method.

1.4 QUALITY ASSURANCE

- A. Provide in accordance with Section 01400 and as specified herein.
- B. The Contractor installing the CIPP system shall have completed at least three (3) projects, in the United States, within the past two (2) years and projects that included CIPP installation lengths of at least 1,000 continuous linear feet, on-site or off-site wet-out or resin impregnation of the liner tube, and design of at least 48-inch diameter CIPP with wall thickness based on a fully deteriorated condition. Note: A combination of projects satisfying each of the above provisions may be acceptable as long as three (3) projects have been successfully completed for each provision.
- C. Supervisory personnel shall have a minimum of five (5) years experience and shall have completed at least three (3) projects of similar size and complexity as this project with the United States within the past three (3) years. Attach résumés of each person named. Résumé information shall include, at a minimum, educational background, the number of years in a supervisory capacity and a list of completed projects within the past three (3) years, including project description, complexity and contract total amounts.
- D. Rejection of any subcontractor and/or manufacturer by the Engineer due to insufficient qualifications shall not be grounds for modifications to the Contract Documents such as change in scope, time of completion or contract amount.
- E. Designated supervisory personnel shall be directly involved with and used on this project. Substitutions of personnel will not be allowed without written authorization of the Engineer.
- F. All Contractor's personnel entering pipeline or access structures shall be Confined Space Entry trained per OSHA, Title 29 CFR 1910.46 and shall have a copy of their certification available on site at all times.

1.5 ASTM STANDARDS

- A. CIPP work and materials shall comply with all applicable sections of the following ASTM standards.
 - a. ASTM D790- Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
 - b. ASTM D2412 – Standard Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading.
 - c. ASTM F1216- Standard Practice for Rehabilitation of Existing Pipelines and Conduits by the Inversion and Curing of a Resin-Impregnated Tube.
- B. If conflicts exist between the specifications and the above referenced standards, the more stringent requirements, as determined by the Engineer, shall apply.

1.6 PRODUCTS, MATERIALS, AND EQUIPMENT

- A. Provide in accordance with SECTION 01600.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Cured-In-Place Liners shall consist of the following:
 - 1. Designed and constructed in accordance with ASTM F1216 for “Rehabilitation of Existing Pipelines and Conduits by the Inversion and Curing of a Resin-Impregnated Tube”, and these Specifications.
 - 2. Fabricated to a size that, when installed, shall neatly fit the internal circumference of the existing pipeline. Allowances shall be made for circumferential stretching during installation.
 - 3. Consisting of one or more layers of flexible needled felt, or an equivalent woven, nonwoven or combination material.
 - 4. Capable of carrying resin withstanding installation pressures and curing temperatures. Curing the liner shall form a continuous, hard, impermeable, tight-fitting lining between each installed reach.
 - 5. The finished product in place shall meet the minimum chemical resistance requirements for domestic sanitary sewer applications as listed in table X2.1 of ASTM F1216. Exposure shall be for a minimum of 30 days at 73.4°F (23°C). At least three (3) specimens

shall be used for each material tested and for each chemical solution involved. Specimens shall be removed from each chemical solution and tested. If any specimen fails to meet the 30 days requirements specified herein, the material will be subject to rejection. During this period, CIPP test specimens shall lose no more than 20 percent of their initial flexural strength and flexural modulus when tested in accordance with Section 8 of ASTM F1216.

6. For glass fiber reinforced liner materials, the Contractor shall provide chemical resistance test reports required under ASTM 3681 "Chemical Resistance of 'Fiberglass' (Glass-Fiber, Thermosetting-Resin) Pipe in a Deflected Condition" as indicated herein.

B. Resin

1. General purpose, unsaturated, styrene-based resin and catalyst system, an epoxy resin and hardener, or an epoxy vinyl ester resin and catalyst system, or other approved material compatible with the inversion/installation process that provides cured physical strength properties specified herein.

C. Lateral Connection and End Sealing

1. The sealing material shall be an acrylamide based gel with a minimum of ten (10) percent acrylamide base material by weight in the total sealant mix. The chemical sealing material shall have a viscosity of approximately two (2) centipoises, which can be increased with additives, and a controllable reaction time from ten (10) seconds to one (1) hour. The application of the sealant shall be through a lateral sealing packer. Joint sealing shall be accomplished by forcing chemical sealing materials through the lateral packer into the surrounding soil through the leaking joint, crack or other lateral defect. Final acceptance of the sealed lateral will be accomplished via an air test of the joint or a visual inspection to verify that water is not leaking through the repaired lateral connection.

2.2 DESIGN CRITERIA

A. General

1. The CIPP shall be designed to have sufficient structural strength to support all dead loads, live loads, and groundwater load imposed, including 100 year flood elevation requirements, with the assumption that the existing pipeline is fully deteriorated and cannot share any loading or contribute to structural integrity of the CIPP.

1. All CIPP shall have a wall thickness that, when tested by the parallel plated deflection method in accordance with ASTM D2412, shall have a minimum pipe stiffness of six (6) psi.
2. The properties of the CIPP, when cured, shall have the following minimum values:

<u>Property</u>	<u>ASTM Test Method</u>	<u>Initial¹ psi</u>	<u>Long Term² psi</u>
Flexural Strength	D790	4,500	NA
Flexural Modulus	D790 & D2990	300,000	150,000

Notes: ¹Initial values are determined by ASTM D790.

²Long term value is defined as fifty (50) years and is determined by ASTM D2990.

B. Design Performance Limits and Design Parameters

1. The CIPP shall be designed such that the lining shall not fail, collapse, buckle, crack or delaminate under load. The maximum long-term fifty (50) years calculated deflection under all loads shall not exceed five (5) percent. For glass fiber reinforced liner pipe, the bending strain fifty (50) years developed shall not exceed the higher of the minimum long-term value in ASTM D3262 for the pipe stiffness supplied or that substantiated by long-term strain tests done in accordance with ASTM D3681 using 1.0 N sulfuric acid.

C. The following design parameters shall be used and all criteria shall apply to each CIPP installation:

1.	Depth Cover Above Crown of Pipe ¹	The greatest of actual depth for each pipe reach.
2.	Depth of Groundwater Above Crown (Perm.)	Ground surface
3.	Specific Weight of Soil	120 lb. ft.
4.	Wheel Load ²	16,000 lbs.
5.	Railroad Load ³	N/A
6.	Design Temperature	80°F
7.	Deflection Lag Factor, D _L	1.0 (Initial) 1.5 (50 years)
8.	Modulus of Soil Reaction E'	1,200 psi
9.	Ovality Correction Factor	2%
10.	Long Term Modulus of Elasticity	50 years under constant stress, when submerged in water, to be used for constrained buckling resistance design for combined external loads from groundwater and earth cover.
11.	Minimum Factor of Safety	2.0 unless otherwise specified
12.	Deflection Coefficient, K _x	0.103
13.	Shape Factor	6

- Notes:
- ¹Design of the CIPP shall be based on prism load on the liner pipe, using the outside diameter of the liner in the calculations.
- ²Impact factors to be included when depth of cover is less than three (3) feet per values recommended by AASHTO.
- ³Impact factors to be included when depth of cover is less than ten (10) feet per criteria established by AREA "Manual of Recommended Practice".

- D. The minimum thickness of the CIPP shall be as determined for the design parameters imposed. Calculations for the determination of the required liner pipe stiffness shall be the largest pipe stiffness for each CIPP installation reach (inversion/installation access structure to termination point), as determined by calculations provided for the following parameters: (1) Maximum Deflection; (2) Minimum Pipe Stiffness; (3) Ring Bending Strength; and (4) Constrained Buckling Resistance Using Long Term Modulus of Elasticity. The design calculations shall consider all cases of loading to the CIPP and the liner thickness required shall withstand these loads without collapsing.

PART 3 - EXECUTION

3.1 GENERAL

- A. Contractor shall perform all work in accordance with municipal, state and federal requirements.
- B. Contractor shall obtain all permits required to perform work prior to the commencement of construction except those permits already obtained by the owner as specified in Section 01060.
- C. The length of the CIPP shall equal the length indicated on the Drawings unless otherwise required by the Engineer. The Contractor shall verify the internal pipe diameter/dimension(s) and lengths in the field prior to liner impregnation.
- D. All work associated with CIPP operations shall be accomplished without excavation from existing ground surface, except in areas specifically designated on the Drawings or as approved by the Owner.
- E. Individual inversions/installations may be performed via one or more existing access structures as determined by the Contractor and as approved by the Owner.
- F. The CIPP shall be performed with minimal excavation or removal of existing structures. Excavation for point repairs or emergencies shall be permitted, but only as approved by the Owner.
- G. Contractor shall review all existing conditions data prior to the commencement of construction including TV logs attached in the appendices of these Specifications.
- H. Contractor shall inspect, clean, and CCTV the existing pipe prior to commencement of CIPP operations, including flow diversion as necessary, and provide the Engineer the opportunity to verify the condition of the pipe for the CCTV operations.
- I. Contractor shall commence CIPP operations at the beginning of a period of at least three (3) days of anticipated dry weather and as required by the Engineer.

3.2 PREPARATION

- A. Contractor shall perform all preparation operations in accordance with Section 02760 and Section 02761.
- B. Contractor shall inspect interior of the pipelines to determine locations of any conditions which may prevent proper installation of the liner. Inspections shall note protruding service taps, collapsed/crushed pipe. And reductions in the cross-sectional area that could impact lining of the pipe.

- C. Contractor shall clear the line of obstructions such as solids, dropped joints, protruding lateral connections or collapsed pipe that will hinder the installation. If inspection reveals an obstruction that cannot be removed by conventional cleaning equipment, then the Contractor shall make a “point repair” excavation to uncover and remove or repair the obstruction. Such excavation shall be approved in writing by the Engineer prior to the commencement of the work. Point repairs shall be defined as repairs to the existing pipeline that are required to facilitate renewal work. Point repairs shall be identified during internal inspection. The Contractor shall perform point repairs after cleaning and pre-installation internal inspection has been complete. The Contractor shall notify the Engineer not less than 48 hours in advance of making any such point repairs.
- D. Contractor shall grout seal visible leaks prior to installation of the liner material.
- E. Contractor shall investigate and determine the purpose and source of all lateral connections. Methods shall include, but are not limited to, internal inspections within adjacent buildings, smoke testing and dye testing. Contractor shall record location, size, material and relative invert elevation of each lateral connection with respect to the pipeline. Contractor shall note presence of floor drains or other outlet pipes in adjacent buildings. Contractor shall obtain written approval from the Owner and property owner(s) prior to any testing and/or building entry. Contractor shall verify that lateral connections have been installed according to plumbing codes and have traps to prevent the migration of odors into buildings.

3.3 INSTALLATION

- A. Contractor shall install a resin impregnated flexible felt tube inverted/ installed into the existing pipe utilizing a vertical inversion standpipe and hydrostatic head method, air pressure inversion method, pulled-in and inflate method or other method approved by the Engineer.
- B. Curing shall be accomplished by circulating hot water, steam or other approved methods to cure the resin into a hard, impermeable pipeline. When cured, the new material shall extend over the length of the inversion/ installation reach in a continuous, tight-fitting, watertight pipe-within-a-pipe.
- C. The Contractor shall designate the locations where the reconstruction tube will be vacuum impregnated prior to installation. The Contractor shall allow the Engineer and the Owner to inspect the materials and “wet-out” procedure. A catalyst system compatible with the resin and reconstruction tube shall be used.

- D. The wet-out reconstruction tube shall be inserted through an existing access structure or other access point by approved techniques/processes of the Contractor. Tubes that are pulled in place shall be done in a manner that shall not damage the tube. The winch shall be equipped with a dynamometer to record the pulling forces required during installation. Pull forces shall not exceed manufacturer's recommendations that shall be based on a maximum longitudinal stretch of five (5) percent of the total tube length. Inversion heads for tubes that are inverted in place shall not exceed manufacturer's recommendations so as not to overstress the tube material or exceed 5% longitudinal stretch. Progressive rounding of the liner shall be performed, prior to curing, to eliminate all trapped water between the liner and the existing pipeline. The Contractor shall describe the process or (techniques) to be used progressively round the liner tube to remove all trapped water between the liner pipe and the existing pipe.
- E. After inversion/installation is completed, the Contractor shall supply a suitable heat source and fluid recirculation equipment or other approved methods. The equipment shall be capable of delivering hot water/steam throughout the section by means of a pre-strung hose to uniformly raise the water/steam temperature above the temperature required to effect a cure for the resin. This temperature shall be determined by the CIPP manufacturer and based on the resin/catalyst system employed.
- F. The heat source shall be fitted with suitable monitors to gauge the temperature of the incoming and outgoing water/steam supply. Another such gauge shall be placed between the impregnated reconstruction tube and the pipe invert at the terminating manhole to determine the temperatures during cure. Water/steam temperature in the line during the cure period shall be recommended by the resin manufacturer.
- G. Initial cure shall be deemed to be completed when inspection of the exposed portions of cured liner appear to be hard and sound and the remote temperature sensor indicates that the temperature is of a magnitude to realize an exotherm. The cure period shall be of a duration recommended by the resin manufacturer, as modified for the CIPP process, during which time the recalculation of the water/steam and cycling of the heat exchangers to maintain the temperature continues. Curing temperatures and duration shall be in accordance with previously submitted data and information.
- H. The Contractor shall cool the hardened pipe to a temperature below 100 degrees F before relieving the static head. Cool-down may be accomplished by the introduction of cool water into the inversion standpipe to replace water being drained from a small hole made in the downstream end. If Contractor elects to drain cure-water via the upstream end, the water shall be pumped to a discharge location approved by the Owner at no additional cost to the Owner. Care shall be taken in the release of the static head so that a vacuum

shall not develop that could damage the newly installed pipeline. Contractor shall verify with the Owner that discharging the cure-water directly into the existing system is acceptable. If deemed unacceptable, Contractor shall collect and pump cure-water to a location to be determined by the Contractor and approved by the Owner.

- I. After completion of pipe line curing, the Contractor shall dispose of curing water in accordance with all federal, state, and local requirements. Curing water discharged to a municipal or MWRA sewer shall be in accordance with the requirements of 360 CMR 10: MWRA Sewer Use Regulations and as indicated the attachment to this Section. The Contractor shall note all time requirements that may be needed for approval by MWRA. The point of discharge to the MWRA sewer system shall be designated by the MWRA Field Operations Department. Alternatively, the Contractor may elect to transport the curing water off site for disposal utilizing a uniform hazardous waste manifest. The transporter shall be appropriately licensed and the disposal facility shall be a licensed wastewater treatment facility. The Contractor shall sample and analyze appropriate samples as required by the disposal facility.
- J. Contractor shall mitigate all odors onto public or private property due to renewal operations immediately after notification from the Owner or the Engineer including, but not limited to, forced-air ventilation and/or chemical cleaning of buildings at no additional cost to the Owner. If odors persist on public or private property to a point that air sampling and/or associated testing is required by the Owner, the Engineer or a regulatory agency, the Contractor shall perform this work at no additional cost to the Owner.
- K. Contractor shall repair all uncured areas, defects, test sample section repairs or other deformities in the liner during inversion operations in accordance with the manufacturer's recommendations.
- L. The finished CIPP shall be continuous over the entire length of an inversion/installation run and be as free as commercially practicable from visual defects such as foreign inclusions, dry spots, pinholes, wrinkles, delamination, or other deformities. Any such conditions deemed by the Owner shall be repaired and/or replaced at no additional cost to the Owner.

3.4 SYSTEM REINSTATEMENT

- A. Once a section of liner has been cured completely, the Contractor shall reinstate all access structures located along its alignment. For intermediate access structures, the Contractor shall cut the top portion of the liner to match the opening in the riser section providing a smooth, clean cut and continuous transition. At inversion/installation or termination access structures, the

Contractor shall extend the liner a sufficient distance into the structure to allow for a smooth, clean cut to match the configuration of the riser and base sections. The CIPP shall make a tight fitting seal with the existing pipe(s) in the manhole. Half-inch (1/2") diameter activated oakum band soaked in Scotch Seal 5600, or approved equal, shall be applied circumferentially near the annular space, touching the end of existing pipe, and encased with a cementitious mortar. The top half of the pipe shall be neatly cut off, and not broken or sheared off, at least four (4) inches away from the walls. The channel in the manhole shall be a smooth continuation of the pipe(s) and shall be merged with other lines or channels, if any. Channel cross-section shall be U-shaped, with a minimum height of half pipe diameter to three-fourths of the pipe diameter for fifteen (15) inches or larger. The side of the channels shall be built up with mortar/concrete to provide benches at a maximum of 1 in 12 pitch towards the channel. Any nominal annular gap between the liner and the host pipe shall be filled with a resin mixture and/or epoxy compatible with the CIPP liner and the terminated ends of the liner shall be beveled to allow for a smooth transition.

- B. Lateral connections shall be reestablished with a cutting device specifically designed for cutting CIPP. The exact location and number of lateral connections shall be determined during the internal inspection(s) and/or in the field. The Contractor shall reconnect all lateral connections to the liner pipe, including those unoccupied, abandoned, or from vacant lots, unless otherwise required by the Engineer. Shape of pipeline cut-out shall match shape of lateral connection. The annular space between the liner pipe and the lateral connection shall be sealed with a resin mixture and/or epoxy compatible with the CIPP.
- C. Lateral connections shall be reinstated by experienced operators so that no blind attempts are made in the liner. Location shall be re-verified carefully with pre-construction videotapes for accuracy, especially where dimples are not defined or clearly ascertained. The cut shall be smooth and circular with no jagged edges. The hole shall be a maximum of 100 percent and a minimum of 95 percent of the lateral pipe inside diameter. It shall be properly aligned and be concentric to the existing connection.
- D. The Contractor shall minimize the time that an inversion/installation access point remains open. Consideration shall be provided to complete and coordinate all work including pipeline cleaning, pre installation internal inspection, pipeline renewal and post installation internal inspection to minimize disturbance to adjacent property owners.

3.5 TESTING

- A. For each separate length of CIPP installed, the Contractor shall prepare at least two (2) samples in accordance with ASTM F1216, Section 8.1.1 or

Section 8.1.2 for testing at a laboratory approved by the Engineer. For samples used per section 8.1.1, the Contractor shall hold the pipe in place by a suitable heat sink, otherwise this method will not be acceptable.

- B. If flat plate samples are used for testing, the samples shall be taken from a section of the length of CIPP to be installed. Flat plate samples cured by a suitable heat sink and tested in accordance with ASTM F1216, section 8.1.1 shall be considered as passing if they exceed the design value criteria. Flat plate samples cured in the downtube or in the silencer in accordance with ASTM F1216, section 8.1.2, shall be considered as passing the design value criteria if the arithmetic mean of the tested samples, as defined by ASTM D790, is greater than or equal to parameters set forth in this Section after the arithmetic means is reduced to 80% of its original calculated value.
- C. The Contractor shall provide one sample for each inversion to the Engineer for independent testing. The samples shall be labeled with each pipe inversion identification and date.
- D. Samples secured as specified shall be tested to verify that the pipe flexural modulus and flexural strength of the CIPP is at least equal to that required by the approved design submittal, and the wall thickness is at least equal to that required in the approved design submittal. Wall thickness shall be verified at each inversion, intermediate manhole(s), and termination access at four equidistant points around the perimeter.
- E. If any sample fails the verification tests specified, the Contractor shall take five (5) additional samples throughout the length of the inversion/installation and retested to ensure the specified criteria has been met. If any sample fails these retests, the entire inversion/installation length shall be rejected.
- F. Any rejected inversion/installation shall be relined or replaced by the Contractor at no additional cost to the Owner. The Contractor shall submit method of repair of the rejected inversion/installation length for review and approval by the Owner prior to constructing any repair work. Any samples taken from within the final completed liner pipe shall be repaired by the Contractor, in accordance with the shop drawings, at no expense to the Owner.
- G. Contractor shall submit curing water test reports as required by any discharge permit requirements or as required by Attachment X.
- H. Contractor shall submit the names, addresses and EPA identification number of the transporter and disposal facility in the event a disposal facility is used. Test results and disposal documentation from this facility shall also be submitted.

3.6 ACCEPTANCE

- A. Prior to final acceptance, any defects that may affect the integrity or strength of the pipeline in the opinion of the Engineer shall be repaired by the Contractor at no additional cost to the Owner. Wrinkles or fins in the bottom half of the lined pipe shall not exceed 2% of the nominal pipe diameter and shall not have an adverse effect on the flow. If in excess, the liner shall be repaired and/or removed and replaced at no additional cost to the Owner.
- B. Pipeline shall be true to line and grade, with no visual bulges, sags, protrusions, wrinkles transverse to the flow, deflections, offset joints, leaking joints, or other visible infiltration, or other defects that would impair the intended use of the completed pipeline.
- C. Final acceptance of work shall not be granted until all defective areas are repaired in accordance with the CIPP manufacturer's recommendations and to the Owner's satisfaction.
- D. Any repairs required by the Engineer as a result of the post construction internal inspection shall be performed by the Contractor.
- E. Contractor shall perform a post construction internal inspection in accordance with Section 02760. Final acceptance of the work shall not be granted until post installation inspection has been reviewed and approved by the Engineer.
- F. Contractor shall perform testing as specified. Final acceptance of the work shall not be granted until the appropriately formatted testing results have been reviewed and approved by the Engineer.

3.7 CONTRACT CLOSEOUT

- A. Provide in accordance with Section 01700.

PART 4 – COMPENSATION

Item 2767.1 Full Length Cured-In-Place Pipelining – 42"x48"

METHOD OF MEASUREMENT:

Measurement for payment for Full Length Cured-in-Place Pipelining - 42"x48" shall be based on the actual linear feet of 42"x48" pipe cured-in-place pipelining rehabilitation system cleaned, installed, cured, tested, and inspected, complete as shown on the Contract Drawings and as measured by the Engineer along the centerline of the pipe between the centers of manholes or the defined limits of the rehabilitation.

Pipe installed but not successfully tested and accepted and service laterals within each pipe reach shall be paid for at a maximum of 75 percent of the unit prices bid under this item. The remaining 25 percent shall be paid upon receipt of successful test results by the Engineer and acceptance by the Engineer. All reductions in payment due to unsuccessful testing shall be made prior to normal retainage.

BASIS OF PAYMENT:

Payment for Full Length Cured-in-Place Pipelining - 42"x48" will be based on the unit price bid for this item in the proposal. Under the linear foot price for the item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required to furnish and install the cured-in-place pipelining rehabilitation system in the 42"x48" pipe as shown on the Contract Drawings or at the requirements of the Engineer. The work includes, but is not limited to; mobilization and demobilization of the pipe lining operation and equipment; installation, maintenance, and removal of insertion and receiving pits, including layout, excavation; construction dewatering; support of excavation, excavation, backfill and grading; flow handling to facilitate the installation of the cure-in-place pipelining; homeowner notifications and coordination; heavy duty or light duty pipeline cleaning as may be required by existing conditions; pre and post-installation inspection by closed circuit television; providing photographic documentation; reconnecting and sealing around service connections or other pipe penetrations; connections and sealing around manhole and structure penetrations; testing; any restoration work needed to replace damaged structures, landscaping, pavement, and/or ground conditions; and all incidental work not specifically included for payment elsewhere.

ATTACHMENT
TO SECTION 02767
REQUIREMENTS FOR THE DISCHARGE OF CIPP CURING WATER TO A
MUNICIPAL OR MWRA SEWER

1. Authorization to discharge the CIPP curing water to a municipal or MWRA sewer shall be obtained from the MWRA prior to beginning the discharge operation.
2. No release of curing water shall be allowed prior to sampling the water to ensure compliance with MWRA Sewer Use Regulations, 360 CMR 10.021-10.024. Sampling and analysis shall be completed by a DEP certified testing laboratory, using wastewater methods appearing in 40 CFR 136. Minimum scope of analysis shall include VOA, ABN, TSS, sulfide, and ammonia. MWRA shall specify what parameters are to be sampled depending on the site and specific process conditions.
3. Results of analyses shall be sent to the Project Manager of Permitting at MWRA via facsimile at 617-371-1604.
4. Water from the CIPP curing operation shall be treated to comply with the MWRA Sewer Use Regulations, including the Specific Discharge Limitations/Local Limits contained in 360 CMR 10.023-10.024 at the discharge point, prior to mixing with other wastewater streams. Sampling shall be conducted after treatment prior to discharge to the sewer system. Treated wastewater shall be held on-site until MWRA provides authorization to proceed with the discharge.
5. The water from the CIPP curing operation shall contain no solids or viscous substances in quantities that could cause obstruction to flow in sewers, or cause other interferences with the operation of the sewer system. Substances include, but are not limited to, sand, mud, wood, stone, or marble dust pursuant to 360 CMR 10.023(8).
6. The proposed measured flow, in gallons, of treated wastewater from the CIPP curing operation, prior to mixing with other wastewater streams, shall be submitted to the Project Manager of Permitting at MWRA via facsimile at 617-371-1604.
7. The MWRA shall be notified of significant changes to the discharge flow, or proposed times and duration of discharge or of any accidental spills, releases of chemicals, or contaminated water to the sanitary sewer system.
8. Contractor/Permittee shall cease the discharge as directed by MWRA Operations management as required during wet weather or high flow conditions. MWRA may require that the discharge be stopped immediately if it is determined that the discharge is having an actual or potential adverse impact on the operation of MWRA sewer systems.

END OF SECTION 02767

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SECTION 03300
CONCRETE

3300.1	CIP CONCRETE PIPE CONNECTION GREATER THAN 24-INCH THROUGH 36-IN DIAMETER (CIP FIELD CLOSURE)	EACH
3300.2	CIP CONCRETE PIPE CONNECTION GREATER THAN 36-INCH THROUGH 48-IN DIAMETER (CIP FIELD CLOSURE)	EACH
3300.3	CIP CONCRETE PIPE CONNECTION BETWEEN 48-IN DIAMETER TO MWRA NCRS OVERFLOW STRUCTURE	LUMP SUM
3300.4	CIP CONCRETE WATER QUALITY SAMPLING STATION EQUIPMENT PAD	LUMP SUM

PART 1 – GENERAL

1.1 SUMMARY

- A. This section specifies cast-in-place concrete, including formwork, reinforcement, concrete materials, mix design, placement procedures, and finishes.

1.2 DEFINITIONS

- A. Cementitious Materials: Shall be a combination of Portland cement and Blast Furnace slag.

1.3 SUBMITTALS

- A. Shop Drawings: Submit the following in accordance with Section 01300 - SUBMITTALS:
1. Product Data: For each type of manufactured material and product indicated.
 2. Design Mixes: For each concrete mix. Include alternate mix designs when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.
 3. Steel Reinforcement Shop Drawings: Details of fabrication, bending, and placement, prepared according to ACI 315, "Details and Detailing of Concrete Reinforcement." Include material, grade, bar

schedules, stirrup spacing, bent bar diagrams, arrangement, and supports of concrete reinforcement. Include special reinforcement required for openings through concrete structures.

4. Welding Certificates: Copies of certificates for welding procedures and personnel.
5. Material Certificates: Signed by manufacturers certifying that each of the following items complies with requirements:
 - a. Cementitious materials and aggregates.
 - b. Form materials and form-release agents.
 - c. Steel reinforcement and reinforcement accessories.
 - d. Admixtures.
 - e. Waterstops.
 - f. Curing materials.
 - g. Bonding agents.
 - h. Adhesives.
 - i. Ready-mix concrete producer.
 - j. Repair materials.
 - k. Grout.
6. Minutes of preinstallation conference.
7. Detailed cold-weather protection methods.

1.4 QUALITY CONTROL

- A. Provide in accordance with Section 01400 – QUALITY CONTROL and as specified.
- B. Installer Qualifications: An experienced installer who has completed concrete Work similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

- C. **Manufacturer Qualifications:** A firm experienced in manufacturing ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.
1. Manufacturer must be certified according to the National Ready Mixed Concrete Association's Certification of Ready Mixed Concrete Production Facilities.
- D. **Testing Agency Qualifications:** Contractor shall employ a testing agency, acceptable to the Engineer and qualified according to ASTM C 1077 and ASTM E 329 to conduct the 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-1 or an equivalent certification program.
- E. **Source Limitations:** Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, each aggregate from one source, and each admixture from the same manufacturer.
- F. **ACI Publications:** Comply with the following, unless more stringent provisions are indicated:
1. ACI 301, "Specification for Structural Concrete."
 2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
- G. **Preinstallation Conference:** Conduct conference at Project site to comply with requirements in Division 1 Section "Project Meetings."
1. Before submitting design mixes, review concrete mix design 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 mixes.
 - c. Ready-mix concrete producer.
 - d. Concrete subcontractor.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Provide in accordance with Section 01600 – PRODUCTS, MATERIALS AND EQUIPMENT and as specified.
- B. Deliver, store, and handle steel reinforcement to prevent bending and damage.

PART 2 – PRODUCTS

2.1 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. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
 - a. Medium-density overlay, Class 1, or better, mill-release agent treated and edge sealed.
- B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.
- C. Forms for Cylindrical Columns, Pedestals, Light Pole Piers, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that will produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.
- D. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.
- E. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
 - 1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
- F. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.

1. Furnish units that will leave no corrodible metal closer than 1-1/2 inch to the plane of the exposed concrete surface.
2. Furnish ties that, when removed, will leave holes not larger than 1 inch in diameter in concrete surface.
3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing and for walls which are part of water containing tanks or structures.

2.2 STEEL REINFORCEMENT

- A. Reinforcing materials shall have a recycled content of 30% or greater and shall conform to the following standards:
1. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.
 2. Low-Alloy-Steel Reinforcing Bars: ASTM A 706/A 706M, deformed.
 3. Plain-Steel Wire: ASTM A 82, as drawn.
 4. Plain-Steel Welded Wire Fabric: ASTM A 185, fabricated from as-drawn steel wire into flat sheets.
 5. Reinforcing shall be uncoated unless indicated otherwise on the Contract Drawings.

2.3 REINFORCEMENT ACCESSORIES

- A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete or fiber-reinforced concrete of greater compressive strength than concrete, and as follows:
1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected or CRSI Class 2 stainless-steel bar supports.
- B. Joint Dowel Bars: Plain-steel bars, ASTM A 615/A 615M, Grade 60. Cut bars true to length with ends square and free of burrs.

2.4 CONCRETE MATERIALS

- A. Portland Cement: ASTM C 150, Type II.

- B. Normal-Weight Aggregate (NW): ASTM C 33, uniformly graded, and as follows:
 - 1. Class: Severe weathering region, but not less than 3S.
 - 2. Nominal Maximum Aggregate Size: 3/4 inch.
- C. Water: Potable and complying with ASTM C 94.

2.5 CONCRETE REPAIR MATERIALS

- A. Repair material shall be one-component, freeze/thaw resistant cementitious product for below grade, exterior applications with a 2-3 hour finish time. Patching compound shall have a compressive strength of at least 5,000 psi at 28 days as measured by ASTM C-109 and a minimum of 1,000 psi bond strength at 28 days as measured by ASTM C-882 modified when applied in accordance with these specifications.
- B. Water used for cleaning, mixing and finishing shall be clean, potable, free from oil, acid, injurious amounts of vegetable matter, alkalis or other salts. No colorants, accelerators, bonding agents or other additives shall be added to the patching compound without express written direction of the manufacturer. Manufacturer shall have a successful performance history for similar projects of no less than 10 years.
- C. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Concrete Repair Materials
 - a. Emaco S-88 CI by BASF Chemical Company
 - b. Sikarepair SHB by Sika Corporation
 - c. Thin Patch V/O by US Concrete Products, Inc.

2.6 GROUT

- A. Cement Grout: Portland cement, ASTM C 150, Type I; and clean, natural sand, ASTM C 404, Size No. 2. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.
- B. Nonmetallic, Shrinkage-Resistant Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, Portland cement, shrinkage compensating agents, plasticizing and water-reducing

agents, complying with ASTM C 1107, of consistency suitable for application, and a 30-minute working time.

2.7 ADMIXTURES

- A. General: Admixtures certified by manufacturer to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material and to be compatible with other admixtures and cementitious materials. Do not use admixtures containing calcium chloride.
- B. Air-Entraining Admixture: ASTM C 260.
- C. Water-Reducing Admixture: ASTM C 494, Type A.
- D. Water-Reducing and Accelerating Admixture: ASTM C 494, Type E.
- E. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.

2.8 WATERSTOPS

- A. Flexible PVC Waterstops: CE CRD-C 572, for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.
 - 1. Profile: Ribbed with center bulb.
- B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. PVC Waterstops:
 - a. Greenstreak.
 - b. Meadows: W. R. Meadows, Inc.
 - c. Vinylex Corporation.
- C. Self-Expanding Strip Waterstops: Manufactured rectangular or trapezoidal strip, sodium bentonite or other hydrophylic material for adhesive bonding to concrete.
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

- a. Volclay Waterstop-RX; Colloid Environmental Technologies Co.
- b. Hydrotite; Greenstreak.
- c. Adeka Ultra Seal; Mitsubishi International Corporation.

2.9 CURING MATERIALS

- A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. dry.
- B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- C. Water: Potable.
- D. Volatile Organic Compounds (VOC) shall meet maximum emission limits of authorities having jurisdiction at project site.

2.10 RELATED MATERIALS

- A. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
- B. Epoxy-Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class and grade to suit requirements, and as follows:
 1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

2.11 CONCRETE MIXES

- A. Prepare design mixes for each type and strength of concrete determined by either laboratory trial mix or field test data bases, as follows:
 1. Proportion normal-weight concrete according to ACI 211.1 and ACI 301.
 2. Ground Granulated Blast-furnace slag shall not be used.
 3. Fly ash shall not be used.
- B. Use a qualified independent testing agency for preparing and reporting proposed mix designs for the laboratory trial mix basis.

C. Concrete mixes shall be designed for the classes indicated below and in accordance with the requirements indicated.

Design Mix Schedule								
Class	Specified Compressive Strength (psi)	Minimum Cement Content (lb/cy)	*Maximum Water/Cementitious Ratio	Admixture				Density and Aggregate Size
				% Air Entrainment	Corrosion Inhibitor (gal./cy)	Fiber Reinforcement (lb/cy)	Silica Fume (%/wt. Cement)	
A	4,000	610	0.44	5.5+/-1	N/A	N/A	N/A	NW-3/4"
B	1,500	N/A	0.76	N/A	N/A	N/A	N/A	NW-3/4"
C	5,000** (min.) (pre-cast)	Set By Manufacturer	0.44	5.5+/- 1	N/A	N/A	N/A	NW-3/4"

* Total water in mix at time of mixing, including free water in aggregates.

** Concrete strength to be determined by Manufacturer as required by Design.

NW = Normal Weight Aggregate – Refer to 2.4(C)

1. Class A shall be used on all areas as indicated on the drawings and as follows: Structural (S Series) and Civil (C Series).
2. Class B shall only be used where ever low strength concrete fill is indicated.
3. Class C shall be used for Pre-cast concrete structures.

Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant; at no additional cost to Owner and as accepted by the Engineer. Laboratory test data for revised mix design and strength results must be submitted to and accepted by the Engineer before using in work.

- D. Slump Limits: Proportion and design mixes to result in concrete slump at point of placement as follows:
 - 1. Other concrete: Not more than 4 inches.
- E. Admixtures: Subject to Engineer's approval, use admixtures according to manufacturer's written instructions.
 - 1. Use water-reducing admixture 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.

2.12 FABRICATING REINFORCEMENT

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

2.13 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94, and furnish batch ticket information.
 - 1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 – EXECUTION

3.1 FORMWORK

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until concrete 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 concrete surfaces exposed to view.
 - 2. Class C, 1/2 inch, for other concrete surfaces.
- D. Construct forms tight enough to prevent loss of concrete mortar.
- E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical. Kerf wood inserts for forming keyways, reglets, recesses, and the like, for easy removal.
 - 1. 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 inspection ports where interior area of 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 where indicated on Drawings.
- I. Do not chamfer corners or edges of concrete.
- J. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.
- K. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- L. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- M. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use Setting Drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 1. Install anchor bolts, accurately located, to elevations required.

3.3 GROUTING OF EQUIPMENT

- A. Set equipment accurately in locations and to elevations indicated and according to manufacturer's recommendation.
- B. Clean concrete and equipment bearing surfaces of bond-reducing materials and roughen surfaces prior to setting.
 - 1. Set equipment on wedges, shims, or setting nuts as required by the manufacturer.
 - 2. Tighten anchor bolts after supported members have been positioned and plumbed. Do not remove wedges or shims, but, if protruding, cut off flush with edge of base or bearing plate prior to packing with grout.
 - 3. Pack grout solidly between bearing surfaces and equipment so no voids remain. Finish exposed surfaces, protect installed materials, and allow to cure.
 - a. Comply with manufacturer's instructions for proprietary grout materials:

3.4 REMOVING AND REUSING FORMS

- A. General: Formwork, for sides of beams, walls, columns, and similar parts of the Work, that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 72 hours after placing concrete provided concrete is hard enough to not be damaged by form-removal operations and provided curing and protection operations are maintained. When cold weather concrete requirements apply, formwork shall be left-in-place for a minimum of 7 days.
- B. Leave formwork, for beam soffits, joists, slabs, and other structural elements, that supports weight of concrete in place until concrete has achieved the following:
 - 1. At least 75 percent of 28-day design compressive strength.

2. Determine compressive strength of in-place concrete by testing representative field cured test specimens according to ACI 301.
 3. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.
- C. 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.
- D. 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 Engineer.

3.5 SHORES AND RESHORES

- A. Comply with ACI 318, ACI 301, and recommendations in ACI 347R for design, installation, and removal of shoring and reshoring.
- B. In multistory construction, extend shoring or reshoring over a sufficient number of stories to distribute loads in such a manner that no floor or member will be excessively loaded or will induce tensile stress in concrete members without sufficient steel reinforcement.
- C. Plan sequence of removal of shores and reshore to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excessive stress or deflection.

3.6 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials.
- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain required concrete cover. Do not tack weld crossing reinforcing bars, unless indicated on the Drawings.
1. Shop- or field-weld reinforcement according to AWS D1.4, only where indicated on the Drawings.
 2. Do not install reinforcement into previously placed concrete.

- D. Set wire ties with ends required into concrete, not toward exposed concrete surfaces.
- E. Install welded wire fabric 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.

3.7 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by the Engineer.
 - 1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated.
 - 2. Form using bulkhead forms with keys, unless otherwise indicated. Leave-in-place bulkhead forms are prohibited.
 - 3. Use a bonding agent at locations where indicated on Drawings, and where fresh concrete is placed against hardened concrete surfaces.

3.8 WATERSTOPS

- A. Flexible Waterstops: Install in construction joints as indicated to form a continuous diaphragm. Install in longest lengths practicable. Support and protect exposed waterstops during progress of Work. Field-fabricate joints in waterstops according to manufacturer's written instructions.
- B. Self-Expanding Strip Waterstops: Install in construction joints and at other locations indicated, according to manufacturer's written instructions, bonding or mechanically fastening and firmly pressing into place. Install in longest lengths practicable.

3.9 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 in writing by the Engineer.

- C. Deposit concrete continuously or in 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 specified. Deposit concrete to avoid segregation.

- D. Deposit concrete in forms in horizontal layers no deeper than 24 inches and in a manner to avoid inclined construction joints. Place each layer while preceding layer is still plastic, to avoid cold joints.
 - 1. Limit drop height of concrete off of chute to 48-inches.
 - 2. Consolidate placed concrete with mechanical vibrating equipment. Use equipment and procedures for consolidating concrete recommended by ACI 309R.
 - 3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations no farther than the visible effectiveness of the vibrator. Place vibrators 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 mix constituents to segregate.

- E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
 - 1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 - 2. Maintain reinforcement in position on chairs during concrete placement.
 - 3. Screed slab surfaces with a straightedge and strike off to correct elevations.
 - 4. Slope surfaces uniformly to drains where required.
 - 5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, free of humps or hollows, before excess moisture or bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

6. Pulling of welded wire fabric through wet concrete from subgrade is prohibited.
- 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 air temperature has fallen to or is expected to fall below 40 deg F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.
 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 mix designs.
- G. Hot-Weather Placement: Place concrete according to recommendations in ACI 305R and as follows, when hot-weather conditions exist:
1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
 2. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
 3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.10 FINISHING FORMED SURFACES

- A. The finish of formed surfaces shall proceed concurrently with, or immediately after the repair of surface defects. The selection of finishes shall be as indicated in the table below.

Concrete Surfaces)Location	Finishes (Formed	Finish
Footings, exterior walls, pile caps, portions of grade beams below grade and all other concrete not exposed to view		Rough-Formed Finish
Walls, portions of grade beams above grade, and all other concrete surfaces exposed to view. Surfaces to be coated or covered with waterproofing, dampproofing, plaster or paint		Smooth-Formed Finish

- B. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defective areas repaired and patched. Remove fins and other projections exceeding ACI 347R limits for class of surface specified.
- C. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defective areas. Remove fins and other projections exceeding 1/8 inch in height.
1. Apply to concrete surfaces exposed to public view or to be covered with a coating or covering material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster, or painting.
- D. Smooth Rubbed Finish to Permanently Exposed Surfaces: Apply the following to smooth-formed finished concrete:
1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
- E. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.11 MISCELLANEOUS CONCRETE ITEMS

- A. Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete Work.

3.12 CONCRETE PROTECTION 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 with recommendations in ACI 305R for hot-weather protection during curing.
- B. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing by one or a combination of the following methods:
- C. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces, by one or a combination of the following methods:
 - 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
 - a. Water.
 - b. Continuous water-fog spray.
 - c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
 - 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
 - a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
 - b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
 - c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer recommends for use with floor coverings.

3.13 CONCRETE SURFACE REPAIRS

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

3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
 4. Correct other low areas scheduled to 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. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
 6. 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 3/4 inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mix as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
 7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.
- E. Perform structural repairs of concrete, subject to Engineer's approval, using epoxy adhesive and patching mortar.
- F. Repair materials and installation not specified above may be used, subject to Engineer's approval.

3.14 FIELD QUALITY CONTROL

- A. Testing Agency: Contractor shall employ qualified independent testing and inspecting agency to sample materials, perform tests, and submit test reports during concrete placement according to requirements specified in this Article.

- B. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete, plus one set for each additional 50 cu. yd. or fraction thereof.
 - a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mix, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
 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 mix. Perform additional tests when concrete consistency appears to change.
 3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; ASTM C 173, volumetric method, for structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.
 4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
 5. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of four standard cylinder specimens for each composite sample.
 - a. Cast and field cure one additional set of four standard cylinder specimens for each composite sample, when outside air temperature is below or expected to fall below 40°F (4.4°C) that night. Also provide field cured cylinders to determine strength for form removal.
 6. Compressive-Strength Tests: ASTM C 39; test one laboratory-cured specimen at 7 days, two at 28 days, and one at 56 days.
- C. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
- D. Strength of each concrete mix 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.

- E. Test results shall be reported in writing via FAX to Engineer, Owner, 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 mix proportions and materials, compressive breaking strength, and type of break for both 7-and 28-day tests.
- F. 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 shall conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42 or by other methods as required by Engineer. Petrographical analysis to determine water/cement ratio cement content, hydrated cement content, etc. shall be performed by the testing and inspection agency as required by the Engineer when test results indicate requirements have not been met.

3.15 CONTRACT CLOSEOUT

- A. Provide in accordance with Section 01701.

PART 4 - COMPENSATION

Item 3300.1 – CIP Concrete Pipe Connection Greater Than 24-inch Through 36-inch Diameter (CIP Field Closure)

METHOD OF MEASUREMENT:

Measurement for payment for CIP Concrete Pipe Connection Greater Than 24-inch Through 36-inch Diameter (CIP Field Closure) shall be on the basis of the number of individual collars, of this size, complete as measured by the Engineer.

BASIS OF PAYMENT / INCLUSIONS:

Payment for CIP Concrete Pipe Connection Greater Than 24-inch Through 36-inch Diameter (CIP Field Closure) will be based on the unit price bid for this item in the proposal. Under the unit price bid for this item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required to furnish and install concrete collars greater than 24-inch through 36-inch in diameter as detailed in the Contract Drawings. The work shall include, but is not limited to: furnishing and installing rebar; furnishing, installing and removing formwork; furnishing and installing waterstops and seals; furnishing and installing concrete; jointing; preparation of subgrade; furnishing, installing and compacting bedding;

saw cutting; excavation; temporary excavation support installed, left in place and cut off below grade where required or required; furnishing and placing backfill per one of the approved methods; compaction; compaction testing; concrete testing; construction dewatering; dampproofing; brick masonry and all incidental work required to construct the collar as detailed and specified.

EXCLUSIONS

Items not included for payment herein include, but are not limited to; pipe collars for sizes other than greater than 24-inch through 36-inch Diameter and removal of concrete slab and railroad rails and ties. Pipe rubber couplings for pipe sizes equal to and less than 24-in are paid for separately.

Item 3300.2 – CIP Concrete Pipe Connection Greater Than 36-inch Through 48-inch Diameter (CIP Field Closure)

METHOD OF MEASUREMENT:

Measurement for payment for CIP Concrete Pipe Connection Greater Than 36-inch Through 48-inch Diameter (CIP Field Closure) shall be on the basis of the number of individual collars, of this size, complete as measured by the Engineer.

BASIS OF PAYMENT / INCLUSIONS:

Payment for CIP Concrete Pipe Connection Greater Than 36-inch Through 48-inch Diameter (CIP Field Closure) will be based on the unit price bid for this item in the proposal. Under the unit price bid for this item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required to furnish and install concrete collars greater than 36-inch through 48-inch in diameter as detailed in the Contract Drawings. The work shall include, but is not limited to: furnishing and installing rebar; furnishing, installing and removing formwork; furnishing and installing waterstops and seals; furnishing and installing concrete; jointing; preparation of subgrade; furnishing, installing and compacting bedding; saw cutting; excavation; temporary excavation support installed, left in place and cut off below grade where required or required; furnishing and placing backfill per one of the approved methods; compaction; compaction testing; concrete testing; construction dewatering; dampproofing; brick masonry and all incidental work required to construct the collar as detailed and specified.

EXCLUSIONS

Items not included for payment herein include, but are not limited to; pipe collars for sizes other than greater than 36-inch through 48-inch Diameter; CIP Concrete Pipe Connection between 48-inch Diameter and NCRS Overflow Structure; and removal of concrete slab and railroad rails and ties. Pipe rubber couplings for pipe sizes equal to and less than 36-in are paid for separately.

Item 3300.3 – CIP Concrete Pipe Connection between 48-inch Diameter and NCRS Overflow Structure

METHOD OF MEASUREMENT:

Measurement for payment for CIP Concrete Pipe Connection between 48-inch Diameter and NCRS Overflow Structure shall be on a Lump Sum basis paid by the schedule of values, complete as measured by the Engineer.

BASIS OF PAYMENT / INCLUSIONS:

Payment for CIP Concrete Pipe Connection between 48-inch Diameter and NCRS Overflow Structure will be based on the Lump Sum Price bid for this item in the proposal. Under the Lump Sum Price bid for this item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required to furnish and install CIP Concrete Pipe Connection between 48-inch Diameter and NCRS Overflow Structure as detailed in the Contract Drawings. The work shall include, but is not limited to: selective demolition of RCP pipe, brick pipe, and brick manhole as shown on the Contract Drawings; protection of existing structures as shown on the Contract Drawings; furnishing and installing rebar; furnishing, installing and removing formwork; furnishing and installing waterstops and seals; furnishing and installing concrete; jointing; preparation of subgrade; furnishing, installing and compacting bedding; saw cutting; excavation; temporary excavation support installed, left in place and cut off below grade where required or required; furnishing and placing backfill per one of the approved methods; compaction; compaction testing; concrete testing; construction dewatering; dampproofing; brick masonry and all incidental work required to construct the collar as detailed and specified.

EXCLUSIONS

Items not included for payment herein include, but are not limited to: all other pipe collars; furnishing and installation of FRP pipe; furnishing and installation of manhole; and removal of concrete slab and railroad rails and ties.

Item 3300.4 – CIP Concrete Water Quality Sampling Station Equipment Pad

METHOD OF MEASUREMENT:

Measurement for payment for CIP Concrete Water Quality Sampling Station Equipment Pad shall be on a Lump Sum basis paid by the schedule of values, complete as measured by the Engineer.

BASIS OF PAYMENT / INCLUSIONS:

Payment for CIP Concrete Water Quality Sampling Station Equipment Pad will be based on the Lump Sum Price bid for this item in the proposal. Under the Lump Sum Price bid for this item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required to furnish and install CIP Concrete Water Quality Sampling Station Equipment Pad as detailed in the Contract Drawings. The work shall include, but is not limited to: excavation; coordination with electrical and telecom conduits as shown on the Contract Drawings; coordination with 8” Ductile Iron sampling pipe as shown on Contract Drawings; coordination with sidewalk demolition and restoration; furnishing and installing rebar;

furnishing, installing and removing formwork; furnishing and installing waterstops and seals; furnishing and installing concrete; jointing; preparation of subgrade; furnishing, installing and compacting bedding; saw cutting; excavation; temporary excavation support installed, left in place and cut off below grade where required or required; furnishing and placing backfill per one of the approved methods; compaction; compaction testing; concrete testing; construction dewatering; dampproofing; brick masonry and all incidental work required to construct the collar as detailed and specified.

EXCLUSIONS

Items not included for payment herein include, but are not limited to: electrical and telecom conduit; ductile iron sampling pipe; sidewalk restoration; concrete base for irrigation systems, bus shelters, or other surface restoration appurtenances.

END OF SECTION 03300

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SECTION 03315

GROUT

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Furnish all materials for grout in accordance with the provisions of this Section and shall form, mix, place, cure, repair, finish, and do all other work as required to produce finished grout, in accordance with the requirements of the Contract Documents.
- B. The following types of grout shall be covered in this Section:
 - 1. Non-Shrink Grout: This type of grout is to be used wherever grout is shown in the Contract Documents, unless another type is specifically referenced.
 - 2. Cement Grout
 - 3. Epoxy Grout
 - 4. Topping Grout

1.2 RELATED WORK

- A. Section 03300 - CONCRETE

1.3 SUBMITTALS

- A. Shop Drawings: Submit the following in accordance with Section 01300 – SUBMITTALS:
 - 1. Submit certified test results verifying the compressive strength, shrinkage, and expansion requirements specified herein; and manufacturer's literature containing instructions and recommendations on the mixing, handling, placement and appropriate uses for each type of non-shrink and epoxy grout used in the work.

1.4 QUALITY CONTROL

A. Field Tests:

1. Cement Grout and Topping Grout
 - a. Compressive strength of cement grout and topping grout shall be tested in accordance with the requirements of ASTM C 109. The frequency of tests shall conform to the requirements of Section 03300 - CONCRETE.
2. Prepackaged Grout
 - a. Compression test specimens shall be taken during construction from the first placement of each type of grout, and for each different batch number of each type of grout thereafter. The specimens will be made by the Owner or its representative.
 - b. Compression tests and fabrication of specimens for non-shrink grout shall be performed as specified in ASTM C 109. A set of three specimens shall be made for testing at 24 hour, 28 days, and each additional time period as appropriate.
 - c. Compression tests and fabrication of specimens for epoxy grout shall be performed as specified in ASTM C 579, Method B. A set of three specimens shall be made for testing at 24 hours, and each earlier time period as appropriate.
3. All grout, already placed, which fails to meet the requirements of these specifications, is subject to removal and replacement at the cost of the Contractor.
4. The cost of all laboratory and field tests on grout shall be borne by the Contractor, and the Contractor shall assist the Owner in obtaining specimens for testing. The Contractor shall supply all materials necessary for fabricating the test specimens.

- ### B. Construction Tolerances: Construction tolerances shall be as specified in the Section 03300 - CONCRETE except as modified herein and elsewhere in the Contract Documents.

PART 2 - PRODUCTS

2.1 CEMENT GROUT

- A. Cement Grout: Cement grout shall be composed of one part cement, three parts sand, and the minimum amount of water necessary to obtain the desired consistency. Where needed to match the color of adjacent concrete, white Portland cement shall be blended with regular cement as needed. The minimum compressive strength at 28 days shall be 4000 psi.
- B. Cement grout materials shall be as specified in Section 03300 - CONCRETE.

2.2 PREPACKAGED GROUTS

- A. Non-Shrink Grout:
 - 1. Non-shrink grout shall be a prepackaged, inorganic, non-gas-liberating, non-metallic, cement-based grout requiring only the addition of water. Manufacturer's instructions shall be printed on each bag or other container in which the materials are packaged. The specific formulation for each class of non-shrink grout specified herein shall be that recommended by the manufacturer for the particular application.
 - 2. Class A non-shrink grouts shall have a minimum 28 day compressive strength of 5000 psi; shall have no shrinkage (0.0 percent) and a maximum 4.0 percent expansion in the plastic state when tested in accordance with ASTM C-827; and shall have no shrinkage (0.0 percent) and a maximum of 0.2 percent expansion in the hardened state when tested in accordance with CRD C 621.
 - 3. Class B non-shrink grouts shall have a minimum 28 day compressive strength of 5000 psi and shall meet the requirements of CRD C 621.
 - 4. Application:
 - a. Class A non-shrink grout shall be used for the repair of all holes and defects in concrete members which are water bearing or in contact with soil or other fill material, grouting under all equipment base plates, and at all locations where grout is specified in the contract documents; except, for those applications for Class B non-shrink grout and epoxy grout specified herein. Class A non-shrink grout may be used in place of Class B non-shrink grout for all applications.

- b. Class B non-shrink grout shall be used for the repair of all holes and defects in concrete members which are not water-bearing and not in contact with soil or other fill material, grouting under all base plates for structural steel members, and grouting railing posts in place.

B. Epoxy Grout:

1. Epoxy grout shall be a pourable, non-shrink, 100 percent solids system. The epoxy grout system shall have three components: resin, hardener, and specially blended aggregate, all pre-measured and prepackaged. The resin component shall not contain any non-reactive diluents. Resins containing butyl glycidyl ether (BGE) or other highly volatile and hazardous reactive diluents are not acceptable. Variation of component ratios is not permitted unless specifically recommended by the manufacturer. Manufacturer's instructions shall be printed on each container in which the materials are packaged. Epoxy grout shall be Burk Epoxy Anchoring Grout by The Burke Company, Sikadur 32 Hi-Mod by Sika Corporation, Richmond, VA, Sikadur 32, Hi-Mod Gel by Sika Corporation, Richmond, VA, or approved equivalent.
2. The chemical formulation of the epoxy grout shall be that recommended by the manufacturer for the particular application.
3. The mixed epoxy grout system shall have a minimum working life of 45 minutes at 75 degrees F.
4. The epoxy grout shall develop a compressive strength of 5000 psi in 24 hours and 10,000 psi in seven days when tested in accordance with ASTM C 579, Method B. There shall be no shrinkage (0.0 percent) and a maximum 4.0 percent expansion when tested in accordance with ASTM C 827.
5. The epoxy grout shall exhibit a minimum effective bearing area of 95 percent. This shall be determined by a test consisting of filling a 2-inch diameter by 4-inch high metal cylinder mold covered with a glass plate coated with a release agent. A weight shall be placed on the glass plate. At 24 hours after casting, the weight and plate shall be removed and the area in plan of all voids measured. The surface of the grout shall be probed with a sharp instrument to locate all voids.
6. The peak exotherm of a 2-inch diameter by 4-inch high cylinder shall not exceed 95 degrees F when tested with 75 degree F material at laboratory temperature. The epoxy grout shall exhibit a maximum thermal coefficient of 30×10^{-6} inches/inch/degree F when tested according to ASTM C 531 or ASTM D 696.

7. Application: Epoxy grout shall be used to embed all anchor bolts and reinforcing steel required to be set in grout, and for all other applications required in the Contract Documents.

2.3 TOPPING GROUT

- A. Grout for topping of slabs shall be composed of cement, fine aggregate, coarse aggregate, water, and admixtures proportioned and mixed as specified herein. All materials and procedures specified for normal concrete in Section 03300 shall apply except as noted otherwise herein.
- B. Topping grout shall contain a minimum of 564 pound of cement per cubic yard with a maximum water cement ratio of 0.45.
- C. Coarse aggregate shall be graded as follows:

US Standard Sieve Size	Percent By Weight Passing
1/2"	100
3/8"	90-100
No. 4	20-55
No. 8	5-30
No. 16	0-10
No. 30	0

- D. Final mix design shall be as determined by trial mix design under supervision of the approved testing laboratory.
- E. Strength: Minimum compressive strength of topping grout at the end of 28 days shall be 3000 psi.

2.4 CURING MATERIALS

- A. Curing materials shall be as specified in Section 03300 - CONCRETE, for cement grout and as recommended by the manufacturer of prepackaged grouts.

2.5 CONSISTENCY

- A. The consistency of grouts shall be that necessary to completely fill the space to be grouted for the particular application.
- B. The slump for topping grout shall be adjusted to match placement and finishing conditions but shall not exceed 4 inches.

2.6 MEASUREMENT OF INGREDIENTS

- A. Measurements for cement grout shall be made accurately by volume using containers. Shovel measurement shall not be allowed.
- B. Prepackaged grouts shall have ingredients measured by means recommended by the manufacturer.

PART 3 - EXECUTION

3.1 GENERAL

- A. All surface preparation, curing, and protection of cement grout shall be as specified in Section 03300 - CONCRETE. The finish of the grout surface shall match that of the adjacent concrete.
- B. The manufacturer of Class A non-shrink grout and epoxy grout shall provide on-site technical assistance upon request.
- C. Base concrete or masonry must have attained its design strength before grout is placed, unless authorized by the Engineer.

3.2 GROUTING PROCEDURES

- A. Prepackage Grouts: All mixing, surface preparation, handling, placing, consolidation, curing, and other means of execution for prepackaged grouts shall be done according to the instructions and recommendations of the manufacturer.
- B. Base Plate Grouting:

1. For base plates, the original concrete shall be blocked out or finished off a sufficient distance below the plate to provide for a one-inch thickness of grout or a thickness as shown on the Drawings.
2. After the base plate has been set in position at the proper elevation by steel wedges or double nuts on the anchor bolts, the space between the bottom of the plate and the original pour of concrete shall be filled with non-shrink-type grout. The mixture shall be of a trowelable consistency and tamped or rodded solidly into the space between the plate and the base concrete. A backing board or stop shall be provided at the back side of the space to be filled with grout. Where this method of placement is not practical or where required by the Owner, alternate grouting methods shall be submitted for acceptance by the Engineer.

C. Topping Grout:

1. All mechanical, electrical, and finish work shall be completed prior to placement of topping. The base slab shall be given a roughened textured surface by sandblasting or hydroblasting exposing the aggregates to ensure bonding to the base slab.
2. The minimum thickness of grout topping shall be one inch. Where the finished surface of concrete fill is to form an intersecting angle of less than 45 degrees with the concrete surface it is to be placed against, a key shall be formed in the concrete surface at the intersection point. The key shall be a minimum of 3-1/2-inches wide by 1-1/2-inches deep.
3. The base slab shall be thoroughly cleaned and wetted prior to placing topping. No topping concrete shall be placed until the slab is completely free from standing pools or ponds of water. A thin coat of neat Type II cement grout shall be broomed into the surface of the slab just before topping of fill placement. The topping shall be compacted by rolling or tamping, brought to established grade, and floated.
4. Topping grout placed on sloping slabs shall proceed uniformly from the bottom of the slab to the top, for the full width of the placement.
5. The surface shall be tested with a straight edge to detect high and low spots which shall be immediately eliminated. When the topping has hardened sufficiently, it shall be steel troweled to a smooth surface free from pinholes and other imperfections. An approved type of mechanical trowel may be used as an assist in this operation, but the last pass over the surface shall be by hand-troweling. During

finishing, no water, dry cement or mixture of dry cement and sand shall be applied to the surface.

3.3 CONSOLIDATION

- A. Grout shall be placed in such a manner, for the consistency necessary for each application, so as to assure that the space to be grouted is completely filled.

PART 4 – COMPENSATION (Not Used)

END OF SECTION 03315

SECTION 03411

PRECAST CONCRETE VAULTS AND STRUCTURES

3411.1	ISOLATION GATE STRUCTURE	LUMP SUM
3411.2	TOTAL PHOSPHOROUS DEFLECTION STRUCTURE	LUMP SUM
3411.3	OUTFALL	LUMP SUM

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Precast concrete for the isolation gate structure, the total phosphorous deflection structure, and the outfall to the Charles River.

1.2 RELATED WORK

- A. Section 02252 – MANHOLES
- B. Section 02271– RIP RAP
- C. Section 02715 – PRECAST REINFORCED CONCRETE BOX CULVERT AND HEADWALL
- D. Section 03300 – CONCRETE
- E. Section 03315 – GROUT
- F. Section 07160 – DAMPROOFING
- G. Section 32000 – ROADWAY AND STREETScape CONSTRUCTION

1.3 SUBMITTALS

- A. Shop Drawings: submit the following in accordance with requirements specified in section 01300 - SUBMITTALS.
 - 1. Shop Drawings: Design calculations; structural drawings and drawings indicating layout, unit locations, fabrication details, reinforcement, connection details, support items, dimensions, openings, and relationship to adjacent materials; and Certificate of Design all signed and sealed by a Professional Structural Engineer licensed in the State of Massachusetts.

1.4 DESIGN REQUIREMENTS

- A. Design system to accommodate construction tolerances, deflection of other building structural members, and clearances of intended openings.
- B. Design structural precast concrete members in accordance with ACI 350R.

1.5 QUALITY CONTROL

- A. Perform work in accordance with the requirements of PCI MNL-116 Manual for Quality Control for Plants and Production of Structural Pre-cast Concrete Products, latest edition; ACI 301; Specifications for Structural Concrete; and Manual of Concrete Practice, latest edition.

1.6 QUALIFICATIONS

- A. Fabricator: Company specializing in manufacturing watertight precast concrete components with minimum five years documented experience.
- B. Erector: Company specializing in erecting watertight precast concrete components with five years documented experience and approved by manufacturer.
- C. Welder: Qualified within previous 12 months in accordance with AWS D 1.1 Structural Welding Code - Steel and AWS D1.4 Structural Welding Code – Reinforcing Steel.
- D. Design precast concrete members under direct supervision of a Professional Structural Engineer experienced in design of structural precast concrete components and licensed in the State of Massachusetts.

1.7 REGULATORY REQUIREMENTS

- A. Conform to ACI 350-06 Code Requirements for Environmental Engineering Concrete Structures and Commentary for design load and construction requirements applicable to work of this section.

1.8 DELIVERY, STORAGE, AND PROTECTION

- A. Deliver, store, protect, and handle products at the site under provisions of Section 01600 – PRODUCTS, MATERIALS AND EQUIPMENT.
- B. Handle precast members in position consistent with their shape and design. Lift and support only from support points.

- C. Lifting or Handling Devices: Capable of supporting member in positions anticipated during manufacture, storage, transportation, and erection.
- D. Protect members to prevent staining, chipping, or spalling of concrete.
- E. Mark each member with date of production and final position in structure.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Cement: Cement shall conform to the requirements of Section 03300 – CONCRETE.
- B. Aggregate, Sand, Water, Admixtures: Determined by precast fabricator as appropriate to design requirements and PCI MNL-116 and Section 03300 – CONCRETE.

2.2 ACCESSORIES

- A. Connecting and Supporting Devices: ASTM A 666 stainless steel plates, angles, items cast into concrete.
- B. Grout: Grout shall conform to the requirements set forth in Section 03315 - GROUT.
- C. Pre-cast vaults and structures shall further conform to the applicable requirements of Section 02252 – MANHOLES and applicable details.

2.3 FABRICATION

- A. Fabrication procedure to conform to PCI MNL-116 and ACI 318.
- B. Maintain plant records and quality control program during production of precast members. Make records available upon request.
- C. Ensure reinforcing steel, anchors, inserts, plates, angles, and other cast-in items are embedded and located as indicated on shop drawings.

2.4 LOADS

- A. Structures Below Grade
 - 1. Hydrostatic liquid pressure due to maximum 62.4 lb./CF internal operating liquid level with no balancing external lateral pressure.

2. Lateral soil pressure with groundwater 90 psf assumed at finished grade.
3. Lateral seismic loads: Per Massachusetts State Building Code
4. Lateral load due to surcharge loading of 250 psf construction crane and AASHTO HS-20 loading shall be added to load (2).
5. All Structures shall be designed to resist buoyancy due to ground water at finished grade with a Minimum Safety Factor (S.F.) equal to 1.10.
6. Roof Slab at or below Grade:
DL: Weight of Concrete Slab
SDL: Backfill or other Superimposed Dead Loads
LL: Greater of 400 psf or equipment weight plus 50 psf, or AASHTO HS 20 load.
7. Structures and all related elements shall be designed to accommodate an internal hydraulic pressure of 10 psi.

2.5 DESIGN STRESSES

A. Concrete and Reinforcing Steel

1. Liquid Containing Structures:
Building Code Requirements for Reinforced Concrete, with durability factor per ACI 350-06, Code Requirements for Environmental Engineering Concrete Structures and Commentary, and base crack control on a maximum Z of 115.

Specified concrete compressive strength of concrete

$$f'c = 5,000 \text{ psi}$$

Reinforcing steel (A 615, Gr. 60)

$$fy = 60,000 \text{ psi}$$

2.6 DESIGN CONSIDERATIONS

A. Below Grade Structure Load Cases:

1. Structure empty with full lateral exterior load.
2. Structure filled to the maximum level possible with water while disregarding exterior soil pressures.

- B. All elements of the Precast Vaults and Structures specified shall be designed to withstand internal hydraulic pressures of 10 psi or greater. Such elements include but are not limited to:
 - 1. Jointing
 - 2. Pipe Connections
 - 3. Raising frames and covers to grade. Use of bricks and mortar is strictly prohibited. Precast or cast-in-place riser rings shall be used.
 - 4. Precast Concrete Removable Slabs with lifting hooks
 - 5. Mounting various mechanical elements (i.e. slide gates; gate valves; valve boxes; flap valves; etc.)

2.7 FABRICATION TOLERANCES

- A. Conform to PCI MNL-116.
- B. Maximum Out-of-Square: 1/8 inch/10 feet, non-cumulative.
- C. Maximum Misalignment of Anchors, Inserts, Openings: 1/8 inch.

PART 3 – EXECUTION

- 3.1 INSPECTION: Acceptance of precast reinforced concrete sections and structures will be made on the basis of plant tests, material tests, and inspection of the completed product, in accordance with the requirements of ASTM C478, latest revision, with the following modifications.
 - A. Complete Structures and Sections shall not be shipped for at least five days after manufacture when cured by subjecting them to thoroughly saturated steam at a temperature between 100 and 150 degrees F for a period of not less than 8 hours, or when necessary, for such additional time as may be required to enable the manhole sections to meet specification requirements.
 - B. All Structures and Sections will be inspected upon delivery; structures or sections which do not conform to specification requirements will be rejected and shall be removed immediately from the site by the Contractor. Furnish all labor and facilities necessary to assist the Owner in inspecting the material.
 - C. All structures and sections which have been damaged after delivery, or damaged during the work will be rejected and shall be removed and replaced by the

Contractor with new, sound and approved material, at no additional expense to the Owner. At the time of inspection, the surfaces of the structures and sections shall be dense and close-textured. Cores shall serve as a basis for rejection if poor bond or reinforcement is exposed.

- D. The quality of all materials, processes of manufacture, and the finished structures and sections shall be subject to inspection and approval of the Owner. Such inspection may be made at the place of manufacture and/or on the site, and the structures and sections shall be subject to rejection at any time because of failure to meet any of the specification requirements, even though sample manhole sections may have been accepted as satisfactory.

3.2 HANDLING:

- A. Each structure or section shall be handled into its position in the trench only in such manner and by such means as recommended by the manufacturer of the structure sections, and as approved. Provide all necessary slings, straps and other devices for the safe and satisfactory handling and support of the sections during lifting, installation and final positioning of the sections. Lifting holes may be permitted provided suitable rubber or concrete stopper or other approved devices are provided for plugging and sealing the holes and watertight, all as approved.

3.3 INSTALLATION:

- A. Installation shall be according to manufacturer's instructions.

3.4 BITUMINOUS DAMPPROOFING:

- A. In accordance with Section 07160 - DAMPPROOFING.

3.5 SURFACE RESTORATION RELATED TO THE OUTFALL

- A. In accordance with Section 32000 – ROADWAY AND STREETSCAPE CONSTRUCTION. Specifically, refer to Items 32765.91 Hydroseeded Native Planting at Western Outfall, 32765.92 Custom Fescue Lawn Mix, and 32767.7 Salt Marsh Hay Mulch at Western Outfall.

PART 4 – COMPENSATION

Item 3411.1 – Isolation Gate Structure

METHOD OF MEASUREMENT:

Payment for the Isolation Gate Structure shall be based on the Lump Sum Price bid in the proposal. Measurement for payment for the Isolation Gate Structure will be on a percent of the

Lump Sum bid calculated by dividing the elapsed time to date by the contractual construction time limit as approved by the Engineer.

BASIS OF PAYMENT / INCLUSIONS:

Under the Lump Sum Price bid for this item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required for the complete procurement, installation, cleaning, and leakage testing/inspection of precast concrete Isolation Gate Structure complete as indicated on the Contract Drawings and Specifications, or as directed by the Owner or Engineer. This work shall include furnishing, installing, and/or performing the following: excavation; transporting material to/from soil staging area; filter fabric as required; bedding, including compaction; precast structure with frames, wall flanges, appurtenances, grouting for inverts; miscellaneous metalwork including lifting hooks, stem pocket cover and removable chain; placing and compacting suitable backfill soil; compaction testing; and all incidental work.

SPECIAL NOTES ON EXCLUSIONS:

The following item(s) are not included for payment under this item and are included for payment elsewhere: disposal of construction debris; treatment of groundwater discharged under the DEP Dewatering Permit; procurement of off-site common fill; temporary excavation support consisting of cofferdam; environmental controls; dewatering operations; pipe connections; and furnishing of Access Hatch, Cast Iron Slide Gate, and Access Platform.

Item 3411.2 – Total Phosphorous Deflection Structure

METHOD OF MEASUREMENT:

Payment for the Total Phosphorous Deflection Structure shall be based on the Lump Sum Price bid in the proposal. Measurement for payment for the Total Phosphorous Deflection Structure will be on a percent of the Lump Sum bid calculated by dividing the elapsed time to date by the contractual construction time limit as approved by the Engineer.

BASIS OF PAYMENT / INCLUSIONS:

Under the Lump Sum Price bid for this item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required for the complete procurement, installation, cleaning, and leakage testing/inspection of precast concrete Total Phosphorous Deflection Structure complete as indicated on the Contract Drawings and Specifications, or as directed by the Owner or Engineer. This work shall include furnishing, installing, and/or performing the following: pavement or sidewalk sawcutting; excavation of bituminous concrete roadway; excavation; transporting material to/from soil staging area; temporary excavation support consisting of trench boxes, or timber or steel sheeting left in place and cut off below grade as per the Contract Specifications; dewatering operations; filter fabric as required; bedding, including compaction; precast structure with frames, covers, appurtenances; grouting and brickwork for inverts; miscellaneous metalwork; placing and compacting suitable backfill soil; compaction testing; and all incidental work.

EXCLUSIONS

The following item(s) are not included for payment under this item and are included for payment elsewhere: disposal of construction debris; removal of concrete slab, rails, cobbles, and ties; pipe connections; and embankment and walkway restoration.

Item 3411.3 – Outfall

METHOD OF MEASUREMENT:

Payment for the Outfall shall be based on the Lump Sum Price bid in the proposal. Measurement for payment for the Outfall will be on a percent of the Lump Sum bid calculated by dividing the elapsed time to date by the contractual construction time limit as approved by the Engineer.

BASIS OF PAYMENT / INCLUSIONS:

Under the Unit Price bid for this item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required to for the installation of the outfall and related outfall work as indicated on the Contract Drawings and Specifications, or as required by the Owner or Engineer. This work shall include furnishing, installing, and/or performing the following: prepare and submit all work plans and submittals; install, maintain, and remove hay bales and silt fences along the Charles River embankment; flagging of wetland boundaries; implement provisions of Order of Conditions; compliance with regulatory agency requirements and construction permit fees; install, maintain and remove temporary vegetation for erosion control; furnish, install, maintain, relocate and remove all floating turbidity curtain and floating siltation curtain system measures as shown on the Contract Drawings or at the requirements of the Engineer including but not limited to aluminum spars, sandbags, erosion control filter fabric, and floats; establish the work zone including, but not limited to, temporary fencing and access gate(s), temporary access ramp(s), removal and resetting of all signage within work zone; sawcutting; temporary excavation/fill to establish equipment landings on the river bank, earth support systems, and grading; furnish, install, maintain, and remove temporary excavation support, including cofferdam; excavation, including within the cofferdam; dredging; transporting material to/from soil staging area; dewatering operations; filter fabric as required; bedding, including compaction; fabricate, transport, furnish and install precast concrete headwall structure and precast concrete box culvert sections with appurtenances; joint seals; joining box culvert; bedding; grout; pipe fittings and connections; parging of joints; Class A and B concrete for concrete fill for slope to centerline of invert; placing backfill; compaction; compaction testing, control density fill as backfill; bouyancy control; exterior bituminous damproofing; manufacture pipe testing; in-place testing; concrete; mortar; placing and compacting suitable backfill soil; placing and compacting native soil within the cofferdam; placing and compacting additional crushed stone in the dredged area and within the cofferdam; prepare placement and subgrade for the installation of riprap and foundation stones to the lines and grades shown on the Contract Drawings; furnish and install rip rap and foundation stones; site restoration to the lines and grades shown on the Contract Drawings, including river bottom; loaming and seeding; plantings; shoreline riprap; installation of hot mix asphalt walkway; and all incidental work, in accordance with the sequence of construction.

SPECIAL NOTES ON EXCLUSIONS

The following item(s) are not included for payment under this item and are included for payment elsewhere: sedimentation and erosion control in roadways; overexcavation of peat and other organic silts; tree protection; disposal of construction debris; furnish and installation of isolation gate structure and appurtenances; removing and resetting existing sign on Memorial Drive; removing and resetting existing curb; and installation of new granite curbing as required by the Engineer.

END OF SECTION 03411

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SECTION 05500

MISCELLANEOUS METALS

5500.1

5' X 3' ACCESS HATCH

EACH

PART 1 – GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Steel framing and supports for applications where framing and supports are not specified in other Sections,
2. Shelf angles,
3. Loose bearing and leveling plates,
4. Steel weld plates and angles for casting into concrete not specified in other Sections,
5. Miscellaneous steel trim including steel angle corner guards and steel edgings,
6. Pipe guards,
7. Baffle plates and support angles,
8. Steel hatches

B. Products furnished, but not installed, under this Section include the following:

1. Anchor bolts, steel pipe sleeves, epoxy anchors and wedge-type inserts indicated to be cast into concrete or built into unit masonry.

C. Related Sections include the following:

1. Section 01045 – CUTTING AND PATCHING
2. Section 01630 – RESTORATION OF GROUNDS AND CLEANING UP
3. Section 02590 – BRICK MASONRY

4. Section 03300 – CONCRETE
5. Section 03315 – GROUT
6. Section 03411 – PRECAST CONCRETE VAULTS AND STRUCTURES

1.2 PERFORMANCE REQUIREMENTS

- A. Thermal Movements: Provide exterior metal fabrications that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 1. Temperature Change (Range): ambient - 120 F; material surfaces - 180°F.

1.3 SUBMITTALS

- A. Furnish submittals in accordance with Section 01300 – SUBMITTALS.
- B. Product Data: For the following:
 - 1 Grout.
- C. Shop Drawings: Show fabrication and installation details for metal fabrications.
 1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
 2. Provide templates for anchors and bolts specified for installation under other Sections.
 3. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 4. An ICBO report listing the ultimate load capacity in tension and shear for each size and type of concrete anchor. The Contractor shall submit manufacturer's recommendations installation instructions and procedures for adhesive anchors. Upon review by Engineer, these instructions shall be followed specifically.

5. No substitutions for the indicated adhesive anchors will be considered unless accompanied with ICBO report verifying strength and material equivalency, including temperature at which load capacity is reduced to 90 percent of that determined at 75°F.
- D. Samples for Verification: For each type and finish of extruded nosing and tread.
- E. Mill Certificates: Signed by manufacturers of stainless-steel sheet certifying that products furnished comply with requirements.
- F. Welding certificates.
- G. Qualification Data: For professional engineer.

1.4 QUALITY ASSURANCE

- A. Welding: Weld procedures and welder qualifications shall be available in the Contractor's field office for review. Qualify procedures and personnel according to the following:
 1. AWS D1.1, "Structural Welding Code - Steel."
 2. AWS D1.2, "Structural Welding Code - Aluminum."
 3. AWS D1.3, "Structural Welding Code - Sheet Steel."
 4. AWS D1.6, "Structural Welding Code - Stainless Steel."

1.5 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication and indicate measurements on Shop Drawings.
 1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating metal fabrications without field measurements. Coordinate wall and other contiguous construction to ensure that actual dimensions correspond to established dimensions.
 2. Provide allowance for trimming and fitting at site.

1.6 COORDINATION

- A. Coordinate installation of anchorages for metal fabrications. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- B. Coordinate installation of steel weld plates and angles for casting into concrete that are specified in this Section but required for work of another Section. Deliver such items to Project site in time for installation.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

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

2.2 METALS - GENERAL

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces, unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
- B. Corrosion Protection: Unless otherwise indicated, miscellaneous steel metalwork shall be hot-dip galvanized after fabrication.

2.3 FERROUS METALS

- A. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.
- B. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

- C. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 316L.
- D. Stainless-Steel Bars and Shapes: ASTM A 276, Type 316L.
- E. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.
- F. Rolled-Stainless-Steel Floor Plate: ASTM A 793.
- G. Abrasive-Surface Floor Plate: Steel plate with abrasive material metallurgically bonded to steel by a proprietary process.
 - 1. Products:
 - a. IKG Industries, a Harsco company; Mebac.
 - b. W. S. Molnar Company; SlipNOT.
- H. Steel Tubing: ASTM A 500, cold-formed steel tubing.
- I. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40), unless another weight is indicated or required by structural loads.
- J. Cast Iron: ASTM A 48/A 48M, Class 30, unless another class is indicated or required by structural loads.

2.4 NONFERROUS METALS

- A. Aluminum Plate and Sheet: ASTM B 209 (ASTM B 209M), Alloy 6061-T6.
- B. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), Alloy 6063-T6.
- C. Aluminum-Alloy Rolled Tread Plate: ASTM B 632/B 632M, Alloy 6061-T6.
- D. Aluminum Castings: ASTM B 26/B 26M, Alloy 443.0-F.

2.5 FASTENERS

- A. General: Unless otherwise indicated, provide Type 316 stainless-steel, Class 2 fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, at exterior walls. Provide

stainless-steel fasteners for fastening aluminum. Select fasteners for type, grade, and class required.

- B. Corrosive Service: Bolts, nuts, and washers in the locations listed below shall be stainless steel as indicated.
1. Buried locations.
 2. Submerged locations.
 3. Locations subject to seasonal or occasional flooding.
 4. Inside hydraulic structures below the top of the structure.
 5. Inside buried vaults, manholes, and structures that do not drain through a gravity sewer or to a sump with a pump.
 6. Chemical handling areas.
 7. Inside trenches, containment walls, and curbed areas.
 8. Locations indicated by the Contract Documents or designated by the Engineer to be provided with stainless steel bolts.
- C. Threads on stainless steel bolts shall be protected with an antiseize lubricant suitable for submerged stainless steel bolts, to meet government specification MIL-A-907E. Buried bolts in poorly drained soil shall be coated the same as the buried pipe.
1. Antiseize lubricant shall be classified as acceptable for potable water use by the NSF.
 2. Antiseize lubricant shall be "PURE WHITE" by Anti-Seize Technology, Franklin Park, IL, 60131, AS-470 by Dixon Ticonderoga Company, Lakehurst, NJ, 08733, or equal.
- D. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with hex nuts, ASTM A 563 (ASTM A 563M); and, where indicated, flat washers.
- E. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, nuts and, where indicated, flat washers; ASTM F 593 (ASTM F 738M) for bolts and ASTM F 594 (ASTM F 836M) for nuts, Alloy Group [1 (A1)].
- F. Anchor Bolts: ASTM F 1554, Grade 36.

1. Provide hot-dip or mechanically deposited, zinc-coated anchor bolts where item being fastened is indicated to be galvanized.
- G. Eyebolts: ASTM A 489.
- H. Machine Screws: ASME B18.6.3 (ASME B18.6.7M).
- I. Lag Bolts: ASME B18.2.1 (ASME B18.2.3.8M).
- J. Wood Screws: Flat head, ASME B18.6.1.
- K. Plain Washers: Round, ASME B18.22.1 (ASME B18.22M).
- L. Lock Washers: Helical, spring type, ASME B18.21.1 (ASME B18.21.2M).
- M. Cast-in-Place Anchors in Concrete: Anchors capable of sustaining, without failure, a load equal to four times the load imposed, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
1. Threaded or wedge type; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, hot-dip galvanized per ASTM A 153/A 153M.
- N. Expansion Anchors: Anchor bolt and sleeve assembly with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
1. Material for Anchors in Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B 633, Class Fe/Zn 5.
 2. Material for Anchors in Exterior Locations: Alloy Group [1 (A1)] stainless-steel bolts complying with ASTM F 593 (ASTM F 738M) and nuts complying with ASTM F 594 (ASTM F 836M).
- O. Adhesive Anchors: Unless otherwise indicated, drilled concrete or masonry anchors shall be adhesive anchors. No substitutions will be considered unless accompanied with ICBO report verifying strength and material equivalency.

1. Epoxy adhesive anchors are required for drilled anchors for outdoor installations, in submerged, wet, splash, overhead, and corrosive conditions, and for anchoring handrails and reinforcing bars. Epoxy shall comply with Section 03315 – GROUT. Threaded rod shall be galvanized for general purpose applications and stainless steel Type 316 for corrosive applications. Epoxy anchors shall not be permitted in areas where the concrete temperature is in excess of 100°F or higher than the limiting temperature recommended by the manufacturer, whichever is lower. Epoxy anchors shall not be used where anchors are subject to vibration or fire. Embedment depth shall be as the manufacturer recommends for the load to be supported.
2. Unless otherwise indicated, glass capsule, polyester resin adhesive anchors will be permitted in locations not included above and shall be Hilti HVA or Cobra Anchors. Threaded rod shall be galvanized steel.

2.6 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79.
 1. Use primer with a VOC content which complies with regulations of the State of Massachusetts. .
 2. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
- C. Zinc-Rich Primer: Complying with SSPC-Paint 20 or SSPC-Paint 29 and compatible with topcoat.
 1. Use primer with a VOC content of which complies with regulations of the State of Massachusetts.
 2. Products:
 - a. Benjamin Moore & Co.; Epoxy Zinc-Rich Primer CM18/19.
 - b. Carboline Company; Carbozinc 621.
 - c. ICI Devoe Coatings; Catha-Coat 313.

- d. PPG Architectural Finishes, Inc.; Aquapon Zinc-Rich Primer 97-670.
 - e. Tnemec Company, Inc.; Tneme-Zinc 90-97.
- D. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.
 - E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.
 - F. Nonshrink, Metallic Grout: Factory-packaged, ferrous-aggregate grout complying with ASTM C 1107, specifically recommended by manufacturer for heavy-duty loading applications.
 - G. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.
 - H. Concrete Materials and Properties: Comply with requirements in Section 03300 – CONCRETE for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi, unless otherwise indicated.

2.7 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch, unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- D. Form exposed work true to line and level with accurate angles and surfaces and straight edges.
- E. Weld corners and seams continuously to comply with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

2. Obtain fusion without undercut or overlap.
 3. Remove welding flux immediately.
 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts, unless otherwise indicated. Locate joints where least conspicuous.
- G. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
- I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
1. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches, with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

2.8 MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.
- B. Fabricate units from steel shapes, plates, and bars of welded construction, unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction retained by framing and supports. Cut, drill, and tap units to receive hardware, hangers, and similar items.
1. Fabricate units from slotted channel framing where indicated.
 2. Furnish inserts if units are installed after concrete is placed.

- C. Fabricate supports for operable partitions from continuous steel beams of sizes indicated with attached bearing plates, anchors, and braces as indicated. Drill bottom flanges of beams to receive partition track hanger rods; locate holes where indicated on operable partition Shop Drawings.
- D. Fabricate steel girders for wood frame construction from continuous steel shapes of sizes indicated.
 - 1. Provide bearing plates welded to beams where indicated.
 - 2. Drill girders and plates for field-bolted connections where indicated.
 - 3. Where wood nailers are attached to girders with bolts or lag screws, drill holes at 24 inches o.c.
- E. Fabricate steel pipe columns for supporting wood frame construction from steel pipe with steel baseplates and top plates as indicated. Drill baseplates and top plates for anchor and connection bolts and weld to pipe with fillet welds all around. Make welds the same size as pipe wall thickness, unless otherwise indicated.
 - 1. Unless otherwise indicated, fabricate from Schedule 40 steel pipe.
 - 2. Unless otherwise indicated, provide 1/2-inch baseplates with four 5/8-inch anchor bolts and 1/4-inch top plates.
- F. Galvanize miscellaneous framing and supports where indicated.
- G. Prime miscellaneous framing and supports with zinc-rich primer where indicated.

2.9 SHELF ANGLES

- A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inch bolts, spaced not more than 6 inches from ends and 24 inches o.c., unless otherwise indicated.
 - 1. Provide mitered and welded units at corners.
 - 2. Provide open joints in shelf angles at expansion and control joints. Make open joint approximately 2 inches larger than expansion or control joint.

- B. For cavity walls, provide vertical channel brackets to support angles from backup masonry and concrete.
- C. Galvanize shelf angles located in exterior walls.
- D. Prime shelf angles located in exterior walls with zinc-rich primer.
- E. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

2.10 LOOSE BEARING AND LEVELING PLATES

- A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.
- B. Galvanize plates after fabrication.
- C. Prime plates with zinc-rich primer.

2.11 STEEL WELD PLATES AND ANGLES

- A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with not less than two integrally welded steel strap anchors for embedding in concrete.

2.12 MISCELLANEOUS STEEL TRIM

- A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.
- B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.
 - 1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.
- C. Galvanize exterior miscellaneous steel trim and interior miscellaneous steel trim, where indicated.

2.13 PIPE GUARDS

- A. Fabricate pipe guards from 3/8-inch thick by 12-inch wide steel plate, bent to fit flat against the wall or column at both ends and to fit around pipe with 2-inch clearance between pipe and pipe guard. Drill each end for two 3/4-inch anchor bolts.
- B. Galvanize pipe guards after fabrication.

2.14 HATCHES

- A. Where access hatches are mounted on a floor slab (including top slabs that are not covered with a roofing membrane) or on a concrete curb, the hatch shall be a flush type as indicated.
- B. Hatches shall be fabricated from aluminum 5086 H34, 6063-T5 or 6061-T6, unless otherwise indicated. Hatch hardware shall be Type 316 stainless steel. Hatches shall be gutter-type; Bilco Type J or JD, Babcock-Davis Type B-FGA or equal.
- C. The design live load shall be 300 psf, unless indicated otherwise.
- D. Hatch opening sizes, number and swing direction of door leaves, and locations, shall be as indicated. Sizes are for the clear opening. Where the number of leaves is not given, openings larger than 42-inches in either direction shall have double-leaf doors. Unless indicated otherwise, hinges shall be located on the longer dimension side. Unless indicated otherwise, ladder hatches shall be a minimum of 30-inches wide by 36-inches long, with the ladder centered on the shorter dimension, and the door hinge opposite the ladder.
- E. Door leaves shall be a minimum of 1/4-inch thick checkered pattern plate. Channel frames shall be a minimum of 1/4-inch material with an anchor flange around the perimeter. Hatches shall be provided with an automatic hold-open arm with release handle. Hatches shall be designed for easy opening from both inside and outside. Hatches shall be provided with a locking mechanism.
- F. Hatches shall be designed to be water-tight and shall be equipped with a joint gutter and moat-type edge drain. A minimum 1-1/2 inch diameter drain connection shall be provided, located by the manufacturer.

2.15 IRON CASTINGS

- A. Iron castings shall be of uniform quality, free from blowholes, porosity, hard spots, shrinkage, distortion, or other defects. They shall be smooth and well cleaned by shotblasting.
- B. Covers and grates shall fit together evenly, so that the cover fits flush with the surrounding finished surface and so that the cover does not rock or rattle when loading is applied. Round covers and frames shall have machined bearing surfaces.
- C. Covers and grates with matching frames shall be designed to support the following loadings:
- D. Where located within a structure, the design loading shall match that required for the adjacent floor area, or, if no floor loading is given, a minimum of 300 pounds per square foot.
- E. Exterior covers and grates shall be designed for AASHTO HS-20 loading unless indicated otherwise.

2.16 FINISHES - GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish metal fabrications after assembly.

2.17 STEEL AND IRON FINISHES

- A Galvanizing: Hot-dip galvanize items as indicated to comply with applicable standard listed below:
 - 1. ASTM A 123/A 123M, for galvanizing steel and iron products.
 - 2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.
- B. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed metal fabrications:
 - 1. Exteriors (SSPC Zone 1B): SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 2. Interiors (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."

- C. Shop Priming: Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes and those to be embedded in concrete, sprayed-on fireproofing, or masonry, unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
 - 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

2.18 STAINLESS-STEEL FINISHES

- A. Remove tool and die marks and stretch lines or blend into finish.
- B. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.
- C. Bright, Directional Satin Finish: No. 4.
- D. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

2.19 ALUMINUM FINISHES

- A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
- B. As-Fabricated Finish: AA-M10 (Mechanical Finish: as fabricated, unspecified).
- C. Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.

PART 3 – EXECUTION

3.1 INSTALLATION - GENERAL

- A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

- B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- C. Welding shall be by the metal-arc method or gas-shielded arc method as described in the American Welding Society's "Welding Handbook" as supplemented by other pertinent standards of the AWS. Qualifications of welders shall be in accordance with the AWS Standards governing same.
- D. Field Welding: Comply with the following requirements:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- E. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag bolts, wood screws, and other connectors.
- F. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- G. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint.

3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.
- B. Anchor supports for operable partitions securely to and rigidly brace from building structure.

- C. Support steel girders on solid grouted masonry, concrete, or steel pipe columns. Secure girders with anchor bolts embedded in grouted masonry or concrete or with bolts through top plates of pipe columns.
 - 1. Where grout space under bearing plates is indicated for girders supported on concrete or masonry, install as specified in "Installing Bearing and Leveling Plates" Article.
- D. Install pipe columns on concrete footings with grouted baseplates. Position and grout column baseplates as specified in "Installing Bearing and Leveling Plates" Article.
 - 1. Grout baseplates of columns supporting steel girders after girders are installed and leveled.

3.3 INSTALLING BEARING AND LEVELING PLATES

- A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.
- B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.
 - 1. Use nonshrink grout, either metallic or nonmetallic, in concealed locations where not exposed to moisture; use nonshrink, nonmetallic grout in exposed locations, unless otherwise indicated.
 - 2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.4 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - 1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.
- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

PART 4 – COMPENSATION

Item 5500.1 – 5' X 3' Access Hatch

METHOD OF MEASUREMENT:

Measurement for payment for 5' x 3' Access Hatch will be based on the actual number of hatches installed, complete as shown on the Contract Drawings or as required by the Engineer and as measured by the Engineer.

BASIS OF PAYMENT:

Payment for 5' x 3' Access Hatch will be based on the unit price bid for this item in the proposal. Under the per each unit price bid for the item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required to install each hatch complete as shown on the Contract Drawings or at the requirements of the Engineer. The work includes, but is not limited to: furnish and install hatch, wall thimble or mounting, gaskets and appurtenances; locking mechanism; connections to proposed structures; protective coatings; supports; and all incidental work required for the installation of hatches not specifically included for payment elsewhere.

END OF SECTION 05500

SECTION 06610

GLASS FIBER AND RESIN FABRICATIONS

6610.1	6'L X 2'W ACCESS PLATFORM	EACH
6610.2	ROUND MANHOLE ACCESS PLATFORM	EACH

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes the following:

1. Furnishing, installing, and testing fabricated fiberglass reinforced plastic items (FRP) items, complete and in place, in accordance with the Contract Documents.

1.2 RELATED WORK

A. Section 05500 – MISCELLANEOUS METALS

1.3 SUBMITTALS

A. Submit the following in accordance with Section 01300 – SUBMITTALS

1. Shop Drawings for each FRP item.
 - a. Include plans, elevations, and profiles that clearly show material sizes, types, styles, part or catalog numbers. Drawings shall include complete details for the fabrication and erection of components, including location, dimensions, lengths, joining method, type and size of fasteners, clip angles, member sizes, and connection details.
 - b. Layout drawings for grating shall show the direction of span, type and depth of grating, size and shape of grating panels, seat angle details, and details of grating hold down fasteners.
2. Product Literature: Manufacturer's published literature including structural design data, structural properties, and load and deflection tables for each style and depth of grating, corrosion resistance tables, certificates of compliance, test reports (as applicable), anchoring system allowable load tables and ICBO reports.

3. Calculations: Structural calculations shall be submitted for stairs, stair support systems, handrails, railing systems, brackets, support flanges, ladders, and fasteners or anchors. Calculations shall be signed and sealed by a professional engineer registered in the State of Massachusetts.
4. Samples: Samples of each type of product shall be submitted if requested by the ENGINEER.
5. Certification: The CONTRACTOR shall certify on the Shop Drawings that fabricated items are of sufficient strength to serve their intended function without undue distortion or deflection.

1.4 QUALITY ASSURANCE

- A. Provide in accordance with Section 01400 – QUALITY CONTROL and as specified.
 1. Manufacturer's Qualifications: Items provided under this Section shall be furnished only by manufacturers having experience in the manufacture of similar products, with a record of 5 similar successful installations in the last 5 years.
 2. Quality: Fiberglass items shall be constructed of new, first-class, commercial-quality, fiberglass fabric-reinforced polyester or vinyl ester resin laminate material of the strength, thickness, and dimensions indicated, using the matched die-molded method.
- B. Owner reserves right to inspect and test by independent service at manufacturer's plant or elsewhere at his own expense.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

- A. FRP items shall be composed of fiberglass reinforcement and resin in quantities, qualities, properties, arrangements, and dimensions as necessary to meet the design requirements and dimensions indicated.
- B. Fiberglass reinforcement shall be continuous roving, continuous strand mat, and surfacing veil or a combination thereof in sufficient quantities for the application and physical properties required.
- C. Unless indicated otherwise, resin shall be fire retardant isophthalic polyester or vinyl ester with chemical formulation as necessary to provide the corrosion resistance, strength, and other physical properties as required. FRP items used in chemical storage or containment areas shall be vinyl ester resin, with chemical formulations as necessary to provide the corrosion resistance, strength, and other physical properties required in those areas.

- D. Finished surfaces of FRP items and fabrications shall be smooth, resin-rich, free of voids, and without dry spots, cracks, crazes, or unreinforced areas. Glass fibers shall be well covered with resin to protect against exposure from wear or weathering.
- E. FRP products shall have a tested flame spread rating of 25 or less per ASTM E 84 - Surface Burning Characteristics of Building Materials. Gratings and stair treads shall also meet the self-extinguishing requirements of ASTM D 635 - Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position.
- F. Supports and Fasteners: The CONTRACTOR shall provide bolts, anchor bolts, nuts, washers, and supports as required for the WORK of this Section in accordance with the requirements of the manufacturers of the items. Bolts, anchor bolts, washers, and supports shall be Type 316 stainless steel. Concrete anchor systems shall be in accordance with Section 05500 – MISCELLANEOUS METALS.
- G. Cut or machined edges, holes, scratches, gouges, and abrasions shall be sealed with a resin compatible with the resin matrix used in the original item

2.2 FIBERGLASS GRATING

A. GENERAL

1. Seat Angles: Where grating is supported on concrete members, continuous embedded seat angles shall be provided on all sides. Grating seat angles shall be made of FRP and be as detailed on the Drawings; except that specially manufactured pultruded FRP seat angles intended to be cast in concrete may be submitted for acceptance by the ENGINEER.
2. Load/Deflection Requirements: Grating shall be capable of spanning the distances indicated with a minimum safety factor of 3 for stresses and without exceeding a deflection equal to the lesser of 1/4-inch or the span divided by 180. The loading used for determining stresses and deflections shall be the uniform live load of the adjacent floor area or 200 pounds per square foot, whichever is greater, or a concentrated load of 1000 pounds at the center of the span, unless otherwise indicated.
3. Color: The color of the grating and seat angles shall match. The color shall be high visibility safety yellow. The color selected shall result in no additional cost to the OWNER.
4. The top surface of grating shall be provided with a non-slip surface by embedding or bonding grit to the FRP.
5. Penetrations: Cutouts shall be provided were needed for penetrations through the grating. The grating shall be reinforced where necessary to meet the load/deflection requirements despite the cutouts.

6. Dimensional Requirements: When grating is designed to span primarily in one direction, the grating shall be fabricated to span in the shorter span direction, unless indicated otherwise. Individual pieces of grating shall not exceed 80 pounds in weight, unless indicated otherwise.
7. Mechanical grating clips shall be manufactured of Type 316 stainless steel. Grating hold-down clips shall be provided, spaced at a maximum of 4-feet apart or as recommended by the manufacturer, whichever is less. A minimum of 4 clips per piece of grating is required.

2.3 MOLDED FRP GRATING

- A. Molded FRP grating shall be of a one piece molded construction with tops and bottoms of bearing bars and cross bars in the same plane. Grating shall have a square mesh pattern.
- B. Gratings shall be reinforced with continuous rovings of equal number of layers in each direction to provide bidirectional load bearing.
- C. Non-slip surfacing: Grating shall have a grit surface on the top of each bar for maximum slip resistance.
- D. Molded FRP grating shall be Fibergrate by Fibergrate Composite Structures, Inc., Corgrate Molded Fiberglass Grating by IKG Industries, Duragrate by Strongwell; or equal.

2.4 PULTRUDED FRP GRATING

- A. Pultruded FRP grating shall be fabricated from bearing bars and cross rods manufactured by the pultrusion process. The glass fiber reinforcement for the bearing bars shall have a core of continuous glass strand rovings wrapped with a continuous strand glass mat. The outermost layer covering shall be a surface veil to provide a resin-rich surface. Bearing bars shall be interlocked and chemically bonded into place to provide a panel that resists twist forces and prevents internal movement of the bearing bars.
- B. Pultruded FRP grating shall be Safe-T-Span by Fibergrate Composite Structures, Inc.; Corgrate by IKG Industries; Duradek by Strongwell; or equal.

2.5 STRUCTURAL SHAPES

- A. Structural shapes shall be manufactured by the pultrusion process and have a maximum of 55 percent and a minimum of 45 percent glass content (by weight).
- B. Pultruded structural shapes are to have the minimum longitudinal mechanical properties listed below:

Property	ASTM Method	Minimum Value	Units
Tensile Stress (Lengthwise)	D 638	30,000	psi
Tensile Modulus (Lengthwise)	D 638	2.5 x 10 ⁶	psi
Flexural Stress (Lengthwise)	D 790	30,000	psi
Flexural Modulus (Lengthwise)	D 790	1.6 x 10 ⁶	psi
Short Beam Shear (Lengthwise)	D 2344	4,500	psi
Shear Modulus (Lengthwise)	N/A	4.2 x 10 ⁵	psi
Coefficient of Thermal Expansion (Lengthwise)	D 696	4.4 x 10 ⁻⁶	in/in/°F

- C. FRP structural shapes shall be Dynaform Fiberglass Structural Shapes by Fibergrate Composite Structures, Inc; Extren by Strongwell; CorLight by IKG Fiberglass Systems; or equal.

PART 3 - EXECUTION

3.1 PRODUCT DELIVERY AND STORAGE

- A. Delivery of Materials: Manufactured materials shall be delivered in original, unbroken pallets, packages, containers, or bundles bearing the label of the manufacturer. Adhesives, resins, catalysts, and hardeners shall be crated or boxed separately.
- B. Storage of Products: Materials shall be carefully handled to protect them from abrasion, cracking, chipping, twisting, deformations, and other types of damage. Store items in an enclosed area and free from contact with soil and water. Store adhesives, resins, catalysts, and hardeners in dry indoor storage facilities between 70 and 85 degrees F (21 to 29 degrees C). There shall be labels on the outside of the boxes indicating that the products shall be stored as described above.

3.2 GENERAL

- A. FRP products shall meet the dimensional requirements and tolerances indicated. The CONTRACTOR shall verify measurements and determine correct size and locations of required holes or cutouts from field dimensions before fabrication.
- B. FRP products shall be fabricated free from warps, twists, or other defects that affect appearance and serviceability.
- C. The CONTRACTOR shall give ample notice prior to the beginning of any fabrication work so that the ENGINEER can perform shop inspections.

- D. The CONTRACTOR shall install FRP structures in accordance with the manufacturer's assembly drawings. Field cut and drill FRP products with carbide or diamond tipped bits and blades. Seal cut or drilled surfaces in accordance with manufacturer's instructions. Follow manufacturer's instructions when cutting or drilling fiberglass products or using resin products.
- E. Bonding of FRP items shall be through the use of an epoxy adhesive recommended by the manufacturer of the particular item. The surfaces to be bonded shall be solvent cleaned and abraded sufficiently to remove the surface gloss and to remove any mold release agent or other contaminants which may interfere with proper bonding. The adhesive manufacturer's instructions and recommendations shall be followed. The items bonded shall not be stressed until at least 48 hours have passed.

3.3 GRATING

- A. Layout: Each grating section shall be readily removable except where indicated. As much as possible, manufacturer shall provide openings and holes where indicated on the Contract Drawings. Grating openings which fit around protrusions (pipes, cables, machinery, etc.) shall be discontinuous at approximately the centerline of opening so each section of grating is readily removable.
 - 1. Install the grating with a minimum 1.5-inch bearing surface at the support ends.
 - 2. Tolerances between sections shall provide for not more than 1/4-inch clearance between adjacent sections or between grating and frames. Adjacent sections shall line up to form an uninterrupted straight line where possible.
 - 3. The grating shall be as free, as commercially possible from visual defects such as foreign inclusions, delamination, blisters, resin burns, air bubbles, and pits. The surface shall have a smooth finish (except for non-slip surfaces).
 - 4. Seat angles shall be mitered and bonded at corners to produce smooth, even, level seating surface.
 - 5. Grating shall be installed so that the top surface is level and even with adjacent walking surfaces. There shall be no protrusions above the top surface.
 - 6. Grating shall be fastened to supports.
 - 7. Removable or hinged grating shall be supported along the edges with no intermediate supports for clear access by personnel.

3.4 STRUCTURAL SHAPES

- A. Measurement: The CONTRACTOR shall verify dimensions, making any field measurements necessary, and shall be fully responsible for accuracy and layout of WORK. The CONTRACTOR shall review the Drawings, and any discrepancies shall be reported to the ENGINEER for clarification prior to starting fabrication
- B. Fabrication
 - 1. Structural FRP shall be fabricated in accordance with the Drawings and as indicated on the Shop Drawings.
 - 2. Materials shall be properly marked and match-marked for field assembly.
 - 3. Where finishing is required, assembly shall be completed including bolting before starting of finishing operations.
- C. Connections: Shop and field connections shall be bonded and bolted as indicated. Unless indicated otherwise, connections shall develop full strength of members joined.
- D. Holes for other WORK: Holes shall be provided as necessary or as indicated for securing other WORK to FRP framing, and for the passage of other WORK through FRP members. Threaded nuts shall be epoxied to framing, and other specialty items as indicated to receive other WORK. Field cuts and drilled edges shall be sealed with a resin compatible with the original resin and recommended by the manufacturer. The sealing of the edges shall prevent premature fraying at the field cut edges.
- E. Erection
 - 1. Anchor bolts and other connectors required for securing structural FRP to in-place WORK and templates and other devices for presetting bolts and other anchors to accurate locations shall be furnished by the CONTRACTOR.
 - 2. The CONTRACTOR shall be responsible for designing and installing any temporary bracing required for the safe erection of all structural FRP members.
- F. Setting bases and bearing plates
 - 1. Prior to the placement of nonshrink grout beneath base and bearing plates, the bottom surface of the plates shall be cleaned of bond-reducing materials. Concrete and masonry bearing surface shall also be cleaned of bond-reducing materials and be roughened to improve bonding.
 - 2. Loose and attached base plates and bearing plates for structural members shall be set on wedges, leveling nuts, or other adjustable devices.

3. Anchor bolts shall be tightened after the supported members have been positioned and plumbed and the nonshrink grout has attained its required strength.
4. Base plates shall be grouted with nonshrink grout to assure full uniform bearing. Grouting shall be done prior to placing loads on the structure.

G. Field Assembly

1. Structural frames shall be set accurately to the lines and elevations indicated. The various members shall be aligned and adjusted to form a part of a complete frame or structure before permanent fastening. Bearing surfaces and other surfaces that will be in permanent contact shall be cleaned before assembly. Necessary adjustments to compensate for discrepancies in elevations and alignments shall be performed.
2. Individual members of the structure shall be leveled and plumbed within required tolerances. The CONTRACTOR shall provide and install all temporary bracing required until structure is complete.

H. Misfits at Bolted Connections

1. Where misfits in bolting are encountered, the ENGINEER shall be immediately notified. The CONTRACTOR shall submit a method to remedy the misfit for review by the ENGINEER. The ENGINEER will determine whether the remedy is acceptable or if the member must be refabricated. Methods of remedy may include, but are not limited to the following:
 - a. Reaming holes that must be enlarged to admit oversized bolts.
 - b. Drilling additional holes in the connection, to conform to manufacturer's standards for bolt spacing, end, and edge distances, and adding additional bolts.
 - c. Rejecting the improperly fabricated member and fabricating a new member to ensure proper fit.
2. Mis-sized or misaligned holes in members shall not be enlarged by burning or by the use of drift pins.
3. The CONTRACTOR shall pay costs associated with the repair of misfits.

PART 4 - COMPENSATION

Item 6610.1 – Isolation Structure Access Platform

METHOD OF MEASUREMENT:

Measurement for payment for Isolation Structure Access Platform will be based on the actual number of access platforms installed, complete as shown on the Contract Drawings or as required by the Engineer and as measured by the Engineer.

BASIS OF PAYMENT:

Payment for Isolation Structure Access Platform will be based on the unit price bid for this item in the proposal. Under the per each unit price bid for the item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required to install each access platform complete as shown on the Contract Drawings or at the requirements of the Engineer. The work includes, but is not limited to: design, furnish, and install access platform and structural support shapes; mounting hardware including hinges and anchors; protective coatings; and all incidental work and appurtenances not specifically included for payment elsewhere.

EXCLUSIONS:

The following item(s) are not included for payment under this item and are included for payment elsewhere: procurement and installation of precast Isolation Gate Structure.

Item 6610.2 – Round Manhole Access Platform

METHOD OF MEASUREMENT:

Measurement for payment for Round Manhole Access Platform will be based on the actual number of access platforms installed, complete as shown on the Contract Drawings or as required by the Engineer and as measured by the Engineer.

BASIS OF PAYMENT:

Payment for Round Manhole Access Platform will be based on the unit price bid for this item in the proposal. Under the per each unit price bid for the item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required to install each access platform complete as shown on the Contract Drawings or at the requirements of the Engineer. The work includes, but is not limited to: design, furnish, and install access platform and structural support shapes; mounting hardware including anchors; rubber step handles; protective coatings; and all incidental work and appurtenances not specifically included for payment elsewhere.

SPECIAL NOTES ON EXCLUSIONS:

The following item(s) are not included for payment under this item and are included for payment elsewhere: procurement and installation of precast manhole.

END OF SECTION 06610

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SECTION 07160

BITUMINOUS DAMPPROOFING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The work covered under this Section of the specifications includes furnishing all plant, labor, equipment, appliances and materials and performing all operations in connection with the furnishing and application of bituminous dampproofing and, at all manholes, box culverts, and structures including surface preparation and appurtenant work, complete in place, in accordance with the Drawings and Specifications.
- B. Contractor shall apply dampproofing to sides, bases, and flat top slabs of precast structures including precast riser sections. Contractor shall apply dampproofing to CIP concrete pipe field closures and other cast-in-place structures as indicated in the Drawings and Specifications.

1.2 RELATED WORK

- A. Section 02252 - MANHOLES
- B. Section 03300 – CONCRETE
- C. Section 03411 – PRECAST CONCRETE VAULTS AND STRUCTURES

1.3 SUBMITTALS

- A. The Contractor shall submit manufacturer's technical product data on the bituminous dampproofing and installation instructions for all materials required under this Section.

PART 2 - PRODUCTS

2.1 BITUMINOUS DAMPPROOFING

- A. Bituminous dampproofing materials shall conform to Federal Specification SS-A-701 or ASTM D 449, Type A and shall be Dehydratine 4 as manufactured by W.R. Grace & Company; Tremco; Hydrocide 648 as manufactured by Sonneborn; or approved equivalent.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Bituminous dampproofing shall be applied in strict accordance with the printed instructions of the approved manufacturer. The surface must be clean and free of all foreign matter. Do not apply over a frost-covered surface. All cracks, voids, honeycombs, etc., shall be filled and repaired with mortar to provide a sound structural surface. No heating or thinning is required. If thinning is absolutely necessary, use a small amount of mineral spirits. Apply by brush or spray in a continuous unbroken film free from pinholes or other surface breaks. All surfaces to be dampproofed shall receive two coats. Each coat shall dry a minimum of 20 to 24 hours before application of the next coating. The second coat shall be applied perpendicular to the first. Allow a minimum of 48 hours for drying before backfilling. Each coat shall be applied at a rate of 65 square feet per gallon. Bituminous dampproofing can be factory applied providing application meets coating manufacturer's requirements. Additional field coatings must be applied, as required by the Engineer, to repair any coating imperfections and chipped or damaged areas.

PART 4 – COMPENSATION (Not Used)

END OF SECTION 07160

SECTION 09800

PROTECTIVE COATINGS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Provide for the surface preparation and application of shop primers on ferrous metals, excluding stainless steels, as specified.
- B. Provide and apply paints and coatings as specified and indicated. Prepare, clean, and finish all surfaces to be field painted as specified and indicated.
 - 1. The terms "paint" and "coating" used herein include emulsions, enamels, paints, stains, varnishes, sealers, and other coatings, organic or inorganic, whether used as intermediate, or finish coats.
- C. Complete painting in accordance with specifications, paint manufacturer's current surface preparation and application instructions and safety requirements. In the event of conflict, the more stringent specifications will apply.
- D. Furnish and apply pipe, valve, and equipment identification legends as specified.

1.2 RELATED WORK

- A. Division 1 - GENERAL REQUIREMENTS
- B. Section 03300 – CONCRETE
- C. Section 02615 – DUCTILE IRON PIPE FOR SANITARY AND STORM DRAIN GRAVITY
- D. Section 05500 – MISCELLANEOUS METALWORK
- E. Section 15200 - VALVES, GENERAL

1.3 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Section 01300 – Submittals.
 - 1. List of coating products (Coating Schedule) with brand, type and manufacturer including dry film thickness and volatile organic compound (V.O.C.) limits conforming to these specifications.

2. Manufacturer's specifications and data on the proposed primers and detailed surface preparation, application procedures and dry mill thicknesses, including list of items and surfaces to receive shop painting.
3. Manufacturer's current printed recommendations and product data sheets for each including performance criteria, surface preparation and applications, instructions and safety requirements.
4. Product data and pertinent information indicating compatibility of field applied coatings with shop applied primers including a schedule listing each primer with field applied coatings to be applied over the primer.
5. Color chip samples of materials proposed and matching color of coatings indicated in Finish Schedule.
6. Submit manufacturer's published data showing service record.
7. Submit letter, signed by Contractor, stating that surfaces to be coated are ready for preparation as specified in paragraph 3.1 B.

1.4 QUALITY ASSURANCE

- A. Use products of one manufacturer in any one paint coating system with compatible coating materials. Provide same coating product for touch-up as for original coating.
- B. Do not use or retain contaminated, outdated, or diluted materials for painting. Do not use materials from previously opened containers. Do not use such materials for field touch-up of shop painting.
- C. Provide materials having equal quality of products of manufacturers listed here in.
- D. Provide paint products having a minimum of five (5) years of-service, with no peeling, flaking, chipping, blistering, or fading, under similar service conditions.

1.5 PAINT STORAGE AND MIXING AREAS, AND WASTE DISPOSAL

- A. Store paints and painter's materials only in area or areas designated for this purpose. Confine mixing, thinning, clean-up and associated operations, and storage of painting debris before authorized disposal, to these areas.
- B. Store waste temporarily in closed, nonflammable containers until final disposal. Keep no rubbish disposal. Keep no rubbish in painter's area longer than 24 hours.

1.6 DELIVERY, HANDLING, STORAGE, PROTECTION

- A. Deliver materials to painter's area in original, unbroken, containers with name and analysis of product, manufacturer's name, and shelf life date. Do not use or retain contaminated, outdated, prematurely opened, or diluted materials.
- B. Store coated items and protect coating from damage and foreign matter, by not allowing contact with soil or pavement, exposure to wind-blown particles, or other harmful contacts which necessitate special cleaning. Use blocking during storage.
- C. Do not expose primed surfaces to weather for more than six months before top coating. Allow less open time if recommended by coating manufacturer.
- D. Protect coated items, whether prime or finish, from damage due to shipping and handling. For items with type E or S service coatings; use padding, blocking, fabric slings.
- E. At time of delivery of shop painted items to job site, coatings are to be undamaged and in good condition.

1.7 JOB CONDITIONS

- A. Environmental Requirements:
 - 1. Comply with manufacturer's recommendations as to environmental conditions under which coatings and coating systems can be applied.
 - 2. Do not apply coatings when dust is being generated.
- B. Protection:
 - 1. Cover or otherwise protect finish work of other trades and surfaces not being painted concurrently or not to be painted.

PART 2 - PRODUCTS

2.1 MATERIALS - SHOP PAINTING

- A. Coatings are divided into the following types, as determined by service conditions:
 - 1. Type S Service (Submerged Surfaces): Shop primer for ferrous metals which will be submerged or which are subject to splash action or which are specified to be considered submerged service. Spray one coat with a dry film thickness of 3.5 to 4.5 mils with on of the following:

- a. Tnemec 66 Boston Gray Primer manufactured by Tnemec Co., North Kansas City, MO.
 - b. Koppers 654 Epoxy Primer manufactured by Koppers Co., Pittsburgh, PA.
 - c. Valspar 13-R-60 Epoxy Metal Primer manufactured by Valspar Corp., Short Hills, NJ.
 - d. Or equal.
2. Type E Service (Non-Submerged Ferrous Surfaces - Interior and Exterior): Spray one coat with a dry film thickness of 3.0 to 4.0 mils with one of the following:
- a. Tnemec 66 Boston Gray Primer manufactured by Tnemec Co., North Kansas City, MO.
 - b. Koppers 654 Epoxy Primer manufactured by Koppers Co., Pittsburgh, PA.
 - c. Valspar 13-R-60 Epoxy Metal Primer manufactured by Valspar Corp., Short Hills, NJ.
 - d. Or equal.
- B. Provide written statement, signed by the Contractor, stating that the equipment manufacturer approves shop primers as compatible with their field primers and finish coats as specified herein.

2.2 MATERIALS - FIELD PAINTING

- A. General: Apply paint coatings as recommended by the manufacturer for intended service. Use coatings on ferrous surfaces for Type S or Type E service of protective paint coating quality.
- B. Colors: All colors and shades of color of all coats of paint shall be as indicated or selected by the Owner. Each coat shall be of slightly different shade, to facilitate inspection of surface coverage of each coat. Finish colors shall be as selected from the manufacturer's standard color samples by the Owner.
- C. Coating Types:
1. Coatings are described in following list with minimum dry film thicknesses (DFT) and maximum allowable for volatile organic compounds (V.O.C.) required and abbreviations for identification on COATINGS SCHEDULE:

ACCEPTABLE COATINGS AND ABBREVIATIONS			
Abbr.	Description (minimum solids content, by volume & Maximum V.O.C.)	Brand	DFT/Coat (Mils)
AGE	Alkyd Gloss Enamel (49 percent - V.O.C. 3.21)	Tneme-Gloss Series 24	2.0-3.0
APE	Aliphatic Polyurethane Enamel (68 percent - V.O.C. 3.41)	Endura-Shield Series 74	3.0-5.0
AU	Alkyd Undercoater (52 percent - V.O.C. 3.32)	36-603	2.0-3.0
EP	Epoxy Primer (69 percent - V.O.C. 3.37)	Series 69 BG62 Boston Gray Primer	3.0-4.0
HSE	High Solid Epoxy (80 percent - V.O.C. 1.85)	High Solids Epoxy 104	6.0-8.0
PE*	Polyamide Epoxy Finish (56 percent - V.O.C. 2.79)	Epoxoline II Series 69	6.0-8.0
LTE	Low Temperature Epoxy (56 percent	Series 161 V.O.C. 2.99)	4.0-6.0
RPP	Penetrating Primer (43 percent - V.O.C. 3.50)	Chem-Prime 37-77	3.5
VE	Vinyl Ester Coating (92 percent - V.O.C. 2.20)	Series 120 Vinester	12.0-18.0
VES**	Vinyl Ester Surfacer and Filler (92 percent - V.O.C. 1.30)	Series 120- 5003 Vinester	1/2-in. max. thickness
CTE	Coal Tar Epoxy Coating (73 percent - V.O.C. 1.83)	Tneme Tar 46H-413	8.0-10.0
EPWT	Epoxy-Polamide (Potable Water Tank System, 56 percent - V.O.C. 3.02	Series 20FC	4.0-6.0

* *If application of PE type coating occurs during low temperatures, provide and apply LTE type coating in lieu of PE and substitute throughout in Paint Schedule at end of Section, unless otherwise recommended by coating manufacturer.*

** *Provide patching surfacer and filler for concrete surfaces requiring deep patching repair up to 1/2-in. deep when sandblasting has opened up deep depressions and holes.*

2. Description of coating types includes minimum acceptable percent, by volume, of component solids and volatile organic compounds (V.O.C.). Brand identification is keyed to products of Tnemec Co., Inc., Kansas City, MO, to establish standard of quality. Products meeting physical characteristics and performance criteria, manufactured by Koppers Co., Inc., Newark, NJ; Valspar Corp., Short Hills, NJ; or equal are acceptable.

D. Pipe, Valve/Equipment Identification And Color Coding:

1. Provide identification of pipes, valves, pumps and vaults with name of contents, directional flow arrows and other required legend.
 - a. Use stenciled letters and arrows or self-adhesive labels or tapes located at intervals no greater than 20 ft. apart on straight runs. Mark each valve, branch, wye change in direction and each side of floor and wall penetrations.
 - b. Provide legend of size, character and location conforming to ANSI A13.1 for stenciled letters or labels.

PART 3 - EXECUTION

3.1 APPLICATION - SHOP PAINTING

A. Surface Preparation and Priming:

1. Sandblast clean in accordance with SSPC-SP-6, Commercial Grade, immediately prior to priming non-submerged components scheduled for priming, as defined above.
2. Sandblast clean in accordance with SSPC-SP-10, Near White, immediately prior to priming submerged components scheduled for priming, as defined above.
3. Before priming, surfaces are to be dry and free of dust, oil, grease and other foreign material.
4. Shop prime in accordance with approved manufacturer's printed recommendations.

B. Non-primed Surfaces: Apply approved coating in accordance with manufacturer's printed recommendation.

C. Touch-Up:

1. Repair or replace damaged or defective (scratched, gouged, marred, peeling, blistering) coated areas. Resultant shop painting: Paint items as specified.
2. Remove damaged or defective coatings by specified blast cleaning to meet surface cleaning requirements, just before recoating. When small areas of coating need touch up, surface preparation may be done with power needle gun to match specified blast cleaning.

3.2 APPLICATION - FIELD PAINTING

A. Inspection:

1. Examine surfaces scheduled to receive paint and finishes for conditions that will adversely affect execution, permanence or quality of work and which cannot be put into an approved condition through preparatory work.
2. Do not proceed with surface preparation or coating application until after submitting to the Owner a letter signed by Contractor, stating that surfaces to be painted are in acceptable condition for preparation and coating according to the painter and in accordance with paint manufacturer's printed instructions.
3. Clean and paint before assembly, surfaces inaccessible after assembly, unless such areas are seal welded.
4. Paint not allowed on steel fully encased with cast-in-place concrete.

B. Preparation:

1. Basic Steps:
 - a. Prepare and paint surfaces in heated enclosure unless the ambient weather conditions include still air above 50 degree F. temperature, and humidity above manufacturer's printed recommended level. Do not apply paints to surfaces in direct sunlight. Conform to manufacturer's printed instructions for safety requirements.
 - b. Coordinate cleaning and painting operations to eliminate contamination of one by the other.
 - c. Maintain coating materials at manufacturer's recommended mixing and application temperatures for not less than 24 hours before use. Have clean, containers, spray equipment, applicators and accessory item ready for-use before decanting or mixing paint materials.

- d. Coordinate materials to be applied with previous coatings on affected surfaces. obtain, in all cases, manufacturer's written directions, and follow them strictly, except where otherwise specified.
2. Before any paint application, clean surfaces to be coated of dust, dirt, grease, loose rust, mill scale, paint unsuitable for top coating, efflorescence, oil, moisture, foreign matter or similar conditions detrimental to coating bond and durability.
- a. Following cleaning, apply preparatory treatment in strict accordance with manufacturer's written instructions.
 - b. Fill imperfections and holes in surfaces to be painted with material recommended by paint manufacturer.
3. Metals:
- a. Prepare ferrous metals, including field welds and unprimed shop welds, without shop prime coats as follows:
 - i. Near White blast cleaned (SSPC-SP-10), for Type S service.
 - ii. Commercial blast cleaned (SSPC-SP-6), for Type E service.
 - iii. Use needle gun for field welds and shop welds which occur in narrow, unprimed areas in an otherwise shop primed surface, followed by SSPC-SPI-solvent wipe.
 - b. Clean ferrous metals with shop primers as previously specified, then:
 - i. Prepare surface to meet manufacturer's printed recommendations for Type E or S service.
 - c. Epoxy coated metals for paint finish: Clean of dirt, grease, oil and foreign matter, and prime with a barrier coat to prevent bleeding and discoloration of finish.
 - d. Non-ferrous and galvanized metal surfaces for finish: Clean of dirt, grease, oil, and foreign substances, wash thoroughly with grease solvent, then permit to dry. Apply one coat of epoxy primer (EP) to non-ferrous surfaces.

4. Paint Finishes For Concrete:
 - a. Clean thoroughly of form oil, release agents, dirt, dust, grease, paint, loose material and foreign matter. Remove laitance, roughen smooth surfaces by brush sand blasting, remove fins and projections, fill voids and honeycombs with material recommended by paint manufacturer.
 - b. Prime after concrete has dried in strict accordance with manufacturer's printed instructions.
 - c. Concrete for submerged service: Brush blast clean.
5. Provide higher degree of cleaning for acceptable equivalent paint products when paint manufacturer recommends in his printed surface preparation recommendations.
6. Delay painting of areas which will be damaged by heat from welding, until welding is complete. Reclean and recoat substrate as specified for original coats, when coated areas have been damaged by welding or have not been painted to allow welding.

C. Touch-Up:

1. Before applying field coat, touch-up abraded areas of shop coats with paint of the same type. Apply an entire coat. Touch-up coats are in addition to, and not a substitute for first field coat. Clean deteriorated surfaces to bare metal before applying touch-up coat.
2. Equipment, motors, pumps, instrumentation panels, electrical switchgear, and similar items with shop coats, paint filler, enamel or other treatment customary with manufacturer; after installation, touchup scratches and blemishes before applying field coats.

D. Application:

1. Apply one under coat and one finish coat to previously primed surfaces. Following careful inspection of surfaces not previously primed, prepare and clean as specified, apply prime coat, one under coat, and one finish coat. Refer to Field Paint Schedule at end of this specification for coating requirements. Provide additional prime, under, and finish coats as specified, indicated, and recommended by coating manufacturer's printed instructions.
2. Conditions:

- a. Do not apply paints or other finish to wet or damp surfaces, except in accordance with instructions of manufacturer. Do not apply exterior paint during cold, rainy, or frosty weather, or when temperature is likely to drop to freezing. Do not apply paints to surfaces in direct sunlight.
 - b. Paint surfaces which have been cleaned, pretreated, or otherwise prepared for painting with first field coat as soon as practicable after such preparation has been completed, but in any event prior to deterioration of prepared surface.
 - c. Coat blast cleaned metal surfaces in accordance with SSPC guidelines, before any rusting or other deterioration or contamination of the surface occurs. Do not coat blast cleaned surfaces later than 8 hours after cleaning.
3. Methods:
- a. Spraying with apparatus may be substituted for brush application of paints in locations approved for spraying.
 - b. Prepare surfaces, mix and apply paint materials in strict accordance with manufacturer's printed instructions and recommendations. Control temperature of materials upon mixing and application, surface temperature and condition, thinning and modifying.
 - c. Protect surfaces to be coated, before, during and after application.
4. Workmanship:
- a. Apply spot prime of aluminum paints to exposed nails and other ferrous metal on surfaces to be painted with water-thinned paints.
 - b. Apply coating materials to meet manufacturer's spreading rate and dry film thickness recommendations. Dry film thicknesses specified are constant for brush, spray, roller or other form of application.
 - i. Control thinning in accordance with V.O.C. regulations for spray use and to manufacturer's printed instructions, and produce specified dry film thickness on level surfaces, interior and exterior angles.
 - ii. Record quantities of materials of each type, for each coat, used in each location.

- c. Apply paints and coatings using painters continuously employed in the painting profession for no less than five (5) years, brushed or rolled out carefully to a smooth, even coating without runs or sags. Flow enamel on evenly and smoothly. Allow each coat of paint to dry throughout the film thickness, before the next coat is applied. High polymer coatings may be excepted from the drying requirement if recoat time is specified by manufacturer.
- d. Finish surfaces: Uniform in finish and color, and free from flash spots and brush marks.

E. Protection and Clean-Up:

- 1. Protect surfaces to be painted or coated under this Section as follows:
 - a. Arrange for preparation and coating activities to be performed in areas and during times when no continuous traffic and no dust generating activity will be present.
 - b. During time between preparation and coating, protect work from dust and dirt with dropcloth. Do not allow contact with surfaces in this time period.
 - c. During painting activity, clearly mark the area being used by painters to prevent interference with painting being applied as specified.
 - d. After painting, clearly barricade painted surfaces with cones, plastic barrier tape, or other visible barrier. Locate "WET PAINT" signs near painted surfaces. Do not remove barriers and signs until paint surface dries throughout entire film thickness.
- 2. Remove or completely mask accessory items, finish hardware, lighting fixtures, escutcheon plates, trim and similar finish items not to be painted before painting adjacent surfaces. Carefully replace and reposition upon completion of adjacent painting and cleaning work.
- 3. Upon completion of the work, clean up paint spots, oil, and stains from floors, glass, hardware, and similar finished items and remove tape.

F. Schedule of Painting:

- 1. Coordinate and schedule the various cleaning, touch-up and finishing operations. Transmit and coordinate the transmission of materials data, color selections and coating system methods between the coating applicators. Do not exceed exposure and recoat time limits.

COATINGS SCHEDULE			
Surface or Item	Field Coats		
	1st	2nd	Final

Interior concrete of Diversion Structure, walls and roof (*)	VE/ VSE	VE	VE
Exterior concrete to be buried (including box culvert)	CTE		CTE
Exterior equipment with Type S service prime coats	EP	PE	HSE
Exterior equipment with Type E service prime coats	EP	PE	APE
Exterior steel, and exterior galvanized structural steel, exterior supports, exterior ferrous piping and piping supports, valve handles, hydrants, bench stands, and operating devices and supports, guard posts and bollards	EP	PE	APE
Exposed electrical conduit, conduit fittings, and outlet boxes	PE		PE
If against concrete or concrete masonry units.	RPP	AGE	AGE
If against metal panels			
Submerged metal, except aluminum, bronze or stainless steel	CTE	EPWT	CTE

Items with factory finish

Touch up with materials supplied by manufacturer

- * See manufacturer's application guide for surface preparation and lining system procedures. Brush blast for concrete surfaces.

- G. Final Touch-Up: Prior to final completion and acceptance, examine painted and finished surfaces and retouch or refinish areas to leave touched-up areas with same appearance as and even with the surrounding finish specified.

PART 4 – COMPENSATION (Not Used)

END OF SECTION 09800

SECTION 15200
VALVES, GENERAL

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Provide valves, actuators, and appurtenances, complete and operable, as indicated in accordance with the Contract Documents.
- B. Apply the provisions of this Section to all valves and valve actuators except where otherwise indicated.

1.2 RELATED WORK

- A. Section 05500 – MISCELLANEOUS METALS
- B. Section 09800 – PROTECTIVE COATINGS
- C. Section 15201 – VALVE AND GATE ACTUATORS

1.3 SUBMITTALS

- A. Furnish submittals in accordance with the requirements of Section 01300 – SUBMITTALS.
- B. Furnish the following information on Shop Drawings:
 - 1. valve name, size, Cv factor, pressure rating, identification number (if any), and specification section number;
 - 2. complete information on the valve actuator, including size, manufacturer, model number, limit switches, and mounting;
 - 3. assembly drawings showing part nomenclature, materials, dimensions, weights, and relationships of valve handles, hand wheels and position indicators;
- C. Furnish a technical manual containing the required information for each valve, as indicated.
- D. Furnish a spare parts list, containing the required information for each valve assembly, as indicated.
- E. Factory Test Data

1. Where indicated, submit signed, dated, and certified factory test data for each valve requiring certification, before shipping the valve.
2. Furnish a certification of quality and test results for factory-applied coatings.

1.4 SPECIAL REQUIREMENTS

A. Unit Responsibility

1. Make a single manufacturer responsible for the coordination of design, assembly, testing, and furnishing of each valve; however, the CONTRACTOR shall be responsible to the OWNER for compliance with the requirements of each valve Section.
2. Unless indicated otherwise, the responsible manufacturer shall be the manufacturer of the valve.

B. Single Manufacturer

1. Where 2 or more valves of the same type and size are required, the valves shall be furnished by the same manufacturer.

PART 2 - PRODUCTS

2.1 PRODUCTS

A. General

1. Provide valves and gates of new and current manufacture.

B. Valve Actuators

1. Unless otherwise indicated, provide valve actuators in accordance with Section 15201 – Valve and Gate Actuators.

C. Protective Coating

1. Coat the exterior surfaces of valves and the wet interior surfaces of ferrous valves of sizes 4-inch and larger in accordance with the requirements of Section 09800 – PROTECTIVE COATINGS.
2. The valve manufacturer shall certify in writing that the required coating has been applied and tested in the manufacturing plant prior to shipment, in accordance with the indicated requirements.
3. Do not epoxy-coat the flange faces of valves.

D. Valve Testing

1. As a minimum, unless otherwise indicated or recommended by the reference standards, test valves in accordance with the manufacturer's standard procedure.

E. Valve Markings

1. Permanently mark valve bodies in accordance with MSS SP25 - Standard Marking Systems for Valves, Fittings, Flanges, and Unions.

2.2 MATERIALS

A. General

1. Provide materials suitable for the intended application.
2. Provide materials in contact with potable water listed as compliant with NSF Standard 61.
3. Ensure that materials not indicated are of high-grade standard commercial quality, free from defects and imperfections that might affect the serviceability of the product for the purpose for which it is intended.
4. Unless otherwise indicated, provide valve and actuator bodies conforming to the following requirements:
 - a. Cast Iron: Close-grained gray cast iron, conforming to ASTM A 48 - Gray Iron Castings, Class 30, or to ASTM A 126 - Gray Iron Castings for Valves, Flanges, and Pipe Fittings
 - b. Ductile Iron: ASTM A 536 - Ductile Iron Castings, or to ASTM A 395 - Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures
 - c. Steel: ASTM A 216 - Steel Castings, Carbon Suitable for Fusion Welding for High-Temperature Service, or to ASTM A 515 - Pressure Vessel Plates, Carbon Steel, for Intermediate- and Higher-Temperature Service
 - d. Bronze: ASTM B 62 - Composition Bronze or Ounce Metal Castings, and valve stems not subject to dezincification shall conform to ASTM B 584 - Copper Alloy Sand Castings for General Applications
 - e. Stainless Steel: Stainless steel valve and operator bodies and trim shall conform to ASTM A 351 - Steel Castings, Austenitic, for

High-Temperature Service, Grade CF8M, or shall be Type 316 stainless steel

- f. PVC: Polyvinyl chloride materials for valve body, flanges, and cover shall conform to Cell Classification 12454
- g. CPVC: Chlorinated Poly Vinyl Chloride materials for valve body, flanges, and cover shall conform to Cell Classification 23447
- h. NSF Standard 14: Materials shall be listed for use in contact with potable water.

2.3 VALVE CONSTRUCTION

A. Bodies

- 1. Provide valve bodies that are cast, molded (in the case of plastic valves), forged, or welded, of the materials indicated, and with smooth interior passages.
- 2. Provide wall thicknesses uniform and in agreement with the applicable standards for each type of valve, without casting defects, pinholes, and other defects that could weaken the body.
- 3. Perform welds on welded bodies by certified welders and ground welds smooth.
- 4. Provide valve ends as indicated, and rated for the maximum temperature and pressure to which the valve will be subjected.

B. Valve End Connections

- 1. Unless otherwise indicated, valves 2-1/2 inches in diameter and smaller may be provided with threaded end connections.
- 2. Provide valves 3 inches in diameter and larger with flanged end connections.

C. Bonnets

- 1. Connect valve bonnets to the body by clamping, screwing, or flanging.
- 2. Provide bonnets of the same material, temperature, and pressure rating as the body.
- 3. Make provisions for the stem seal with the necessary glands, packing nuts, and yokes.

D. Stems

1. Provide valve stems of the materials indicated, or, if not indicated, of the best commercial material for the specific service, with adjustable stem packing, O-rings, chevron V-type packing, or other suitable seal.
2. Where dezincification is not a problem, bronze conforming to ASTM B 584 may be used, except that the zinc content shall not exceed 16 percent

E. Stem Guides

1. Provide stem guides spaced 10 feet on centers, unless the manufacturer can demonstrate by calculation that a different spacing is acceptable.
2. Construct submerged stem guides from Type 304 stainless steel.

F. Internal Parts

1. Provide internal parts and valve trim as indicated for each individual valve.
2. Where not indicated, construct valve trim from Type 316 stainless steel or other best-suited material.

G. Nuts and Bolts

1. Provide nuts and bolts on valve flanges and supports in accordance with the requirements of Section 05500 – MISCELLANEOUS METALS.

2.4 VALVE ACCESSORIES

- A. Provide valves complete with the accessories required to provide a functional system.

2.5 SPARE PARTS

- A. Furnish the required spare parts, suitably packaged and labeled with the valve name, location, and identification number.
- B. Furnish the name, address, and telephone number of the nearest distributor for the spare parts of each valve.
- C. Spare parts are intended for use by the OWNER, after expiration of the correction of defects period.

2.6 MANUFACTURERS

- A. Valve manufacturers shall have a successful record of not less than 5 years in the manufacture of the indicated valves.

PART 3 - EXECUTION

3.1 VALVE INSTALLATION

A. General

1. Install valves, actuating units, stem extensions, valve boxes, and accessories in accordance with the manufacturer's written instructions and as indicated.
2. Adequately brace gates in order to prevent warpage and bending under the intended use.
3. Firmly support valves in order to avoid undue stresses on the pipe.

B. Access

1. Install valves in a manner to provide easy access for actuation, removal, and maintenance, and to avoid interference between valve actuators and structural members, handrails, and other equipment.

PART 4 - COMPENSATION

(Not Used)

END OF SECTION 15200

SECTION 15201

VALVE AND GATE ACTUATORS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Provide valve and gate actuators and appurtenances, complete and operable, as indicated in accordance with the Contract Documents.
- B. The provisions of this Section apply to valves and gates except where otherwise indicated in the Contract Documents.

1.2 RELATED WORK

- A. Section 05500 – MISCELLANEOUS METALS
- B. Section 09800 – PROTECTIVE COATINGS
- C. Section 15200 – VALVES, GENERAL

1.3 SUBMITTALS

- A. Furnish submittals in accordance with the requirements of Section 01300 – SUBMITTALS and Section 15200 – VALVES, GENERAL.
- B. Submit Shop Drawing information for actuators with the valve and gate submittals as a complete package.
- C. Submit calculations showing dynamic seating and unseating torques versus the output torque of the actuator.

1.4 SPECIAL REQUIREMENTS

- A. Unit Responsibility
 - 1. Make the valve or gate manufacturer responsible for the coordination of design, assembly, testing, and installation of actuators on the valves and gates; however, the CONTRACTOR shall be responsible to the OWNER for compliance of the valves, gates, and actuators with the Contract Documents.
- B. Where 2 or more valve or gate actuators of the same type or size are required, the actuators shall be produced by the same manufacturer.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Unless otherwise indicated, provide shut-off and throttling valves and externally actuated valves and gates with manual actuators.
- B. Provide actuators complete and operable with mounting hardware, gears, hand wheels, levers, chains, and extensions, as applicable.
- C. Provide actuators with torque ratings equal to or greater than required for valve seating and dynamic torques, whichever is greater, and capable of holding the valve in any intermediate position between fully-open and fully-closed without creeping or fluttering.
- D. Manufacturers
 - 1. Where indicated, certain valves and gates may be provided with actuators manufactured by the valve or gate manufacturer.
 - 2. Where actuators are furnished by different manufacturers, coordinate the selection to result in the fewest number of manufacturers possible.
- E. Materials
 - 1. Provide actuators of current models, of the best commercial quality materials, and liberally sized for the required torque.
 - 2. Provide materials suitable for the environment in which the valve or gate is to be installed.
- F. Actuator Mounting and Position Indicators
 - 1. Securely mount actuators by means of brackets or hardware specially designed and sized for this purpose and of ample strength.
 - 2. Cast the word "OPEN" on each valve or actuator, with an arrow indicating the direction to open in the counter-clockwise direction.
 - 3. Equip gear and power actuators with position indicators.
 - 4. Where possible, locate manual actuators between 48 and 60 inches above the floor or the permanent working platform.
- G. Standards
 - 1. Where indicated, provide power actuators in accordance with AWWA C 540 - Power-Actuating Devices for Valves and Sluice Gates.

- H. Provide fasteners in accordance with the requirements of Section 05500 – MISCELLANEOUS METALS.
- I. Provide coatings in accordance with the requirements of Section 09800 – PROTECTIVE COATINGS.

2.2 MANUAL ACTUATORS

A. General

1. Unless otherwise indicated, provide valves and gates with manual actuators.
2. Provide valves in sizes up to and including 4 inches with direct-acting lever or hand wheel actuators of the manufacturer's best standard design except where otherwise required in these Specification Sections.
3. Provide valves and gates larger than 4-inch with gear-assisted manual actuators, with an operating pull of maximum 60 pounds on the rim of the hand wheel.
4. Provide buried and submerged gear-assisted valves, gates, gear-assisted valves for pressures higher than 250 psig, valves 30 inches in diameter and larger, and where indicated, with worm gear actuators, hermetically-sealed water-tight and grease-packed.
5. Valves 6-inch to 24-inch diameter may be provided with worm gear, spur or bevel gear actuators, as appropriate for each valve.

B. Chain Actuator

1. Provide manually-activated valves with the stem located more than 7 feet above the floor or operating level with chain drives consisting of sprocket-rim chain wheels, chain guides, and operating chains supplied by the valve manufacturer.
2. Construct the wheel and guide from ductile iron, cast iron, or steel.
3. Chains
 - a. Fabricate the chain from hot-dip galvanized steel or stainless steel, and extend to 5 feet, 6 inches above the operating floor level.
 - b. Provide an extra strong valve stem on chain-actuated valves in order to allow for the extra weight and chain pull.
 - c. Provide hooks for chain storage where chains interfere with pedestrian traffic.

C. Manual Worm Gear Actuator

1. Provide an actuator consisting of a single- or double-reduction gear unit contained in a weatherproof cast iron or steel body with cover, and a minimum 12-inch diameter handwheel.
2. Provide the actuator to be capable of a 90-degree rotation, and equip the actuator with travel stops capable of limiting the valve opening and closing.
3. Provide the actuator with spur or helical gears and worm gearing.
4. Provide a self-locking gear ratio in order to prevent "back-driving."
5. Construct the spur or helical gears of hardened alloy steel, and the worm gear of alloy bronze.
6. Construct the worm gear shaft and the hand wheel shaft from 17-4 PH or similar stainless steel.
7. Accurately cut gearing with hobbing machines.
8. Use ball or roller bearings throughout.
9. Provide the output shaft end with a spline in order to allow adjustable alignment.
10. Actuator output gear changes shall be mechanically possible by simply changing the exposed or helical gearset ratio without further disassembly of the actuator.
11. Design gearing for a 100 percent overload.
12. The entire gear assembly shall be sealed weatherproof, unless otherwise indicated for buried or submerged service.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install valve and gate actuators and accessories in accordance with the requirements of Section 15200 – VALVES, GENERAL.
- B. Locate the actuators to be readily accessible for operation and maintenance without obstructing access ways.

- C. Do not mount actuators where shock or vibrations will impair their operation, and do not attach the support systems to handrails, process piping, or mechanical equipment.

PART 4 - COMPENSATION

(Not Used)

END OF SECTION 15201

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SECTION 15202

VORTEX VALVES

15202.1 VORTEX VALVE IN EXISTING STRUCTURE EACH

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Furnish, install and test all vortex valves and appurtenances, complete and operable, in accordance with the Contract Documents.
- B. Unit Responsibility: A single manufacturer shall be made responsible for coordination of design, assembly, testing, and furnishing of each valve; however, the Contractor shall be responsible to the Owner for compliance with the requirements with this Section.

1.2 RELATED WORK

- A. Section 05500 – MISCELLANEOUS METALS
- B. Section 09800 – PROTECTIVE COATINGS

1.3 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Section 01300 – SUBMITTALS
 - 1. Shop Drawings: Shop drawings shall contain the following information:
 - a. Valve name, size, capacity, and identification number (if any).
 - b. Complete information on the valve including Manufacturer, model number, general characteristics, performance and mounting / installation.
 - c. Assembly drawings showing part nomenclature, materials, dimensions and weights.
 - 2. Owner's Manual: The Owner's Manual shall contain the required information for each valve.
 - 3. Spare Parts List: A Spare Parts List shall contain the required information for each part in the assembly.

4. Factory Test Data: Submit signed, dated, and certified factory hydraulic test data for each valve. The data shall also include certification of quality and test results for all factory-applied coatings.
5. Manufacturer's literature as needed to supplement data.

1.4 QUALITY ASSURANCE

A. Equipment Field Testing

1. If the manufacturer's Factory Test Data for the specific size and model of vortex valve is not submitted or approved by the ENGINEER, the CONTRACTOR shall coordinate and conduct a hydrostatic test for each vortex valve at no cost to the OWNER.
2. The hydrostatic test shall maintain a downstream flow rate at the maximum possible condition of service (i.e. flooded manhole) and downstream head pressure of zero for a minimum of 30 minutes. Excessive flow or leaks shall be corrected by adjusting and servicing the valve and connection. The valve shall be retested or replaced until approved by the ENGINEER.

1.5 DELIVERY, STORAGE AND HANDLING:

- A. Provide in accordance with Section 01600 – PRODUCTS, MATERIALS, AND EQUIPMENT.
- B. Shipping: Ship equipment, material and spare parts fully assembled except where partial disassembly is required by transportation regulations or for protection of components.

PART 2 - PRODUCTS

2.1 VORTEX VALVE

- A. Type: Device for controlling stormwater flow by hydraulic vortex effect without moving parts or power. The device shall consist of an intake, volute and outlet. Flow shall pass tangentially into the volute to form a vortex that self-regulates the peak discharge flow rate into the receiving pipe. Intake and outlet openings shall be of sufficient size and design to avoid clogging with stormwater debris.
- B. Bypass Door: Vortex valve shall include a pivoting bypass door at the face of the unit for maintenance access. The bypass door shall be self-closing.

- C. Pipe Connection: Vortex valves shall connect to the receiving pipe with a wall anchor plate or gasketed insertion sleeve. Coordinate the type of connection to adapt to existing and proposed conditions encountered in the field. Connection shall be made with a watertight seal.

2.2 MATERIALS

- A. General: All materials and coatings shall be suitable for submerged service in accordance with Section 05500 – MISCELLANEOUS METALS and Section 09800 – PROTECTIVE COATINGS. Materials not specified shall be high-grade standard commercial quality, free from all defects and imperfections that might affect the serviceability of the product for the purpose for which it is intended.
- B. Body and Connection: Type 304L stainless steel. Plastic is not allowed.
- C. Hardware: Type 304 stainless steel.

2.3 PERFORMANCE

- A. Vortex valves shall be sized to regulate discharge to the receiving pipe at the rate indicated on the table below:

MANHOLE AND CATCH BASIN THROTTLE TABLE

LOCATION	CB/MH NO.	CAPACITY	STRUCTURE
GREEN STREET AND PLESANT STREET INTERSECTION	D17CBN4815	0.75 CFS	CATCH BASIN - EXISTING

Note: Where pipe size and invert depths are not available on drawings, the Contractor shall field verify dimensions and coordinate with the manufacturer. Capacity shall be based on maximum submergence equal to the difference between rim and invert elevations.

2.4 MANUFACTURER

- A. Qualifications: Manufacturer shall have a successful record of not less than 5 years in the manufacture of the type of vortex valves indicated.
- B. Manufacturers: The vortex valve manufacture shall be one of the following or equivalent:
 1. Gabriel Novac & Assoc., Inc. - Montreal, Quebec
 2. CONTECH Engineered Solutions - West Chester, OH

3. Hydro International - Portland, ME
4. John Meunier Inc. - Glenside, PA

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Vortex valves shall be installed in strict accordance with the manufacturer's printed recommendations and the requirements herein.
- B. Mounting of Plate Connections
 1. Shortly before setting each valve, apply a 1/8-inch-thick layer of mastic grade polysulfide elastomeric sealant to the back of the plate.
 2. After setting the valve, the nuts shall be turned down on the anchor bolts far enough only to make them snug and to cause the rubber sealant to begin to ooze out, but not far enough to produce any significant stress to the frame.
 3. Excess sealant at the edges shall be removed.
 4. The sealant shall be allowed to cure for at least 7 Days, after which the anchor bolt nuts shall be tightened to their final positions.
 5. If gaskets are being used, they shall be installed over the studs in one piece, or dovetailed and cemented with a liquid-type gasket material.
- C. Damage to surface coatings incurred during shipment or installation shall be repaired.

PART 4 – COMPENSATION

15202.1 – Vortex Valve in Existing Structure

METHOD OF MEASUREMENT:

Measurement for payment for Vortex Valve will be based on the actual number of vortex valves installed, complete as shown on the Contract Drawings or as directed by the Engineer and as measured by the Engineer.

BASIS OF PAYMENT/INCLUSIONS:

Payment for Vortex Valve will be based on the unit price bid for this item in the proposal. Under the per each price for the item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required to install each vortex valve complete as shown on the Contract Drawings or at the direction of the Engineer. The work includes, but is not limited to: furnish and install vortex valve, restraints, gaskets and appurtenances; connections to existing and proposed pipes and structures; concrete; grout; hardware; protective coating; remove and reset castings and pre-cast sections with suitable backfill to allow for installation; support of vortex valve during installation; and all incidental work required for the installation of vortex valves not specifically included for payment elsewhere.

SPECIAL NOTES ON EXCLUSIONS:

The following are not included for payment herein but are included for payment elsewhere; saw cutting pavement; imported gravel sub-base; and pavement, curb and sidewalk restoration.

END OF SECTION 15202

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SECTION 15203

FLOAT THROTTLES

15203.1 FLOAT THROTTLE IN PROPOSED STRUCTURE EACH

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Furnish, install and test all float throttles and appurtenances, complete and operable, in accordance with the Contract Documents.
- B. Unit Responsibility: A single manufacturer shall be made responsible for coordination of design, assembly, testing, and furnishing of each float throttle; however, the Contractor shall be responsible to the Owner for compliance with the requirements with this Section.

1.2 RELATED WORK

- A. Section 05500 – MISCELLANEOUS METALS
- B. Section 09800 – PROTECTIVE COATINGS

1.3 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Section 01300 – SUBMITTALS
 - 1. Shop Drawings: Shop drawings shall contain the following information:
 - a. Float throttle name, size, capacity, and identification number (if any).
 - b. Complete information on the float throttle including Manufacturer, model number, general characteristics, performance and mounting / installation.
 - c. Assembly drawings showing part nomenclature, materials, dimensions and weights.
 - 2. Owner's Manual: The Owner's Manual shall contain the required information for each valve.
 - 3. Spare Parts List: A Spare Parts List shall contain the required information for each part in the assembly.

4. Factory Test Data: Submit signed, dated, and certified factory hydraulic test data for each float throttle. The data shall also include certification of quality and test results for all factory-applied coatings.
5. Manufacturer's literature as needed to supplement data.
6. Recommendations for long term storage.

1.4 QUALITY ASSURANCE

- A. A single manufacturer shall be made responsible for coordination of design, assembly, testing, and furnishing of each float throttle; however, the Contractor shall be responsible to the Owner for compliance with the requirements with this Section.

1.5 DELIVERY, STORAGE AND HANDLING:

- A. Provide in accordance with Section 01600 – PRODUCTS, MATERIALS, AND EQUIPMENT.
- B. Shipping:
 1. Ship equipment, materials and spare parts fully assembled except where partial disassembly is required by transportation regulations or for protection of components.
 2. Furnish items to the Owner for future installation in their original packaging.

PART 2 - PRODUCTS

2.1 FLOAT THROTTLE

- A. General: The float throttle shall be self-activating and shall not require instrumentation or external power. The float throttle shall be essentially non-clogging.

2.2 MATERIALS

- A. General: All materials and coatings shall be suitable for submerged service in accordance with Section 05500 – MISCELLANEOUS METALS and Section 09800 – PROTECTIVE COATINGS. Materials not specified shall be high-grade standard commercial quality, free from all defects and imperfections that might affect the serviceability of the product for the purpose for which it is intended.

- B. Body and Connection: Type 304L stainless steel, in accordance with ASTM A 240.
- C. Hardware: Type 316 stainless steel with insulating washers.

2.3 CAPACITY

- 1. The float throttle shall be sized to regulate discharge to the receiving pipe at the rate indicated on the table below:

Location	Model No.	Max. Discharge (cfs)	Max. Head (ft)	Outlet Pipe Diameter (in)
Total Phosphorus Deflection Structure	DR-250 MINI	2.0	2.5	10

- 2. The float throttle shall provide a watertight seal with the receiving discharge pipe as indicated to avoid bypass.

2.4 FUNCTIONAL DESCRIPTION

- A. The float throttle shall remain in the neutral or fully open position during dry weather flow. The float throttle shall only start to close when the inflow at the upstream control point is greater than the capacity of the fully opened unit and shall fully close when a set hydraulic head upstream of approximately three (3) times the outlet pipe diameter is reached. The float throttle shall open again when the hydraulic head falls below the set threshold. The increasing water level causes the float to rise, which in turn causes the flow area to be adjusted so that a constant discharge is maintained. As the water level increases, the average flow velocity upstream of the unit decreases, thereby allowing settleable solids to decant to the bottom and the floatables to float to the top. As a result, these solids do not interfere with the normal operation of the device.
- B. The flow rate shall progressively increase for upstream heads between zero (0) and one (1) times the outlet nominal diameter, reaching the design constant flow rate once the latter mark is reached. The flow rate shall be maintained constant for head variations between one (1) and two (2) times the nominal outlet diameter. As the head increases from two (2) to three (3) times the nominal outlet diameter, the flow rate shall progressively decrease going from the design constant flow rate to zero (fully closed position). When the upstream head remains above three (3) times the nominal outlet diameter, the unit shall remain fully closed and shall only reopen when the upstream head falls below this mark again.

1. For a unit with a nominal outlet diameter of 10 inches, the upstream water level may vary from 0.8 to 1.7 feet while maintaining a constant discharge. Flow will progressively increase/decrease when the upstream water level falls between 0.0 and 0.8 feet and 1.7 and 2.5 feet, respectively. The unit shall remain fully closed for upstream heads larger than 2.5 feet.
- C. The flow passage area shall be the largest at the most critical time; during dry weather flow, at the beginning of a storm event when the sewer lines are being flushed and at the end of a storm event when the sewer lines are emptying, thereby reducing the chances and frequency of blockage.

2.5 PERFORMANCE

- A. The float throttle shall be designed to comply with the following performance levels:

Hydraulic Head	Allowable Flow Rate
0.00 ft to 0.75 ft	0.0 – 2.00 cfs
0.75 ft to 1.76 ft	2.00 cfs
1.76 ft to 2.50 ft	2.00 – 0.00 cfs
Over 2.50 ft	0.00 cfs

- B. All flows and related pressure head shall be within $\pm 5\%$ if the performance levels stated above.

2.6 MANUFACTURER

- A. Qualifications: Manufacturer shall have a successful record of not less than 5 years in the manufacture of the type of float throttle indicated.
- B. Manufacturers: The float throttle manufacture shall be one of the following or equivalent:
1. Gabriel Novac & Assoc., Inc. - Montreal, Quebec (Model No. DR-250-VN-MINI)

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Where identified on the drawings, CONTRACTOR shall furnish float throttles to the OWNER for future installation.
- B. Float throttles shall be installed in strict accordance with the manufacturer's printed recommendations and the requirements herein.

- C. Mounting of float throttles
1. Shortly before setting each float throttle, apply a 1/8-inch-thick layer of mastic grade polysulfide elastomeric sealant to the back of the frame.
 2. After setting the float throttle, the nuts shall be turned down on the anchor bolts far enough only to make them snug and to cause the rubber sealant to begin to ooze out, but not far enough to produce any significant stress to the frame.
 3. Excess sealant at the edges shall be removed.
 4. The sealant shall be allowed to cure for at least 7 Days, after which the anchor bolt nuts shall be tightened to their final positions.
 5. If gaskets are being used, they shall be installed over the studs in one piece, or dovetailed and cemented with a liquid-type gasket material.
- D. Damage to surface coatings incurred during shipment or installation shall be repaired.

PART 4 - COMPENSATION

15203.2 – Float Throttle in Proposed Structure

METHOD OF MEASUREMENT:

Measurement for payment for Float Throttle will be based on the actual number of Float Throttles supplied, complete as shown on the Contract Drawings or as directed by the Engineer and as measured by the Engineer.

BASIS OF PAYMENT:

Payment for Float Throttle will be based on the unit price bid for this item in the proposal. Under the per each price for the item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required to furnish each Float Throttle complete as shown on the Contract Drawings or at the direction of the Engineer. The work includes, but is not limited to; furnish Float Throttle, restraints, gaskets and appurtenances; and all incidental work required for the furnishing of Float Throttles not specifically included for payment elsewhere.

END OF SECTION 15203

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SECTION 15250

HYDRAULIC GATES, GENERAL

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Furnish and install hydraulic gates with appurtenances, complete and operable, in accordance with the Contract Documents.
- B. Unit Responsibility: The Contractor shall assign to a single manufacturer responsibility for the furnishing and functional operation of the hydraulic gates, including operators and accessories. The designated single manufacturer, however, need not manufacture more than one part of the units, but shall coordinate the design, assembly, testing, and installation of the units.

1.2 RELATED WORK

- A. Section 05500 – MISCELLANEOUS METALS
- B. Section 09800 – PROTECTIVE COATINGS
- C. Section 15201 – VALVE AND GATE ACTUATORS

1.3 SUBMITTALS

- A. Furnish submittals in accordance with Section 01300 – SUBMITTALS.
- B. Shop Drawings
 - 1. Submit Shop Drawings of hydraulic gates as indicated in their respective Section.
- C. Technical Manuals
 - 1. Submit complete technical manuals, including printed instructions for proper maintenance, lubrication, and complete parts list indicating the various parts by name, number, and exploded view where necessary.
 - 2. A list of recommended spare parts for the OWNER to store at the facility shall be included.
- D. Certification
 - 1. The Contractor shall obtain written certification from the designated single manufacturer, addressed to the OWNER, stating that the equipment will

efficiently and thoroughly perform the required functions in accordance with these Contract Documents, and that the designated single manufacturer accepts the Contractor's assignment of responsibility for coordination of gate equipment, including operators, controls, and services required for proper installation and operation.

E. Field Procedures

1. Prior to installation of the gates, provide instructions for field procedures for storage, installation, adjustments, inspection, and testing.

1.4 QUALITY ASSURANCE

A. Equipment Field Testing

1. The Contractor shall be responsible for the coordination of the tests of each hydraulic gate in the presence of the manufacturer's factory service representative.
2. Excessive leaks shall be corrected and the equipment retested until found to be satisfactory.

B. Manufacturer's Services Representative

1. Service and testing assistance by the manufacturer's engineering representative for each gate and valve shall be furnished by the Contractor during installation and startup.
2. The Contractor shall arrange for the services of a factory service representative to instruct the OWNER's personnel in the operation and maintenance of the equipment.

1.5 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. The following industry standards apply to the applicable products under this specification section:

1. AWWA C560 Cast Iron Slide Gates
2. AWWA C561 Stainless Steel Slide Gates
3. AWWA C562 Aluminum Slide Gates
4. AWWA C563 Composite Slide Gates
5. AWWA C 513 Open Channel Fabricated Metal Slide Gates
6. ASTM A 276 Stainless Steel Bars and Shapes

- 7. ASTM B 21 Naval Brass Rod, Bar, and Shapes
- 8. ASTM B 584 Copper Alloy Sand Castings for General Applications

1.6 SPECIAL WARRANTY REQUIREMENT

- A. The Contractor shall furnish the manufacturer's written guarantee that the hydraulic gates comply with the indicated requirements.
- B. The Contractor shall furnish the manufacturer's warranties as published in its literature.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Equipment provided under this Section shall be new, of current manufacture, and shall be the products of reputable manufacturers specializing in the manufacture of such products and which have had previous experience in such manufacture.
- B. The Contractor shall, upon request, furnish the names of not less than 5 successful installations of the manufacturer's equipment of comparable nature to that offered under the Contract.
- C. Combinations of manufactured equipment which are provided under these Specifications shall be entirely compatible, and the Contractor and the manufacturer shall be responsible for the compatible and successful operation of the various components of the units.
- D. Indicated and necessary mountings and appurtenances shall be included.

2.2 MATERIALS

- A. Materials employed in the manufacture and installation of the hydraulic gates and operators shall be suitable for the intended application. Material not specifically called for shall be high-grade, standard commercial quality, free from defects and imperfection that might affect the serviceability of the product for the purpose for which it is intended.

2.3 HARDWARE

- A. Bolts and nuts shall comply with the requirements of Section 05500 – MISCELLANEOUS METALS unless otherwise indicated.

2.4 PROTECTIVE COATING

- A. Coat ferrous metal in accordance with the requirements of Section 09800 – PROTECTIVE COATINGS.

2.5 TOOLS AND SPARE PARTS

- A. Tools
 - 1. Furnish special tools that are necessary for maintenance and repair of the gates.
 - 2. Such tools shall be suitably stored in metal toolboxes and identified with the equipment number by means of stainless steel or solid plastic nametags attached to the box.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Gates shall be installed in strict accordance with the manufacturer's printed recommendations.
- B. Operators shall be located as to avoid interference with handrails and structural members.
- C. Gates with Wall Thimbles
 - 1. Shortly before setting each gate, apply a 1/8-inch-thick layer of mastic grade polysulfide elastomeric sealant to the back of the gate frame.
 - 2. After setting the gate, the nuts shall be turned down on the anchor bolts far enough only to make them snug and to cause the rubber sealant to begin to ooze out, but not far enough to produce any significant stress to the frame.
 - 3. Excess sealant at the edges shall be removed.
 - 4. The sealant shall be allowed to cure for at least 7 Days, after which the anchor bolt nuts shall be tightened to their final positions.
 - 5. If gaskets are being used, they shall be installed over the studs in one piece, or dovetailed and cemented with a liquid-type gasket material.
- D. Damage to surface coatings incurred during shipment or installation shall be repaired.

PART 4 - COMPENSATION

(Not Used)

END OF SECTION 15250

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SECTION 15251

CAST IRON SLIDE GATES

15251.1 4'W X 2'H CAST IRON SLIDE GATE

EACH

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The CONTRACTOR shall provide slide gates, complete and operable, as indicated in accordance with the Contract Documents.

1.2 RELATED WORK

- A. Section 09800 – PROTECTIVE COATINGS
- B. Section 15250 – HYDRAULIC GATES, GENERAL
- C. Section 15201 – VALVE AND GATE ACTUATORS

1.3 SUBMITTALS

- A. Furnish submittals in accordance with Section 01300 – SUBMITTALS and Section 15250 – HYDRAULIC GATES, GENERAL.
- B. Shop Drawings
 - 1. Submit the following:
 - a. drawings of gates, frames, slides, and actuators
 - b. design load calculations for deflection at the maximum expected head
 - c. calculations for the lifting force generated by 40 pounds effort on the handwheel or crank in order to operate the gate.

1.4 QUALITY ASSURANCE

- A. Provide in accordance with Section 15250 – HYDRAULIC GATES, GENERAL.
- B. Procedures and leakage criteria for field test shall conform to AWWA Standards.

PART 2 - PRODUCTS

2.1 CAST IRON SLIDE GATES

- A. Gates shall comply with AWWA C560 - Cast Iron Slide Gates, unless indicated otherwise.
- B. Gates shall be new and of current manufacture.
- C. Gates shall be adequately braced to prevent warping and bending under the intended usage.
- D. Actuators
 - 1. Gate actuators shall be manual worm gear type in accordance with Section 15201 – VALVE AND GATE ACTUATORS.
- E. Construction
 - 1. Unless otherwise indicated, materials of construction shall be in accordance with AWWA C560, as suitable for the service.
 - 2. Materials used in the fabrication of the slide gates shall conform to the requirements of the standards designated for each material indicated below:

Description	Materials Standards
Mounting Assembly	
Anchor Bolts and Nuts	Stainless Steel, ASTM A 276 Type 316
Stem Cover	Clear Plastic with graduated markings
Wall thimble	Cast Iron, ASTM A 48, Class 30
Gate Assembly	
Frame, Slide, and Guide Rails	Cast Iron, ASTM A-126 B
Seating Faces and Stem Guide Bushings	Low-Zinc Bronze, ASTM B-98
Wedges	Low-Zinc Bronze, ASTM B-98
Fasteners	Stainless Steel, ASTM A 276 Type 316
Stem Blocks	Low-Zinc Bronze, ASTM B-98
Flush Bottom Seal Type	
Sill Plate	Cast Iron, ASTM A-126 B
Seal	Rubber, Neoprene 2000-Grade R-62
Retainer	Stainless Steel, ASTM A 276 Type 316
Flush Bottom Seals	Rubber, Neoprene 2000-Grade R-62
Self-Contained Type	
Yoke	Cast Iron, ASTM A-126 B
Stem	Stainless Steel, ASTM A 276 Type 316

- F. Manual Lifting Devices

1. Provide lifting devices complete with stem, lifting nut, intermediate supports with steady bushings, stem cover, indicator, gear reducer, hand wheel and crank.
2. The lifting devices shall be weatherproof.
3. The centerline of the manual actuator shall be approximately 4 feet above the floor for frame-mounted actuators, or as shown on the Contract Drawings.
4. Slide gate hoist heads shall be constructed of cast iron.
5. The operating nut shall be constructed of solid bronze, in accordance with ASTM B 584.
6. Operating thrust shall be taken on roller or ball bearings.
7. Parts shall be provided with an alternative lubrication system.
8. Handwheel Crank
 - a. The unit shall be designed for a 40-pound maximum effort on the crank in order to operate the gate.
 - b. Clockwise movement of the handwheel shall close the gate.
 - c. The operating crank shall be easily removable in order to facilitate the use of a portable power operator.

G. Wall Thimbles

1. Unless otherwise indicated, slide gates shall be provided with cast iron, F-pattern wall thimbles to match the thickness of the walls in which they are installed.
2. Thimbles shall be furnished by the manufacturer of the gates and shall fit the bolt dimensions of the gates.
3. Studs shall be constructed of Type 316 stainless steel.

H. Sealant Manufacturer

1. The elastomeric sealant shall be Rubber Caulk Sealer as manufactured by the Product Research Company or Equal.

I. Manufacturers, or Equal

1. Rodney Hunt, Series Glydaseal
2. Hydro Gate Corp., Series HG560
3. Waterman Gate Company, Series 5000/7000

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Slide gates shall be installed in strict accordance with the requirements of Section 15250 – HYDRAULIC GATES, GENERAL.

PART 4 - COMPENSATION

Item 15251.1 – 4’W x 2’H Cast Iron Slide Gate

METHOD OF MEASUREMENT:

Measurement for payment for 4’W x 2’H Cast Iron Slide Gate will be based on the actual number of gates installed, complete as shown on the Contract Drawings or as required by the Engineer and as measured by the Engineer.

BASIS OF PAYMENT:

Payment for 4’W x 2’H Cast Iron Slide Gate will be based on the unit price bid for this item in the proposal. Under the per each unit price bid for the item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required to install each gate complete as shown on the Contract Drawings or at the requirements of the Engineer. The work includes, but is not limited to: furnish and install gate, wall thimble, manual actuator, gaskets and appurtenances; connections to proposed structures; protective coatings; supports; and all incidental work required for the installation of gates not specifically included for payment elsewhere.

SPECIAL NOTES/EXCLUSIONS:

The following item(s) are not included for payment under this item and are included for payment elsewhere: Isolation Gate Structure; Box Culvert; Access Hatch; and Access Platform.

END OF SECTION 15251

SECTION 32000

ROADWAY AND STREETSCAPE CONSTRUCTION

GENERAL:

WHERE REFERENCE IS MADE BELOW TO THE “MASSDOT STANDARD SPECIFICATIONS”, THIS SHALL BE CONSTRUED TO MEAN THE LATEST EDITION, INCLUDING STANDARD SPECIAL PROVISIONS AND SUPPLEMENTAL SPECIFICATIONS, OF THE MASSACHUSETTS DEPARTMENT OF TRANSPORTATION HIGHWAY DIVISION STANDARD SPECIFICATIONS FOR HIGHWAYS AND BRIDGES (English Units Version).

32102.5

TREE PROTECTION AND MAINTENANCE

LUMP SUM

DESCRIPTION:

Summary of Tree Protection

1. The work to be done under this Item consists of instituting and maintaining positive measures to protect and maintain public and private shade trees within and adjacent to the limits of work as detailed on the Drawings and as directed by the Engineer.
2. This work includes proactive measures prior to, during and after construction to ensure the short and long term health of existing trees to remain on site and to prevent damage due to construction operations.
3. Tree Protection should be assumed for existing trees to remain within the project limit of work where proposed construction activity is to occur beneath the canopy and within the drip lines of existing trees to remain. Tree protection shall remain in place throughout the duration of the construction project but may be temporarily relocated to allow for work in select areas in close proximity to the trees to occur as approved by the Engineer. Tree protection shall be promptly restored following work operations. The measures described herein are anticipated to be required and will be verified based on actual field conditions. Provisions under this Item include: tree protection fencing measures to minimize disturbance to existing trees and their root systems; canopy and root system review and evaluation; canopy and root pruning in areas of proposed disturbance; and post pruning care including mulching and watering of root zones.
4. Tree Protection is assumed for existing trees to remain within the project limit of work where proposed construction activity will not occur beneath the canopies and within the drip lines of existing trees to remain. Tree

ROADWAY AND STREETSCAPE CONSTRUCTION

protection shall remain in place throughout the duration of the construction project but may be temporarily relocated to allow for work in select areas in close proximity to the trees to occur as approved by the Engineer. Tree protection shall be promptly restored following work operations. The measures described herein are anticipated to be required and will be verified based on actual field conditions. Provisions under this Item include: tree protection fencing measures to minimize disturbance to existing trees and their root systems; and mulching and watering of root zones.

General Requirements

1. Clearing and grubbing: Removal of City and private trees as specifically designated on the plans and as directed by the Engineer shall be performed under Item 32103.
2. Pruning: The Contractor shall prune City and private trees within the limit of work under the direction of a Massachusetts Certified Arborist and only as directed by city representative and Engineer. Provide protection of existing trees and vegetation not designated for removal within the limits of work and along truck routes outside the limit of work. Temporarily stump or stockpile as applicable topsoil, shrubs, and vegetation within the limits of work that will interfere with construction and as required.
3. Conduct site clearing and pruning operations to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities only as directed by the Engineer. Do not close or obstruct streets, walks or other occupied or used facilities without permission from the Engineer.
4. Contractor is required to comply with the City of Cambridge Department of Public Works, Division of Urban Forestry regulation "Tree Protection during Construction". This regulation contains specific measures and remedies should the Contractor fail to abide the City's requirements.
5. Public trees are protected by Massachusetts state law, Chapter 87. Section 12 states that a fine of up to five hundred dollars, (\$500.00) per incident of damage to public shade trees can be levied. Each branch broken or improperly pruned, each improper wounding of the trunks of the trees, and each root improperly pruned shall constitute an infraction. Section 12 further provides that anyone who negligently or willfully damages a tree will be liable to the City for all damages.
6. The Contractor shall take the utmost care to avoid unauthorized, unnecessary or improper wounding of public or private shade trees. Prior to construction, the Contractor shall provide a tree protection and maintenance plan and work schedule. A Massachusetts or International Certified Arborist shall be sub-contracted by the Contractor to provide a protection and maintenance plan and perform specified work. All plans and schedules shall be subject to review and approval by the City Tree

ROADWAY AND STREETSCAPE CONSTRUCTION

Warden. Infraction of Massachusetts state law Chapter 87 or failure to provide a protection plan and work schedule will result in fines or the immediate cancellation of the contract.

7. The Contractor shall engage a board certified arborist with a minimum of 5 years of experience including experience with supersonic air tools such as the “airspade” for the project.
8. The work shall consist of the provision of all labor, materials, equipment, and transportation required to complete the pruning as required by the Engineer strict accordance with the conditions and specifications of these Contract Documents. The work shall include, but is not necessarily limited to, the following:
 - A. Initial site visit and assessment with City representatives
 - B. Securing necessary permits and approvals before commencement of work
 - C. Posting work areas for parking restrictions
 - D. Securing police details, if necessary
 - E. Marking work zones for traffic and pedestrian control
 - F. Providing a schedule of work for City review and approval
 - G. Meeting with City staff on a periodic basis
 - H. Visual assessment of each tree to be pruned including the assessment of the need for airspading and/or tree root pruning.
 - I. Determination of pruning objectives.
 - J. Pruning cuts
 - K. Wound care
 - L. Wood waste and debris consolidation & disposal
 - M. Site cleanup

Quality Assurance

1. Tree Protection measures to be performed by Massachusetts Certified Arborist with a minimum of five years of experience and as reviewed and approved by the Engineer and City Tree Warden.

Submittals

Certification: Submit the Certification of the arborist to be performing the work.

Tree Protection and Maintenance Plan and Work Schedule: submit plan for review by the Engineer and City Tree Warden.

Product Data: Submit most recent printed information from manufacturers for:

1. Tree Watering Bags

Samples: Submit samples of:

1. Tree Trunk Wrapping
2. Tree Protection Fencing
3. Tree Protection Stakes
4. Wood Chips
5. Tree Watering Bags

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MATERIALS:

Tree Protection Materials

Tree Trunk Wrapping Protection Lumber: consist of 2 in. x 4 in. and 8 ft. height lumber wired together in close spacing with 16 gauge galvanized steel wire to form a protective enclosure around tree trunks.

Tree Protection Fencing: new 4 ft. height of, high density polyethylene laminar netting. Mesh dimensions: 3-3/4 in. x 2 in with 1/2 in. strands. Fabric color: black.

Tree Protection Stakes: 2" diameter black painted galvanized steel pipe or 2in. x 4in. stained lumber stock as approved by the Engineer.

Wood chips: conform to provisions of Wood Chip Mulch under Materials Section M6.04.3 of the MassDOT Standard Specifications.

Water: Shall be furnished by Contractor, suitable for irrigation and free from ingredients harmful to plant life. Hose and other watering equipment required for work shall be furnished by Contractor.

Tree Watering Bags: Treegator Original as supplied by Spectrum Products, Youngsville, NC 27596, phone #866.873.3428. (or approved equivalent product).

CONSTRUCTION METHODS

Protection of Existing Trees and Improvements

1. Provide protection necessary to prevent damage to existing trees and improvements indicated to remain in place inside or outside of the limit of work. Existing trees and shrubbery to remain shall be protected from injury. Except as otherwise approved, cutting and trimming of existing tree limbs and roots will not be permitted. Existing trees to remain which can potentially be damaged by construction operations shall be boxed and protected. Protection shall be maintained until completion of the work of the Contractor. Tree protection requirements are described in City of Cambridge Department of Public Works, Division of Urban Forestry regulation "Tree Protection During Construction".
2. Protect trees and improvements on adjoining properties and within City right-of-way. Restore improvements damaged by Contractor's clearing and construction activities to their original condition, at no additional expense to the City. Remove and replace trees damaged by Contractor's clearing and construction activities at no additional expense to the City.
3. Protect existing trees and other vegetation indicated to remain in place or

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- outside of the clearing/grading limit lines indicated on the drawings.
4. Erect and maintain temporary rigid fence around drip line of individual trees or around perimeter drip line of groups of trees to remain. At sidewalk tree pits, the entire perimeter of the tree pit shall be fenced. At a minimum, and only if the Engineer determines that the preceding measures are not feasible, the Contractor shall wrap the trunks of all trees with protection lumber sufficient to protect tree trunks from mechanical damage. Remove fence and wrapping when construction is complete.

Equipment

1. The following equipment and vehicles shall be available on-site for use. All gas-powered equipment and vehicles must be five years old or less and in good condition as determined by the Engineer.
 - A. Two (2) aerial lift trucks with an articulating boom that have a working height of not less than sixty (60) feet. with Contractor's name painted on each side.
 - B. Two (2) chipper dump trucks with a minimum capacity of nine (9) cubic yards, with Contractor's name painted on each side.
 - C. Two (2) wood chippers with a capacity for 16" diameter limbs.
 - D. All relevant traffic control devices as prescribed by the Manual of Uniform Traffic Control Devices (MUTCD) of the U.S. Department of Transportation.
 - E. Supersonic air tools such as the "airspade" for use on designated trees with root conflicts as designated by engineer.

Special Requirements

1. The Contractor is required to conform to the requirements of the City of Cambridge Department of Public Works, Division of Urban Forestry regulation "Tree Protection During Construction". This regulation contains specific measures and remedies should the Contractor fail to abide the City's requirements.
2. For definitions and pruning standards, the Contractor is required to adhere to the requirements of ANSI A300, American National Standard for Tree Care Operations "Tree, Shrub and Other Woody Plant Maintenance Standard Practices".

General Horticultural Tree and Root Relationships

The majority of a tree's roots are located in the upper few inches of topsoil. For this reason, trees are vulnerable to immediate and long-term damage. Immediate damage to roots is caused by grading, use of vehicles and tools, and excess pedestrian traffic above

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the roots. Long-term damage is caused by the compaction of the soil above the roots by use of vehicles, storage of materials, and excess pedestrian traffic.

Protection of a tree therefore includes the protection of the roots of the tree as well as its trunk, branches, and leaves. Roots are best protected by fencing off as large an area as possible around each tree, so that no driving, parking, walking, or storage of materials takes place where it may cause damage.

The roots of a tree often extend far into the surrounding landscape, including areas well beyond the outer perimeter of the tree's canopy / drip line. For this reason, operations should be confined to the smallest possible area.

As a practical minimum, however, every effort shall be made to protect the area beneath the canopy of the tree, also known as the area inside the "drip line." This area is sometimes referred to as the "root zone."

Soil is most vulnerable to compaction, and roots to damage, when the soil is wet.

Site Review of Evaluation of Trees and Potential Construction Related Impacts to Root Systems

Prior to mobilization and construction operations, Contractor, Arborist, Engineer and City Tree Warden shall conduct a site review of the existing trees to remain in relation to proposed limits of construction operations, confirm the limits of tree protection fencing, and confirm which trees are to receive other types of Tree Protection. Contractor to document the trees and strategy to receive type of Tree Protection and submit for Engineers approval.

Tree Protection Fencing

Contractor shall erect the tree protection fence before site preparation or other construction activity commences. For each tree to be protected, set posts and fencing at minimum to the limit of the existing non-paved area, i.e. existing tree pit opening, and to the drip line in cases where pedestrian and vehicular movements will not conflict with an expanded fence location. Individual tree protection fencing, trunk protection, branch protection, and wood chips shall be determined on a case by case basis at the start of the project and shall be maintained throughout the duration of the contract until removal is approved by the Engineer.

During the course of the project, adjustments or temporary relocations to the fence locations might be required to facilitate the work. Adjustments shall be made at no additional cost to the City.

Erect the protective fence so that it is securely in place and resistant to seasonal climatic forces, adjacent pedestrian movement, and work operations to ensure root and tree protection.

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Periodically inspect, repair and maintain protective fences during the course of construction operations. During periods of construction stoppages, including but not limited to delays and over-wintering, periodically inspect, repair and maintain protective fences. Of particular concern is compaction by vehicles once the existing pavement has been removed, exposing roots to damage and by drying out.

Engineer reserves the right to require Contractor to provide additional or more secure tree protection devices if it is determined that the existing trees are not being properly protected or if the vegetation is threatened with damage through the construction operations.

Protect existing trees and other vegetation to remain in place. Do not burn, cut, break, skin, or bruise trunk, roots, or branches. Do not fasten ropes, cables, or guys to any existing trees unless specifically authorized by the Engineer.

If the Engineer determines that trees are not being protected to the standards herein, Engineer may order construction activity to stop immediately and to remain stopped until the non-compliant condition or practice is corrected. The Contractor shall comply with this provision at no additional cost to the City. This provision in no way affects the Contractor's obligation to complete the work of this contract by the date specified.

Temporary Access

Temporary access within plant protection areas is permitted to perform construction operations as approved by the Engineer. Work within tree protection areas shall be performed by hand or with small equipment that will not damage or threaten damage to trees. Restore tree protection at the end of each day's operation.

Utility Construction Near Trees

Route utilities away from existing trees. Review re-routing with Engineer. Do not proceed without written direction. Minimize the cutting of tree roots, and when cutting is unavoidable, cut cleanly with a power saw and not an excavating machine.

Activities Prohibited Within Dripline

Do not store and stockpile construction materials and/or excavated materials, park vehicles, drive vehicles, remove soils, and stockpile soils within the drip line of trees, including trees located on adjacent properties which overhang the site unless otherwise indicated in Contract Drawings. Excavation within these areas shall be subject to special care as described below in "Excavation within Dripline".

Excavation Within Drip Line

Where excavation for new construction is required within drip line of trees, tie branches out of the way, hand clear and excavate to minimize damage to root systems and place wood chips to a depth of 6" on the ground to protect the root systems.

Use narrow-tine spading forks and comb soil to expose roots. Relocate roots in backfill areas where possible. If encountering large, main lateral roots, expose roots beyond

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excavation limits to bend and relocate them without breaking. No roots greater than two (2) inches in diameter shall be cut from trees to remain without prior approval of the Engineer. Provide protection for roots over 1 inch diameter cut during construction operations. Prune roots that are either cut or broken with a smooth, clean cut.

Root Pruning

Do not cut main lateral roots or taproots; cut only smaller roots that interfere with installation of structures. Cut roots with sharp pruning instruments; do not break or chop; cutting of roots with machinery is expressly prohibited. When roots that must be cut are encountered, work shall cease until roots have been properly cut.

Root System Exposure and Support

Provide saturated burlap or temporary earth to cover tree roots exposed by construction. Do not allow exposed roots to dry out before placing permanent backfill. Water and maintain roots in a moist condition. Temporarily support and protect roots from damage until they are permanently relocated and covered with soil.

Tree Protection and Air Spading of Roots for Special Mature Trees

The Contractor shall stake out the following in relation to “Existing mature trees” as identified on the Streetscape Materials and Tree Pit Layout plans or identified by the Engineer at the start of the project. This should be done prior to initiating excavation and should be reviewed together in the field by the City’s representatives, the Contractor, Contractor’s arborist, and Engineer.

This includes:

1. limits of utility trenching
2. limits of sidewalks and proposed tree pit openings
3. limits of proposed construction fences,
4. alignment of proposed limits of excavation.

After areas of potential negative impact are reviewed and confirmed in the field, the Contractor’s arborist shall perform subsurface root exploration and evaluate root distribution in the area of the final cut lines.

As a guideline, the minimum final cut line distance from trunk of tree shall be established by taking the tree’s diameter at breast height in inches and converting it to feet, (For example, 12” caliper tree translates into a 12’ offset from the edge of the trunk to the final cut line.) Site constraints may dictate that the final cut line is closer to the trunk than guidelines will allow. Do not perform subsurface exploration near the trunk or within the drip line without authorization from the Engineer or City representative.

The Contractor’s arborist shall perform subsurface exploration in areas of negative impact adjacent to the final cut line using an air spade to cut windows in the soil to a depth of 10” or greater to expose the root systems without damaging them.

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Based on the proposed alignment of the new utilities, pavement, curbs, formwork, etc. in relation to “Existing mature trees” the Contractor’s arborist with the Engineer’s review and approval, will define the final cut lines depending on the density and distribution of the root systems. The final cut line will be created by the supersonic air tool such as “airspade”.

The Contractor’s arborist shall redirect root systems within the final cut line area and shall prune roots that extend beyond the final cut line with pruning tools. The Contractor and arborist shall minimize exposure of tree root systems during the exploration and pruning/construction activities over exposed roots, support edge of excavation and mulch to a depth approved by the Engineer. The Contractor shall saturate burlap and mulch with water and maintain the burlap in a damp condition during daylight hours as to not allow roots to dry out.

Once final cuts are completed by the Contractor’s arborist with Air spade and pruning tools, no mechanical excavation shall be allowed beyond the final cut line around the existing tree to remain.

The Contractor shall install forms for sidewalks or install curbs, etc. in locations shown on drawings at the limits of excavation. If possible existing tree roots to remain can be extended below pavement areas or planting surfaces, or within pavement sand based structural soils or other similar landscape zones that are not in conflict with the final pavements. Horticultural soils shall be hand placed over these areas as shown on drawings and as described in specs.

Root Protection

Roots that cannot be avoided during construction for all other trees to remain shall be carefully and cleanly cut or shaved. Only hand methods for grubbing roots will be accepted inside drip lines of trees to be left standing. All root pruning and shaving must be completed under the supervision of the City Arborist. Root pruning shall include application of root treatment or fertilizer as required.

Trucks and heavy equipment shall not pass over or park on roots of public shade trees; nor shall construction materials, debris, or excavated material be stored within drip line of trees or within tree pits. For occasional or one time access over roots, ½-inch plywood overlapped may be used. Permeable materials such as gravel or wood chips shall be placed over root systems of trees which are not covered by hardscape and over which trucks and heavy equipment must travel during construction operations, when such travel is unavoidable, to prevent soil compaction and root damage. Material shall be replaced as needed.

During sidewalk construction adjacent to trees, suitable soil shall be maintained within tree wells. Moist soil or mulch shall also be maintained around surface roots outside of tree wells which may become exposed during construction. Such covering shall be placed as soon as possible after roots are exposed. If roots are going to be exposed for more than one hour, cover roots with damp burlap. Burlap shall be kept moist until most soil and

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mulch can be used for permanent cover.

Tunneling shall be the preferred method of excavation adjacent to tree roots to avoid root pruning. If root pruning is unavoidable, a certified arborist shall be onsite to execute or oversee the operation with sufficiently sharpened hand tools and in such a fashion as to have minimum negative impact on tree health and safety.

Pruning Safety Standards

Tree pruning and air spading shall be performed only by certified arborists or arborist trainees who, through related training or on-the-job experience, or both, are familiar with the practices and hazards of arboriculture and the equipment used in such operations.

The Contractor's certified arborist must be present at all times while tree pruning is performed.

Tree pruning operations shall comply with the American National Standard for Tree Care Operations—Safety Requirements (ANSI Z133.1), as approved by the American National Standards Institute, and published by the National Arborists Association. Operations shall also comply with applicable Occupational Health and Safety Administration (OSHA) standards.

Pruning Objectives

The pruning operation shall focus on the following types of pruning:

Cleaning. Cleaning shall consist of selective pruning to remove one or more of the following parts—dead, diseased, and/or broken branches. All deadwood that is two (2) inches or greater in diameter shall be removed. Branches with splits, large cavities or any defect that may result in failure shall be reduced, or removed to the trunk if reduction is not feasible.

Thinning. Thinning shall consist of selective pruning to reduce density of live branches. Thinning shall result in an even distribution of branches on individual limbs and throughout the crown.

Raising. Raising shall consist of selective pruning to provide vertical clearance. All branches extending lower than fifteen (15) feet above a public roadway and ten (10) feet above a public sidewalk shall be removed.

Reducing. Reduction shall consist of selective pruning to decrease height and/or spread. Consideration shall be given to the ability of a tree species to tolerate this type of pruning. All branches obstructing park signs, street signs, traffic signs, traffic lights, and park or street lighting shall be removed. Branches shall be pruned away from all houses and buildings a minimum of five (5) feet, or more if appropriate to the tree shape and structure.

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Specialty (Young Trees). For young yet established trees, branches that are rubbing or poorly attached shall be removed. A central leader or leaders as appropriate to the species should be developed. A strong, properly spaced scaffold branch structure should be selected. For newly planted trees, pruning shall be limited to cleaning.

Pruning Practices

The Contractor's certified arborist shall visually inspect each tree before commencing work.

If a condition is observed requiring attention, the condition should be reported to the City within 24 hours. Such conditions may include structural weakness, rot or decay that cannot be corrected by cleaning, and dead trees.

Equipment and work practices that damage living tissue and bark beyond the scope of work shall be avoided. Climbing spurs shall not be used when climbing and pruning trees.

Pruning tools (e.g. chain saws, pole saws, hand saws, pole pruners, etc.) shall be sharp and regularly sharpened and maintained throughout the Contract Term.

Not more than 25% of the foliage of an individual tree should be removed within an annual growing season. The percentage and distribution of foliage to be removed shall vary according to the tree species, age, health and site, in accordance with the types of pruning identified above.

Not more than 25% of the foliage of a branch or limb shall be removed when it is cut back to a lateral. The lateral shall be large enough to assume apical dominance.

Heading shall be permitted only by the expressed permission of the City, when needed to reach a defined objective.

Topping and lion tailing shall be considered unacceptable pruning practices.

All pruning cuts shall be made in accordance with the American National Standard for Tree Care Operations—Standard Practices (ANSI A300 Part 1), as approved by the American National Standards Institute, and published by the National Arborists Association (revised 2001). All terminology included in these Technical Specifications shall be defined by ANSI A300 Part 1.

When tracing wounds, only loose, damaged tissue should be removed. No other wound treatments shall be used.

Watering

Water trees and other vegetation to remain within limits of contract work as required to maintain their health during course of construction operations. Water each tree within the construction area where work is in progress twice per week until each

tree's root system is saturated for the duration of construction activities.

Drainage

Do not permit water to stand around the base of plants within the drip line during construction operations except during that period of inundating flooding which would, in its natural course, cover the base of trees. Provide temporary drainage where required to avoid ponding during construction operations.

Fertilizing

After pruning operations are completed, fertilize trees to increase vigor with a complete, slow release nitrogen, phosphorus, potassium (1:1:1 or 2:1:1) liquid injected fertilizer. Where liquid injected fertilizer is not practical, and when approved by Engineer, drill holes 6" to 10" deep and place granular fertilizer at frequent spacing.

Damage Due to Construction Operations

Contractor shall be responsible for the health of the existing trees in the immediate vicinity of construction. Trees damaged by construction operations which, as determined by the Engineer, can be remedied by corrective pruning measures shall be addressed immediately in the following manner:

Engineer shall engage an independent qualified Arborist to inspect the damaged trees and to make a determination on damage, sustainability, and remediation procedures.

The Contractor shall strictly adhere to the independent Arborist's recommendations.

Broken limbs shall be pruned according to industry standards.

Wounds shall not be painted.

The total cost of tree repair, including the cost of the independent Arborist, shall be borne by the Contractor.

Tree Replacement Due to Damage

If the independent Arborist determines that the damaged tree cannot be repaired and restored to full-growth status, the Contractor shall replace the damaged tree(s) and pay liquidated damages as noted below.

The size of the replacement tree shall equal ½" caliper for every 1" caliper inch of the damaged tree (size of the damaged tree shall be measured, the new tree shall be based on nursery measurements). The species of the replacement tree shall be determined by the Engineer and the City.

In addition to providing a new tree replacement, Contractor shall pay City \$250.00 for every caliper inch of the damaged tree (the size of the damaged tree shall be as shown on the Drawings).

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An example of the conditions stated above: A 20" caliper tree was damaged and determined to need replacement. To remedy this situation, the Contractor would purchase and install a 10" caliper tree and pay the Owner \$5,000.

The total cost of tree replacement, including the cost of the independent Arborist, shall be borne by the Contractor.

Temporary Removal of Shrubs and Topsoil

Topsoil, shrubs, and vegetation to be temporarily removed shall be carefully removed from overall areas to be excavated, and over all other areas to be disturbed as a result of the Contractor's operations in the performance of the Contract work. The topsoil shall be transported and deposited in storage piles convenient to the areas which are subsequently to receive the application of topsoil, separate from other excavated materials, and in approved locations. The topsoil shall be stockpiled free of roots, stones and other undesirable material. The Contractor shall take all necessary precautions to prevent other excavated material or other objectionable material from becoming intermixed with the topsoil, either before or after the stripping and stockpiling operations. Shrubs and other vegetation shall be balled and burlaped and then transported and stored until they can be replaced after construction has been completed in that area. The shrubs and vegetation must be watered and maintained to remain healthy while being temporarily stored. Any shrubs and vegetation that do not remain healthy during storage shall be replaced by the Contractor at no additional cost to the City.

Disposal of Waster Materials

Remove waste materials and unsuitable topsoil from project area and dispose of off site in a legal manner. Waste materials shall include but not be limited to timber, brush, refuse, stumps, roots, vines, debris and other objectionable matter. Removal includes raking and sweeping after completion of clearing and pruning operations.

Tree branches shall be removed in such a manner so as not to cause damage to other parts of the tree, or to surrounding people and property. Where necessary, ropes or other equipment shall be used to lower large branches to the ground.

All severed limbs shall be chipped, hauled away from the site, and disposed of in a legal manner. All wood waste, sawdust, leaves, and associated organic debris shall be collected from both public ways and adjacent private property, hauled away from the site, and disposed of in a legal manner.

Site cleanup shall follow as closely as possible to the pruning operation.

Post-Construction Cleanup

After construction is complete, but prior to preparation and seeding of lawn area and planting, remove and properly dispose of the following off site: wood chips, temporary fencing, branch protection, and trunk protection, and other materials.

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COMPENSATION

Measurement for payment for Tree Protection and Maintenance will be based on a percent of the Lump Sum bid calculated by dividing the elapsed time to date by the original Contractual construction time limit as approved by the Engineer.

Payment for work under Tree Protection and Maintenance will be based on the Lump Sum price bid for this item in the proposal and shall include full compensation for all labor, materials, disposal, equipment, tools, and any other incidentals necessary for the completion of this work as specified, including but not limited to protecting trees; tree maintenance; root and branch pruning; furnishing, installing, maintaining, and removing drip line or tree pit fencing and/or tree wrap; covering exposed roots with moist burlap, mulch, or soil, watering trees; injecting fertilizer into trees; and air spading of roots at trees as specified or as otherwise required by the Engineer or City arborist.

32103 TREE REMOVED – DIAMETER UNDER 24 INCHES EACH

DESCRIPTION:

Work to be done under this item shall conform to the relevant provisions of Section 101 of the MassDOT Standard Specifications and to the following:

CONSTRUCTION METHODS:

Removals shall be as indicated on the Drawings and as directed by the Engineer. Trees to be removed shall be verified with the Engineer prior to undertaking any work under this Item. Trees shall be completely removed, including stumps, and legally disposed of off-site. Existing tree pits shall be restored as sidewalk under the appropriate sidewalk item.

COMPENSATION

Tree removal will be measured for payment as specified in Section 101 of the Standard Specifications and the following:

Payment for work under this item will be at the contract unit price per each and shall include full compensation for all labor, materials, equipment, tools, and any other incidentals necessary for the satisfactory completion of this work as specified.

NOTES ON EXCLUSIONS:

Disposal of excavated soil is not included for payment under this item and shall be paid for separately.

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DESCRIPTION:

Work to be done under this item shall conform to the relevant provisions of Section 120 of the MassDOT Standard Specifications, and in particular Section 120.66, and the following:

This work consists of removing asphalt pavement to varied depths by cold planer in designated areas. Prior to cold-planing, the Contractor shall discuss the proposed final grades and drainage concerns with the Engineer. It shall be the Contractor's responsibility to perform cold-planing in such a manner as to restore the proper roadway grades and insure proper drainage.

CONSTRUCTION METHODS:

Where grades provided on the drawings indicate that proposed grade is to be raised above existing, cold-planing depth and overlay thickness shall be adjusted as directed by the Engineer. Where grades provided on the drawings indicate that proposed grade is to be lowered below existing grade, the Contractor shall excavate test pits to verify whether there is sufficient thickness of existing pavement to support a cold-plane and overlay operation. This requirement for test pits may be modified if other work of this Contract (such as water or drainage installation) is judged by the Engineer to provide similar information on pavement thickness. See drawings for additional information.

The cold planer shall be equipped with an elevating device capable of loading planed material directly into dump trucks while operative. It shall have all necessary safety devices such as reflectors, headlights, taillights, flashing lights, and back up signals so as to operate safely in traffic both day and/or night.

The cold planer shall be designed and built for planing flexible pavements and possess the ability to plane cement concrete patches when encountered in asphalt pavement. It shall be self-propelled and have the means for planing without tearing or gouging the underlying surface. Variable lacing patterns shall be provided to permit a rough grooved or smooth surface as directed.

A three-inch cut to predetermined grade, or any specified lesser depth, shall be required to be made in a single pass. As directed by the Engineer, the Contractor shall cold plane areas which were insufficiently cold planed during the first pass at no additional cost to the City.

Cuts deeper than 3-inches shall be made in two passes. As directed by the Engineer, the Contractor shall cold plane areas which were insufficiently cold planed during the two passes at no additional cost to the City.

The minimum width of pavement planed in each pass shall be six feet, except in areas to be trimmed and edged. The machine shall be adjustable as to crown and depth and meet the standards set by the Air Quality Act for noise and air pollution.

The milled or planed surface shall conform generally to the grade and cross slope required. The surface shall not be torn, gouged, shoved, broken or excessively grooved. It shall be free of imperfections in workmanship that prevent resurfacing after this operation. The surface texture shall be as specified by the Engineer and excess material shall be removed so that the surface is acceptable to traffic if required.

The Contractor shall perform work in such a manner to minimize dust and utilize dust control techniques when necessary or as directed by the Engineer.

The City reserves the option to direct the Contractor to truck the milled material to another site in the City for use as base material. If the City does not exercise this option, the milled material shall become the property of the Contractor.

COMPENSATION:

Pavement Milling will be measured for payment as specified in Section 120 of the Standard Specifications. In areas where milling depth is greater than 3-inches and two passes of the milling machine are required, the area of the second pass will be measured separately.

Payment for work under these items will be at the contract unit price per square yard and shall include full compensation for labor, equipment, tools, hauling and disposal of all milled materials; removal of asphalt from around existing structures and castings; providing and maintaining temporary hot mix asphalt aprons at transitions and castings until final paving; providing temporary pavement markings until final paving; sweeping after the pavement milling operation; dust control, and any other incidentals necessary for the satisfactory completion of this work as specified.

32204.1	RAIN GARDEN OVERFLOW STRUCTURE	EACH
32204.98	RAIN GARDEN INLET STRUCTURE – TYPE 1	EACH
32204.99	RAIN GARDEN INLET STRUCTURE –TYPE 2	EACH

DESCRIPTION:

The work includes the furnishing of all plant, labor, equipment, appliances and materials, and performing all operations in connection with installing inlet and outlet structures

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associated with the Cronin Park Rain Garden, as well as repairing sidewalks, pavement and curbs affected by catch basin installation.

The Contractor shall furnish complete shop drawings for all pre-manufactured products, and shop drawings and manufacturers data showing dimensions, reinforcing, and materials for all items furnished under this section.

MATERIALS:

Overflow Structure

Overflow Structure shall consist of 18 inch diameter smooth-wall polyvinylchloride (PVC) pipe conforming to ASTM D3034, SDR 35 and ASTM F1336 standard for PVC gasketed sewer pipe. The structure shall be furnished with a removable corrosion resistant insert basket and filter to trap sediments and debris. The insert shall be capable of passing 200 gallons per minute without restricting or bypassing the stormwater flows.

Structure shall have pre-formed pipe outlets complete with manufacturer-recommended adapters as required to mate with connecting drainage pipe as shown on the Drawings. Field cutting of outlets will not be permitted.

Overflow structure shall have minimum 24-inch sump below level of lowest pipe outlet.

Grates shall be of “dome” pattern, such that top of dome extends approximately 7-inches above the top of the PVC riser pipe. Grate shall be capable of supporting H-20 wheel loading. Grates shall be 18 inches nominal diameter, and shall be specifically designed to mate with the PVC riser pipe which forms the outlet structure. The grate shall be ductile iron conforming to ASTM A536, Grade 70-50-05.

Overflow structure shall be as manufactured by ADS/Nyoplast, or shall be approved equivalent product.

Inlet Structures (Types 1 and 2)

Inlet Structures shall consist of steel structures, all welded construction, of the dimensions as shown on the Drawings. Structures shall be fabricated from ASTM A36 10-gauge steel, asphalt coated on interior and exterior, and shall meet AASHTO H-25 loading requirements. Structures shall have pipe outlets, required as shown on the plans, preformed by the manufacturer. Field cutting of outlets will not be permitted. Structures shall be complete with sediment traps, with hinged lids, as shown on the Drawings.

Inlet structures shall have minimum 24-inch sump below level of lowest pipe outlet.

Grates and solid lids shall be ductile iron construction and shall meet AASHTO H-25 loading requirements. Grates shall be of bicycle-safe design.

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Inlet structures shall be as manufactured by Gibson Steel basins, or shall be approved equivalent product.

CONSTRUCTION METHODS

Setting Inlet Structures (Types 1 and 2) and Overflow Structures

Structures shall be set on 6-inches compacted gravel base as detailed on the Drawings. Structures shall be installed level and plumb. Bedding and backfill shall be placed and compacted uniformly in accordance with ASTM D2321.

Cutting or tampering of structures in the field, for the purpose of creating new openings or modifying existing openings, will not be permitted.

Frames and covers for inlet structures shall be set with tops conforming accurately to the grade of the pavement or finished ground surface or as indicated on the Drawings. For overflow structures, grates shall be set above grade to the elevation indicated on the Drawings.

All excess material including dirt, loose concrete, bricks, grit, stones and any other material, shall be removed from all structures prior to final review by the Engineer. A final cleaning shall be performed, to include complete removal of all accumulated debris and fluids from each structure, upon complete project completion.

COMPENSATION

Payment for Rain Garden Inlet and Overflow Structures shall be based on the unit prices bid for these items in the proposal. Under the Unit Prices for these items, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required for the complete installation of the structures as shown and indicated in the Contract Documents, and the requirements of the Engineer and as specified. The work includes but is not limited to; saw cutting bituminous and cement concrete; excavation; construction dewatering; furnish and install structures; furnish and install temporary support of excavation; furnish, install and compact bedding; furnish and install backfill; frames and grates; hoods; adjusting frames to grade; pipe connections, including flexible sleeves; and all other work required for the installation of Rain Garden Inlet and Outlet Structures not included for payment elsewhere.

SPECIAL NOTES/EXCLUSIONS:

The following items are not included for payment under these items but are included for separate payment elsewhere under unclassified excavation; removal of concrete slab and railroad rail and ties.

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The Work under this Section shall comply with ordinances and regulations of authorities having jurisdiction.

The Contractor shall obtain and pay for permits, tests and certifications required for the execution of work under this Item and shall furnish copies of permits, certifications and approval notices to the Engineer prior to requesting payment.

Quality Assurance

Installer: A firm which has at least five (5) years experience in work of the type and size required by this Section and which is acceptable to the Engineer.

References:

The Contractor must supply three references for work of this type and size including names and phone numbers of contact person(s).

Applicable requirements of accepted Standards and Codes shall apply to the Work of this Section and shall be so labeled or listed:

1. American Society for Testing & Materials (ASTM)
 - A. ASTM: D1784 Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
 - B. ASTM: D1785 Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and CI200.
 - C. ASTM: D2464 Threaded Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
 - D. ASTM: D2466 Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
 - E. ASTM: D2564 Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems.
 - F. ASTM: D2737-99 Polyethylene (PE) Pressure rated tube.
 - G. ASTM: B43-98 Brass pipe
 - H. ASTM: B88-99 Seamless Copper Water Tube
 - I. ASTM: B828-00 Soldered Copper Joints
2. National Plumbing Code (NPC)
3. National Electric Code (NEC)
4. National Sanitary Foundation (NSF)
5. American Society of Agricultural Engineers (ASAE)
6. Underwriters Laboratories, Inc. (UL)
7. Occupational Safety and Health Regulations (OSHA)

Tests

Observation: The Engineer will be on site at various times to observe that systems are being installed according to the Specifications and Drawings.

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Coverage Test:

After completion of the systems, the Contractor shall test the operation of entire system and adjust sprinklers and drip tubing as directed by the Engineer. Demonstrate to the Engineer that all irrigated areas are being adequately covered. Furnish and install materials required to correct inadequacies of coverage due to deviations from the Drawings or where the system has been willfully installed when it is obviously inadequate or inappropriate without bringing it to the attention of the Engineer.

The Engineer shall be notified 48 hours in advance for observations.

During final observation, the Contractor shall be responsible for having two-way communication and sufficient personnel to provide instantaneous communication between the observation area and the controllers for the systems.

Shop Drawings

The Contractor shall provide copies of product specification sheets on all proposed equipment to be installed to the Engineer for approval prior to the start of work. Work on the irrigation systems may not commence until product sheets are submitted and approved. Submittals shall be marked up to show proper nozzles, sizes, flows, etc. Equipment to be included:

1. Sprinkler Heads
2. Drip Tubing
3. Valves: Manual and Automatic
4. Controllers
5. Valve Boxes
6. Pipe and Fittings (PVC and High Density Polyethylene)
7. Wire and Connectors
8. Quick Coupling Valves
9. Rain Sensors
10. Miscellaneous Materials
11. Drip Filters
12. Automatic Flushing Valves
13. Air/Vacuum Relief Valves
14. Drip Pressure Regulators
15. Pull boxes

Project Record Documents

Record Drawings shall specify and exactly locate sprinkler type; pop up height and nozzle for each sprinkler installed. Each valve box location is to be referenced by distance from a minimum of two permanent locations. Controllers, rain sensors, quick coupling valves, water meters, back flow prevention devices and all other equipment shall be indicated on the drawings. All wire routing, wire size and splices shall be indicated. Main line pipe and wire route shall have two (2) distinctly different graphic symbols (line types).

At the end of each segment of the project the Contractor shall submit the following to the Engineer.

1. Plumbing permits: If none required, so state.
2. Material approvals.
3. Pressure line tests: By whom approved and date.
4. Materials furnished: Recipient and date.

Delivery, Storage and Handling

Store and handle all materials in compliance with manufacturer instructions and recommendations. Protect from all possible damage. Minimize on-site storage.

Guarantee

Obtain in the City's name the standard written manufacturer's guarantee of all materials furnished under this Item where such guarantees are offered in the manufacturer's published product data. All these guarantees shall be in addition to, and not in lieu of, other liabilities that the Contractor may have by law.

In addition to the manufacturers guarantees the Contractor shall warrant the irrigation systems, both parts and labor for a period of one (1) year from the date of acceptance by the City.

As part of the one-year warranty the Contractor shall perform the first year-end winterization and spring start-up for the irrigation systems.

Should any problems develop within the warranty period because of inferior or faulty materials or workmanship, they shall be corrected to the satisfaction of the Engineer at no additional expense to the City.

A written warranty showing date of completion and period of warranty shall be supplied upon completion of each segment of the project.

Coordination

The Contractor shall at all times coordinate his work closely with the Engineer to avoid misunderstandings and to efficiently bring the project to completion. The Engineer shall be notified as to the start of work, progression and completion, as well as any changes to

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the drawings before the change is made. The Contractor shall also coordinate his work with that of subcontractors.

The Contractor shall be held responsible for and shall pay for all damage to other work caused by his work, workmen or subcontractors. Repairing of such damage shall be done by the Contractor who installed the work, as directed by the Engineer.

Maintenance and Operating Instructions

The work shall include an allowance for four (4) hours of instruction of City and/or City's personnel upon completion of check/test/start-up/adjust operations by a competent operator (The Engineer shall be notified at least one (1) week in advance of check/-test/start-up/adjust operations).

Upon completion of work and prior to application for acceptance and final payment, a minimum of three (3) three ring, hard cover binders titled MAINTENANCE AND OPERATING INSTRUCTIONS FOR WESTERN AVENUE IRRIGATION SYSTEMS, shall be submitted to the Engineer. After review and approval, the copies will be forwarded to the City. Included in the Maintenance and Operating binders shall be:

1. Table of Contents
2. Written description of Irrigation System
3. System drawings:
 - A. One (1) copy of the original irrigation plans;
 - B. One (1) copy of the Record Drawings;
 - C. One (1) copy of the controller valve system wiring diagrams
4. Listing of Manufacturers
5. Manufacturers' data where multiple model, type and size listings are included; clearly and conspicuously indicating those that are pertinent to this installation
 - A. "APPROVED" submittals of all irrigation equipment;
 - B. Operation:
 - C. Maintenance: including complete troubleshooting charts.
 - D. Parts list.
 - E. Names, addresses and telephone numbers of recommended repair and service companies. A copy of the suggested "System Operating Schedule" which shall call out the controller program required (zone run time in minutes per day and days per week) in order to provide the desired amount of water to each area under "no-rain" conditions.
 - F. Winterization and spring start-up procedures.
 - G. Guarantee data.

Procedure

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Notify all City departments and/or public utility owners concerned, of the time and location of any work that may affect them. Cooperate and coordinate with them in the protection and/or repairs of any utilities.

Provide and install temporary support, adequate protection and maintenance of all structures, drains, sewers, and other obstructions encountered. Where grade or alignment is obstructed, the obstruction shall be permanently supported, relocated, removed or reconstructed as directed by Engineer.

MATERIALS:

General

All materials to be incorporated in this system shall be new and without flaws or defects and of quality and performance as specified and meeting the requirements of the systems. All material overages at the completion of the installation are the property of the Contractor and shall be removed from the site.

No material substitutions from the irrigation products described in these specifications and shown on the drawings shall be made without prior approval and acceptance from the Engineer.

PVC Irrigation Pipe (Item 32381.02)

All pipe shall bear the following markings: Manufacturer's name, nominal pipe size, schedule or class, pressure rating in psi, and date of extrusion.

All pipe in sizes 1-1/4 inches and smaller shall be PVC, Class 200, Type 1120, SDR 21, Solvent-Weld PVC, conforming to ASTM No. D2241 as manufactured by Certainteed, Cresline, JM or equal.

High Density Polyethylene Irrigation Pipe (Item 32381.03A)

Polyethylene piping shall be HDPE IPS polyethylene piping; CP Chem, ISCO Industries Polypipe or approved equal, SDR 11, PE 4710, 200 psi rated, ASTM 3350, throughout the irrigation system.. Pipe shall also meet the requirements of ASTM F714, D3261 and D3350. Polyethylene pipe shall not be furnished in lengths more than 50 feet. Coiled pipe shall not be accepted.

Polyethylene piping shall be joined by butt fusion method using personnel experienced in the procedure.

Except for threaded fittings at taps and air release valves and support assemblies, all other connections shall be made of butt fused HDPE.

PVC Pipe Sleeves (Item 32381.02)

All pipe sleeves beneath non-soil areas shall be PVC, Class 160 water pipe as manufactured by Certainteed, Cresline, JM or equal. Minimum sleeve size to be 3-inch.

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High Density Polyethylene Pipe Sleeve (Item 32381.03A)

Polyethylene piping shall be HDPE IPS polyethylene piping; CP Chem, ISCO Industries, Polypipe or approved equal, SDR 11, PE 4710, 200 psi rated, ASTM 3350, throughout the irrigation system. Minimum sleeve size to be 3-inch.

Pipe shall also meet the requirements of ASTM F714, D3261 and D3350. Polyethylene pipe shall not be furnished in lengths more than 50 feet. Coiled pipe shall not be accepted.

Irrigation Control Pull Boxes (Item 32381.03A)

Pullboxes for irrigation control shall be precast reinforced concrete in accordance with Section 801 of the MassDOT Standard Specifications.

The pullbox units shall be 12"W x 12"L x 24" D and shall otherwise meet the requirements of MassDOT Standard Specifications Section M4.02.14. Covers shall be clearly marked "IRRIGATION".

Wire Conduit

Conduit for wiring beneath non-soil areas shall be minimum 2-inch PVC, SCH-40 conduit with solvent-weld joints, as manufactured by Certainteed, Cresline, JM or equal.

Sweep ells shall be standard electrical type PVC schedule 40 long sweep elbows. Cap sweep ell with tri-plug with the ring for securing nylon pull rope.

Conduit for above ground wiring to controllers shall be galvanized, rigid metallic conduit.

High Density Polyethylene Irrigation Fittings (Item 32381.03A)

All HDPE fittings shall be PE4710, SDR 11 200 psi rated IPS molded fittings, meeting the requirements of ASTM D3261, and pressure rated for 200 PSI. All fittings in 1-1/4 inch pipe or smaller shall be 4710, SDR 11 IPS molded HDPE, pressure rated at minimum 200 psi. Fittings shall be as manufactured by ISCO Industries, Industrial Pipe Fittings, Central Plastics or approved equal.

Full size PE4710 molded tees shall be used, and if reduction is required, PE4710 concentric reducer(s) shall be fused to the tee. Fittings shall be pressure rated at a minimum of 200 psi and IPS sized.

Connection to valves electric and quick couplers shall be made by butt welding an IPS stainless steel male threaded transition fitting.

PVC Irrigation Fittings

Fittings for solvent weld PVC pipe, 1-1/4 inch and smaller in size, shall be Schedule 40 solvent weld PVC fittings as manufactured by Dura, Lasco, Spears or equal. All threaded

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fitting for solvent weld PVC pipe, 1-1/4 inch and smaller in size, shall be schedule 80 solvent weld PVC fittings as manufactured by Dura, Lasco, Spears or equal

Fittings shall bear manufacturer's name or trademark, material designation, size, and applicable I.P.S. schedule.

All PVC threaded connections in and out of valves shall be made using Schedule 80 toe nipples and Schedule 40 couplers or socket fittings. Schedule 40 threads will not be approved for installation.

PVC solvent shall be NSF approved, for Type I and Type II PVC pipe, and Schedule 40 and 80 fittings. Cement is to meet ASTM D2564 and FF493 for potable water pipes. PVC solvent cement shall be Rectorseal Gold, IPS Weld-ON 711, Oatey Heavy Duty Cement or equal, and shall be used in conjunction with the appropriate primer. Primer shall be NSF approved, and formulated for PVC and CPVC pipe applications. Primer is to meet ASTM F 656. Primer shall be Rectorseal Jim PR-2, IPS Weld-ON P-68 Clear, Oatey Clear Primer for PVC and CPVC, or equal.

All nipples to be schedule 80 PVC.

Polyethylene Irrigation Fittings (Lateral Pipe Only in Landscape Areas)

Fittings for polyethylene pipe shall be insert PVC or Nylon type fittings. Fittings shall conform to NSF standards and be attached with two (2) dog-eared stainless steel clamps. Clamps shall be as manufactured by Oetiker or approved equal.

Supply only pipes and fittings that are marked by the manufacturer with the appropriate ASTM designations and pressure ratings and are free from cracks, wrinkles, blisters, dents or other damage. Fittings shall be per ASTM D2609 as manufactured by Dura, Lasco or approved equal.

Spray Sprinklers (Item 32381.02)

Full and part circle pop up spray sprinklers shall be pressure regulating (30-psi), plastic construction with ratcheting riser, removable nozzle and check valve. Nozzle size shall be as indicated on the drawing and in the legend. Pop-up height shall be 6 inches for turf and 12 inches for ground cover, shrubs and annual beds.

Sprinkler shall carry a minimum 3-year exchange warranty against defects. Sprinklers shall be manufactured by Rain Bird, model 1800-SAM-PRS, Hunter Industries, model PROS-XX-PRS30-CV or approved equal.

In-Line Drip Tubing

In-line emitters in drip tubing to be 0.6 gallon per hour on pre-installed 12-inch spacing within tube for all planting beds. In-line drip tubing to be as manufactured by Netafim Irrigation, Model TLDL-6-12 or approved equal. Start pressure shall be a minimum of 45PSI. Exception shall be 32381.02; system- start pressure shall be a minimum of 35 psi.

In-Line Drip Tubing Fittings

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Fittings for in-line drip tubing shall be constructed of molded brown plastic having a (I.D) of 0.57 inches. Female and male threaded ends shall be capable of mating to standard pipe threads with tapered threads. In-line drip tubing fittings shall be as manufactured by Netafim, TL Series or approved equal.

Stainless steel clamps shall be used to secure in-line drip tubing to insert barbed fittings. Nominal size shall be 13/16 inches, Part No. 210. Clamps shall be constructed of 304-grade stainless steel. Interior clamp wall shall be smooth to prevent crimping or pinching of tubing. Wall thickness of clamps shall be 0.236 inches with an overall bandwidth of 1/4-inch. Properly secured clamps shall be capable of withstanding a maximum operating pressure of 441 psi. Clamps shall be one "ear" type. Clamps shall be as manufactured by Oetiker or approved equal.

Tubing stakes shall be corrosion resistant steel to secure tubing.

Disk Filter

The filters at each drip zone valve shall be a plastic filter consisting of a two piece threaded housing with o-ring seal. The filter screen shall be 140-mesh size. Filters shall be sized to mid-range flow and not exceed 2.5-PSI pressure loss.

Filter shall be as manufactured by Netafim, Model DF-xxx-140 or approved equal.

Pressure Regulators

Pressure regulators shall assure an incoming pressure of 45-PSI into drip tubing. Discharge pressure shall not be less than 45-PSI. Manifold regulators to match flow rate to mid-range flow. The pressure regulator shall be as manufactured by Netafim, Model PRV-XXX-XX-45 or approved equal.

Exception shall be 32381.02- incoming pressure of 35 psi into drip tubing. Discharge pressure shall not be less than 35-PSI. The pressure regulator shall be as manufactured by Netafim, Model PRV-XXX-XX-35 or approved equal.

Automatic Flushing Valves

Flush valves shall produce 1-gallon flush and be constructed of black molded plastic with insert barbed fitting end configuration. The top of the flush valves shall have six openings from which debris or sediment can pass through from the system to the atmosphere or valve box.

Flush valve shall be as manufactured by Netafim, Model TLFV or approved equal.

Air/Vacuum Relief Valves

The air vacuum / relief valves shall be constructed of black plastic with 1/2-inch male pipe thread capable of mating with a threaded PVC reduction bushing.

Air vacuum relief valves shall be as manufactured by Netafim, Model TLAVRV or approved equal.

Electric Control Valves

Electric control valves shall be one -inch remote control, diaphragm type, fiberglass or reinforced nylon body plastic valves with manual flow control, manual bleed screw and 200 psi pressure rating. Valves shall be capable of closing at 0.25 gpm or greater.

Valves shall be manufactured by Rain Bird model PEB, Hunter Industries model ICV or approved equal.

Master Electric Control Valve (32381.03A)

Electric control valve shall be of brass construction one inch in size with external and internal manual bleed. Valve shall have a double beaded diaphragm and be fabric reinforced EPDM. Valve shall be manufactured with a captive plunger in a 24 volt solenoid. Valve shall have a flow range of 0.1 gpm to 40 gpm and a pressure rating of 220 psi.

Valves shall be manufactured by Hunter Industries model IBV or approved equal.

Valve Boxes

All valve boxes shall be manufactured from unformed resin with a tensile strength of 3,100-5,500 psi conforming to ASTM D638. All boxes shall be green in color. Covers shall be green in color unless otherwise specified.

Valve boxes for air relief valves and flushing valves on drip zones shall be 6-inch round valve boxes with metal detection.

Valve boxes for single 1 inch electric valves, isolation valves and quick coupling valves shall be 10-inch round valve boxes with metal detection and bolt down covers

Valve boxes for single drip 1 inch electric valves with filter and pressure regulator shall be 18-inch jumbo valve boxes with metal detection and bolt down covers.

When multiple non drip electric valves are installed in the same area, they are to be installed two (2) valves per box in a 12-inch standard box.

Valve box extensions shall be provided and installed as required for proper box depth. Valve box extensions shall be made by the same manufacturer.

Valve boxes shall be manufactured by Pentek, Carson Specification Grade or approved equal.

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Automatic Controllers

Controllers shall be electronic in construction with capability of up to 10 hour run times per zone in increments of 1 or 10 minutes. Controllers to have minimum four independent programs, auto/off switch and be capable of manual, semi-automatic and automatic operation. Controller shall have water budgeting feature, cycle and soak feature, sensor input terminal, locking, weather resistant cabinet and internal transformer. Terminal strip connection shall be easily accessible. The controller shall be U.L. listed, 120 volt, 60 Hertz, A.C. type.

Controllers shall be as manufactured by Rain Bird model ESP-LXME-16, Hunter Industries model IC-1800PL or approved equal.

Station quantity shall be minimum of 16 per location.

Quick Coupling Valves

The valve body shall be of cast brass construction with a working pressure of 125 psi. The valve seat disc plunger body shall be spring loaded so that the valve is normally closed under all conditions when the key is not inserted.

The top of the valve body receiving the key shall be equipped with ACME threads and smooth face to allow the key to open and close the valve slowly. The quick coupling valve shall be equipped with a vinyl cover.

The valve body construction shall be such that the coupler seal washer may be removed from the top for cleaning or replacement without disassembling any other parts of the valve.

Keys shall be ACME with 1-inch male thread and 3/4-inch female thread at the top.

Contractor shall provide two (2) keys for quick couplers and two (2) 1-inch x 3/4-inch swivel hose ends.

Quick coupling valves, keys and swivels shall be manufactured by Hunter Industries, model HQ-44RC-AW, HK-44 and HS-1 or approved equal.

Wire

All valve control wire shall be minimum #14-awg, common #14-awg, single strand, solid copper, UL- approved direct burial AWG-U.F. 600V and shall meet all state and local codes for this service. Individual wires must be used for each zone valve. Common wire shall be white in color, control wire for spray zones shall be red in color, drip zones shall be orange in color and spare wires shall be blue. White color shall be used for common wire only.

All moisture sensor wires shall be minimum #14-awg, single strand, solid copper, 600v, direct burial (UF) and shall meet all state and local codes for this service. Individual pairs of wires shall be used for each pair of sensors for each area. Sensor wires for each control

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area shall be purple in color. Wires shall be labeled from each control area. Maximum sensor wire run not to exceed 2000 feet.

In ground wire connections shall be UL listed, manufactured by 3M, model DBR/Y-6 splice kits. All wire splices shall be made in valve boxes, at controller, or at valves. Wires shall homerun from controller to valves. No splices shall be allowed from controller to valves without authorization from the Engineer. Any allowed splices must be made within landscape areas only.

Wire type and method of installation shall be in accordance with local codes for NEC Class II circuits of 30-volt A.C. or less.

Isolation Valves

Isolation valves 1-1/4 inches in size shall be gate type, of bronze construction, US Manufacture, 200 WOG with steel cross handle and 200 psi rating. Gate valves to be as manufactured by Nibco, model T-113-K, or approved equal.

Swing Joints

Sprinklers shall be installed on swing pipe assemblies, minimum length 6 inches, maximum 18 inches.

Quick coupling valves to be installed on 1-inch prefabricated PVC unitized swing joint assemblies with double o-ring seals, minimum 315 psi rating and minimum length of 12 inches with brass insert and stabilizer (unless stabilizer is an integral part of the quick coupling valve).

Moisture Sensors (Item 32381.03A)

Moisture sensors to be as manufactured by Irrometer, Watermark series model #200SS-5 or approved equal. The sensors are to have 5 foot lead wires. Each sensor location shown on the drawings represents a pair of sensors wired back to one of four control zones on the moisture control panel.

Moisture Sensor Control Panel (Item 32381.03A)

Moisture sensor control panel to be as manufactured by Irrometer, Watermark series model MHS-4-24. Panel shall have the capability of eight zones each reading from a pair of sensors (model 200SS-5) and outputting to an unlimited number of solenoid valves in that control zone. Panel shall include bypass switch, dial control of each moisture area and LED's to aid in checking system operation.

Automatic Wireless Rain Sensors

Rain sensors shall be plastic in construction with adjustable interruption point, 1/2-inch IPS threads. Receivers shall be mounted on the interior of controllers' enclosures. Rain sensor shall be manufactured by Hunter Industries, model WR-CLIK or approved equal.

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WR-CLIK package shall include WR-CLIK-TR (Transmitter) and WR-CLIK-R (Receiver) or approved equal.

Controller Enclosures

The enclosure shall be vandal and weather resistant in nature manufactured entirely of 304-grade stainless steel. The main housing door shall be louvered at the bottom and equipped with a hollow center thermoplastic door seal. The entry lip shall be louvered on the backside. Filter screens shall cover all louvers. The top entry lid shall have two gas springs, for easy access, a continuous stainless steel piano hinge, and a three point locking mechanism with provisions for padlock. Removable stainless steel tray shall be provided and installed for the mounting of electronics and other equipment.

The enclosure shall be a NEMA 3R Rainproof Enclosure as listed by Underwriters Laboratories, Inc.

Controller enclosure shall be 16 inches wide x 15.5 inches deep x 38 inches tall, as manufactured by Strong Box, model SB-16SS or approved equal.

Water Meters

Water meters shall be furnished by the Cambridge Water Department at no cost to the Contractor. Water meters shall be 1-inch for Item 32381.02 and Item 32381.03A (See Details).

Backflow Prevention Devices

Back flow prevention devices shall be 1-inch and 3/4-inch Reduced Pressure Zone Assembly as per The City of Cambridge Cross Connection Department requirements for Item 32381.02. 1-inch for the irrigation system and 3/4-inch for the drinking fountain.

Back flow prevention device shall be 3/4-inch Reduced Pressure Assembly as per The City of Cambridge Cross Connection Department requirements for Item 32381.03A. Back flow prevention device shall have maximum 12-psi pressure loss at system flow.

Back flow prevention devices shall be as manufactured by Watts model 009-QTS or approved equal.

Pressure Reducing Valves

Pressure reducing valve shall be of bronze construction, stainless steel integral strainer, with replaceable stainless steel seat. Valve shall be capable of 25 - 75 psi down stream pressure setting and supply pressure of up to 300 psi. Valves shall be double union, NPT threaded union female inlet and outlet.

Item 32381.02 shall require a 1-inch for the irrigation system and 3/4-inch for the drinking fountain. Item 32381.03A shall require a 3/4-inch for the irrigation system.

Pressure reducing valve shall be as manufactured by Watts, model 25AUB-DU-Z3 Series 1-inch and 3/4-inch, or approved equal. (SEE Meter/Backflow Prevention Details).

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Concrete Controller and Meter/Backflow Enclosure Bases

Concrete for bases shall be 4,000 psi and shall conform to requirements of Section 900 of the MassDOT Standard Specifications.

Meter/Backflow Prevention Enclosures

The meter/backflow prevention device enclosure shall be of aluminum, heated by two (2) 1500 watt 115 volt heaters and insulated. Enclosure shall meet ASSE Standard #1060.

Meter/Backflow Prevention Enclosure shall be as per The City of Cambridge Cross Connection Department requirements.

The enclosures shall be 72" Long x 45" Wide X 52" High. Unit shall be as manufactured by Hubbell Power Systems. HOT BOX, model HB8000AN or approved equal.

Grounding Equipment

Exterior field controller at James Cronin Park shall include factory-installed and factory-recommended lightning protection and shall be connected to a 5/8-inch diameter x 10-foot long copper clad grounding rods with minimum #6 AWG, solid, bare copper wire and 4-inch x 96-inch x 0.0625-inch copper grounding plates as outlined below. Minimum 20-foot separation between rod and plate. Minimum 12-foot separation between controller and ground rod. Connection to rod shall be with Cadweld or approved equal connector as specified. Connections to plate shall be performed by the plate manufacturer (Paige #182199L) or approved equal with 25-feet of insulated copper wire already attached. Grounding rod is to be covered by a 4-inch round, grated top, plastic valve cover with metal detection and six inches of 4-inch ADS or approved equal drainage pipe. Plate shall be installed in ground enhancement material. Plate shall be covered with 4-inch plastic grated cover with detection and minimum 36 inches of 4 inch ADS or approved equal drainage pipe. Ground rod and plate shall be UL listed.

Item 32381.02 controller shall be grounded to one rod and one plate. The 10-foot rod shall be installed penetrating into the soil to its full length. Plate shall be installed at a 36-inch depth with 50 lbs of PowerSet or approved equal ground enhancement material spread evenly below the plate and 50 lbs spread evenly above the plate in accordance with manufacturer's requirements. The grounding electrodes shall be installed at least 10 feet from wires connected to the field controllers.

Exterior field controller at Item 32381.03A shall include factory-installed and factory-recommended lightning protection and shall be connected to two 5/8-inch diameter x 8-foot long copper clad grounding rods with minimum #6 AWG, solid, bare copper wire. Minimum 18-foot separation between rods. Minimum 10-foot separation between controller and ground rod. All connections to rods shall be with Cadweld or approved equal connectors as specified. Each grounding rod is to be covered by a 4-inch round, grated top, plastic valve cover with metal detection and six inches of 4-inch ADS or approved equal drainage pipe. Ground rods shall be UL listed.

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Item 32381.03A controller shall be grounded to two rods. The 8-foot rod shall be installed penetrating into the soil to its full length. The grounding electrodes shall be installed at least 8 feet from wires connected to the field controllers.

Crushed Stone

Crushed stone shall be in conformance with MassDOT Standard Specifications M2.01.1. Crushed stone shall be used under valve boxes.

Sand

Sand used for backfilling of trenches; under, around and over PVC lines shall be in conformance with MassDOT Standard Specifications M1.04.0 Type B.

Spare Parts

Contractor shall supply the following tools and equipment to the Engineer before final observation:

1. Two (2) wrenches for disassembling and adjusting each type of sprinkler head provided.
2. One (1) quick coupler key assembly for every five or fraction thereof of each type of quick coupling valve provided.
3. One (1) of each type of gate valve used in the project.
4. Two (2) of each type sprinkler head and pattern (PC & FC) used in the project.
5. Two (2) of each type nozzle used in the project.

Before final observation can occur, written evidence that the Engineer has received the tools and equipment must be shown to the City.

CONSTRUCTION METHODS:

General

Before work is commenced, hold a conference with the Engineer to discuss general details of the work. Examine all contract documents applying to this Section, noting any discrepancies and bringing the same to the attention of the Engineer for timely resolution.

All work indicated on Drawings shall be provided whether or not specifically mentioned in the Specifications.

Verify dimensions and grades at job site before work is commenced. Do not proceed with installation of the landscape irrigation system when it is apparent that obstructions or grade differences exist or if conflicts in construction details. Legend or specific notes are discovered. All such obstructions, conflicts, or discrepancies shall be brought to the attention of the Engineer.

Make all field measurements necessary for the work noting the relationship of the irrigation work to the other trades. Coordinate with other trades (landscaping and other

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site work trades). Project shall be laid out essentially as indicated on the Irrigation Plans, making minor adjustments for variations in the planting arrangement. Major changes shall be reviewed with the Engineer prior to proceeding.

Prior to HDPE pipe being installed in the trench, Contractor shall cut out the first butt fused joint of each pipe size. Contractor shall prepare the sample for the test in accordance with "Job Aid/ Bend Back Testing" procedure document prepared by ISCO Industries, LLC dated Oct. 26, 2006 or as revised, and in accordance with ASTM F 2620. The samples shall be tested in the presence of the Engineer, in accordance with testing procedures outlined in the ISCO document. All samples shall be labeled and saved. Testing must be done at 73 degrees F plus or minus 5 degrees. The test temperature and sample size are critical to testing. The purpose of the test is to determine if a good weld was made. A pass means no failures during the bend back test. This means a good weld. A break means a bad weld. Failure shall require additional testing.

Butt fusion equipment must be serviced prior to use on this project. The machines must be environmentally friendly and in satisfactory working order. The hydraulic system must be leak free. The pressure gauge and thermometer must be checked and certified for accuracy. If machines are rented, they must be rented from a company that has a fusion machine service center certified by the machine manufacturer. The machines must arrive on the site with certification that the pressure gauges and heater thermometers were accurate when shipped.

Layout of sprinkler lines indicated on Drawings is diagrammatic only. Location of sprinkler equipment is contingent upon and subject to integration with all other underground utilities. Contractor shall employ all data contained in the Contract Documents and shall verify this information at the construction site to confirm the manner by which it relates to the installation.

Coordinate installation of all sprinkler materials, including pipe, to avoid conflict with the trees, shrubs, or other plantings.

At all times, protect existing irrigation, landscaping, paving, structures, walls, footings, etc. from damage. Any inadvertent damage to the work of another trade shall be reported at once.

Replace, or repair to the satisfaction of the Engineer, all existing paving disturbed during course of work. New paving shall be the same type, strength, texture, finish, and be equal in every way to removed paving.

Pipe and Fittings Installation

Using proper width trencher chain, excavate a straight (vertical) and true trench to a depth of 2-inch of pipe invert elevation.

Loam or topsoil encountered within the limits of trench excavation for irrigation mains and branch lines shall be carefully removed to the lines and depths as shown on the Drawings and stockpiled for subsequent replacement in the upper 6 inches of the trench

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from which it is excavated. Such removal and replacement of the quantities of loam shall be considered incidental to the irrigation system and no additional compensation will be allowed therefore.

Pipe shall be laid on undisturbed trench bottom provided suitable base is available - no rock larger than 1-inch or sharp edges; if not, excavate to 2-inch below pipe invert and provide and install sand base or crushed stone upon which to lay pipe.

Backfilling shall be accomplished as follows: the first 10-inch of backfill material shall contain no foreign matter and no rock larger than 1-inch in diameter. Carefully place material around pipe and wire and tamp in place. Remainder of backfill shall be laid-up in 6-inch (maximum) lifts and tamped to compaction with mechanical equipment. Compact backfill in trenches to dry density equal to the adjacent undisturbed soil, and conform to adjacent grades without dips, sunken area, humps, or other irregularities. Frozen material shall not be used for backfill.

Perform backfilling when pipe is cool. During hot weather cool pipe by operating the system for a short period, or by backfilling in the early part of the morning before the heat of the day.

Do not, under any circumstances, use truck wheels for compacting soil.

Where feasible, the Engineer may authorize the use of flooding in lieu of tamping.

Restore grades and repair damage where settling occurs.

Make all solvent-weld joints for PVC pipe in strict accordance with manufacturer's recommendations, making certain not to apply an excess of primer or solvent, and wiping off excess solvent from each connection. Allow welded joints at least 15 minutes set-up/curing time before moving or handling. When the temperature is above 80° F, allow connections to set minimum 24 hours before pulling or pressure is applied to the system. When temperature is below 80° F, follow manufacturer's recommendations. Provide and install for expansion and contraction as recommended. Wire shall be laid in same trench as mainline and at pipe invert (see Wire Installation).

Make fusion connections for mainline HDPE pipe and fittings per ASTM D2657, ASTM F1056, ASTM F905, PPI Technical Reports 33 and 41 and US DOT Pipeline Safety Regulations (CFR 49).

Check fusion machine heater plates on a regular basis to make sure they are at proper temperature and adjust as required to meet manufacturer's requirements.

Mainline pipe shall have minimum 22 inches of COVER (excavate to invert as required by pipe size). Lateral pipe shall have minimum 16 inches of COVER for PVC and 12 inches of cover for Polyethylene in landscape areas only. (excavate to invert as required by pipe size).

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Cut plastic pipe with handsaw or pipe-cutting tool, removing all burrs at cut ends. All pipe cuts are to be square and true. Bevel cut end as required to conform to Manufacturer's Specifications.

Every precaution shall be taken to prevent foreign material from entering the pipe while it is being placed in the trench. At times, when installation of the piping is not in progress, the open end(s) of the pipe shall be closed by a watertight plug or other means. All piping, which cannot temporarily be joined, shall be sealed to make as watertight as possible. This provision shall apply during the lunch hour as well as overnight. Pipe not to be installed that day shall not be laid out. Should water enter the trench during or after installation of the piping, no additional piping may be installed or back filled until all water is removed from the trench. Pipe shall not be installed when water is in the trench, when precipitation is occurring, or when the ambient temperature is at 40° F or below. Pipe installed at temperatures below 40° F shall be removed and replaced at no cost to the City. PVC pipe shall be snaked in the trench to accommodate for expansion and contraction due to changes in temperature.

In installing irrigation pipe the Contractor shall route the pipe as necessary to prevent damage to tree roots. Where trenching must occur near trees, the Contractor shall provide proper root pruning and sealing methods to all roots 1-inch and larger.

Maintain 6-inch minimum clearance between sprinkler lines and lines of other trades. Do not install sprinkler lines directly above another line of any kind.

Maintain 1-inch minimum between lines which cross at angles of 45 to 90 degrees.

Exercise care when excavating, trenching and working near existing utilities.

Throughout the guarantee period it will be the responsibility of the Contractor to refill any trenches that have settled due to incomplete compaction.

Electrical Wire Conduit Installation

Electrical conduit shall be installed in all non-soil areas, as well as for all above ground wiring where wire passes under or through walls, walks and paving to controllers.

Conduit shall extend 18 inches beyond edges of walls and pavement.

No cable connection shall be made inside conduits or beneath hardscape areas.

Pipe Sleeving Installation

Sleeving shall be installed wherever piping is going under a non-soil area, generally where indicated on the Drawings. Minimum cover over all sleeving pipe shall be 24 inches as shown on the detail.

Sleeving shall extend 18 inches beyond edges of walls, walks and pavement.

Special Note for Western Avenue Pipe Sleeving and Control Conduit (Item 32381.03A)

In general, the location of Western Avenue HDPE sleeving and PVC control conduit are shown diagrammatically on the drawings. Sleeve and conduit may be run in sidewalks as shown, provided that tree roots are protected from damage in accordance with the requirement specified in the Contract Documents. As an alternative, the Contractor may elect to route irrigation sleeving and conduit directly adjacent to street lighting conduit systems.

Irrigation control conduit and wiring shall not be routed through lighting handholes, but shall be routed through separate pullboxes as specified herein. Irrigation control pullboxes are not shown on the Drawings. It is the intent that irrigation control pullboxes be located every 200 feet and at changes in direction.

Isolation Valve Installation

Install isolation valves per detail where indicated on the Drawings. Install all isolation valves on a level crushed stone base so that they can be easily opened or closed with the appropriate valve wrench. Install specified valve box over each isolation valve.

Check and tighten valve bonnet packing before valve box and backfill installation.

Valve Box Installation

Furnish and install a valve access box for each electric valve, quick coupling valve, isolation valve, flushing valve, air relief valve and wire splice.

All valve access boxes shall be installed on a minimum 4-inch crushed stone base. Finish elevation of all boxes shall be at grade. All crushed stone to be supplied by the Contractor and installed before valve box. Crushed stone shall not be poured into previously installed valve boxes.

24 Volt Control Valve Installation

Control valves shall be installed on a level crushed stone base. Grade of bases shall be consistent throughout the project so that finish grades fall within the limits of work. Valves shall be set plumb with adjusting handle and all bolts, screws and wiring

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accessible through the valve box opening. Valves shall be set in a plumb position with 24-inch minimum maintenance clearance from other equipment.

Install at sufficient depth to provide more than 6-inch, nor less than 4-inch cover from top of valve to finish grade.

Adjust zone valve operation after installation using flow control device on valve.

Wiring Installation

Wiring shall be installed along with the main line. All wiring beneath hardscapes shall be installed in electrical conduits from controller location to valves. Conduit ends shall be sealed once wires are installed using a flexible watertight seal. Multiple wire bundles shall be cinched together at maximum 12-foot centers using plastic cable cinches and shall be laid beside, and at the same invert as, the irrigation lines. Sufficient slack for expansion and contraction shall be maintained and wiring shall at no point be installed tightly. Provide and install an additional 8 inches to 12 inches slack at all changes of direction. Wiring in valve boxes shall be a sufficient length to allow the valve solenoid, splice, moisture sensor splice and all connections to be brought above grade for servicing. This additional slack shall be coiled for neatness in the valve box. Each valve shall have a separate wire back to the controller.

All wire shall be laid in trenches, in non hardscape areas, and shall be carefully back-filled to avoid any damage to the wire insulation or wire conductors themselves. In areas of unsuitable material, the trench shall have a 2 inches layer of sand or stone dust on the bottom before the wires are laid into the trench and back-filled. The wires shall have a minimum of 12 inches of cover. Wire not to be installed that day shall not be laid out.

An expansion curl shall be provided and installed within 6 inches of each wire connection to a solenoid or moisture sensor and at least every 100 feet of wire length on runs more than 100 feet in length in non hardscape areas. Expansion curls can be formed by wrapping five (5) turns of wire around a 1-inch diameter or larger pipe and then withdrawing the pipe.

Provide and install a common ground wire of white color. No white color shall be used for power wire. Control wire shall be red, drip zone control wire shall be orange and spare wiring shall be blue in color. Moisture sensor wires shall be purple in color.

Service wiring in connection with Drawings and local codes for 24-volt service. All in-ground wire connections shall be waterproofed with 3M DBR/Y-6 splice kits. All wires shall home run from the controller to each valve location. Any damage to wiring shall require the replacement of wires from controller to valves or moisture sensors..

Contractor shall provide a complete wiring diagram showing wire routing for the connections between the controller and valves. See section one for the inclusion of wiring diagram in operation and maintenance manuals.

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Controllers Installation

Contractor shall install controllers in enclosures, generally where shown on the drawings.

Item 32381.03A controller shall be located a minimum of 10 feet from the adjacent planter. Contractor to wire valves and moisture sensors into controller and set proper program.

Wire controllers to 120-volt electrical supply.

Keys shall be turned over to the Engineer.

Grounding Equipment Installation

Exterior field controller at Item 32381.02 shall be connected to a 5/8-inch diameter x 10-foot long copper clad grounding rods with minimum #6 AWG, solid, bare copper wire and 4-inch x 96-inch x 0.0625-inch copper grounding plates as outlined below. Minimum 20-foot separation between rod and plate. Minimum 12-foot separation between controller and ground rod. Connection to rod shall be with Cadweld or approved equal connector as specified. Connections to plate shall be performed by the plate manufacturer (Paige #182199L) or approved equal with 25-feet of insulated copper wire already attached. Grounding rod is to be covered by a 4-inch round, grated top, plastic valve cover with metal detection and six inches of 4-inch ADS or approved equal drainage pipe. Plate shall be installed in ground enhancement material. Plate shall be covered with 4-inch plastic grated cover with detection and minimum 36 inches of 4 inch ADS or approved equal drainage pipe. Ground rod and plate shall be UL listed.

Item 32381.02 controller shall be grounded to one rod and one plate. The 10-foot rod shall be installed penetrating into the soil to its full length. Plate shall be installed at a 36-inch depth with 50 lbs of PowerSet or approved equal ground enhancement material spread evenly below the plate and 50 lbs spread evenly above the plate in accordance with manufacturer's requirements. The grounding electrodes shall be installed at least 10 feet from wires connected to the field controller.

Exterior field controller at Item 32381.03A shall be connected to two (2) 5/8-inch diameter x 8-foot long copper clad grounding rods with minimum #6 AWG, solid, bare copper wire. Minimum 18-foot separation between rods. Minimum 10-foot separation between controller and ground rod. Controller shall be located a minimum of 10 feet from the planter where the grounds shall be installed. Connections to rods shall be with Cadweld or approved equal connectors as specified. Each grounding rod is to be covered by a 4-inch round, grated top, plastic valve cover with metal detection and six inches of 4-inch ADS or approved equal drainage pipe. Ground rods shall be UL listed.

Item 32381.03A controller shall be grounded to two rods. The 8-foot rod shall be installed penetrating into the soil to its full length. The grounding electrodes shall be installed at least 8 feet from wires connected to the field controllers.

Rain Sensors Installation

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Coordinate final location of rain sensors with Engineer. Rain sensors shall be in direct contact with the weather and not in contact with the irrigation spray. Rain sensors shall be wireless and mounted to lighting poles adjacent to controller locations. Receivers shall be mounted on the inside of controller enclosures.

Moisture Sensors Installation (Item 32381.03A)

Moisture sensors shall be installed per manufacture's recommendations and instructions. The sensors shall be wired in pairs of two for each designated zone. The sensors shall be buried consistent with the root zone of the material being watered. A splice box for the sensor wires should be no more than 4 feet from the sensors and no closer than 2 feet. Sensors must be irrigated by the last valve to run in each valve group it controls. Resequence valves to accomplish this as necessary. Mark each pair of wires from sensors to moisture controller, i.e. Area 1, Area 2...etc.

In-line Emitter Tube Installation

In-line emitter tubing shall be installed in areas designated by hand under the mulch, and shall have an average depth of 4 inches unless otherwise indicated on the drawings. Tubing should not be visible through the mulch. All in-line emitter tubing shall be installed on the high side of the plant material being watered to help insure dispersion of the water.

In-line emitter tubing is to be installed 4 inches from all planter edges, curbs and walls. Spacing of in-line emitter tube is to be 12 inches center-to-center in all irrigated areas.

All in-line tubing shall have a minimum incoming pressure of not less than 5-PSI of the pressure regulator, 45-PSI (Item 32381.03A) or 35-PSI (Item 32381.02), to assure a maximum linear run of 407 feet at 45 psi incoming pressure and 365 at 35 psi incoming pressure.

Drip Pressure Regulator Installation

Pressure regulator shall assure a 45-PSI downstream pressure entering drip supply header PSI (Item 32381.03A) or 35-PSI (Item 32381.02),. Pressure shall be verified by contractor to assure proper operating pressure for the in-line emitter tubing at maximum linear run of 407 feet at 45 psi incoming pressure and 365 at 35 psi incoming pressure. Contractor may need to manifold pressure regulators to reach the mid-range flow of the regulator.

Tuning Stake Installation

In-line drip tubing shall be secured with stakes. Stakes shall be spaced to ensure that tubing does not shift location in presence of foot traffic, operations, gravity on slope installations, or environmental effects. Stake in-line drip tubing at minimum 5-foot intervals to prevent movement.

Air/Vacuum Relief Valve Installation

Air relief valves shall be installed in the emitter tubing, at high elevation points as approximately indicated on the drawing.

Flush Valve Installation

Flush lines shall be installed on end of PVC exhaust header where indicated on the drawings.

Sprinkler Installation

Sprinklers shall not exceed maximum spacing indicated.

Adjust sprinkler zone after installation using flow control device on valve.

Quick Coupling Valve Installation

Provide and install quick coupling valves where indicated on the Drawings.

Quick coupling valves to be mounted on 1-inch prefabricated PVC unitized swing joint assemblies with integral o-rings, minimum length 12 inches with brass insert and stabilizer as per details.

Enclosures and Concrete Bases

Install controller enclosures on concrete bases. Contractor shall construct concrete bases, which shall be 12-inches in thickness and shall have length and width 6-inches beyond each edge of controller enclosure. Base shall have reveal of 3-inches above finished grade, with 1-inch chamfer along full perimeter of top edge. Bases shall be 28"Lx27.5"Wx6"Deep.

Install one (1) 1-inch sweep elbow (power), one (1) 1-1/2-inch sweep elbow (ground), and one (1) 3-inch sweep elbow (field wiring) through concrete pad into controller enclosure as per detail for 32381.02.

Install one (1) 1-inch sweep elbow (power), one (1) 1-1/2-inch sweep elbow (ground), and two (1) 2-inch sweep elbow (field wiring) through concrete pad into controller enclosure as per detail for 32381.03A.

Install Meter/Backflow Prevention enclosures on concrete bases. Contractor shall construct concrete base, which shall be 12-inches in thickness. Concrete bases shall be reinforced with rebar per City of Cambridge Standards. Bases shall be 84"L x 57"W X 12" Deep. Base shall have reveal of 3-inches above finished grade, with 1-inch chamfer along full perimeter of top edge. (See Details)

Item 32381.03A Meter/Backflow Prevention enclosure requires two (2) 2-inch electrical conduits for wiring the master valve in enclosure and for wires to proceed to other valves and moisture sensors along Western Avenue Streetscape Planters #1 thru #14.

Both enclosures shall require two (2) one inch Schedule 40 electrical conduits for wiring the enclosure heaters. Copper discharge pipes shall be installed for Item 32381.02 into landscape areas 24-inches below grade to top of pipes. Discharge pipes for Item 32381.03A shall be installed into the enclosure in sleeves unless the City of Cambridge Cross Connection Department requires copper pipe to be installed to the exterior of the enclosure 24 inches below grade before transitioning to HDPE pipe in sleeves. See Details

Water Meter Installation

Water meters shall be furnished by the Cambridge Water Department at no cost to the Contractor and installed in above grade enclosures. Water meters shall be 1-inch for Item 32381.02 and 3/4-inch for Item 32381.03A. See Details.

BackFlow Preventer Installation

Install reduced pressure back flow prevention assemblies in above grade enclosure as specified. Back flow installation shall be in accordance with The City of Cambridge Cross Connection Department. Item 32381.03A discharge setup downstream of backflow preventer must be approved by The City of Cambridge Cross Connection Department before installation occurs. See Details.

Check/ Test/ Start-up/ Adjust Flushing:

1. After all piping, valves, sprinkler bodies, pipe lines and risers are in place and connected, but prior to installation of sprinkler internals, open the control valves and flush out the system under a full head of water.
2. Sprinkler internals, flush caps and riser nozzles shall be installed only after flushing of the system has been accomplished to the full satisfaction of the Engineer.
3. Drip tubing shall only be closed off after flushing of all tubing within the drip zone as been accomplished. Ends shall be capped however to prevent debris from entering the tubing before flushing as been accomplished. Tubing shall not be pressurized until after flushing.
4. Contractor shall be responsible for flushing the entire system after installation is complete and will be responsible for any clogged nozzles or drip tubing for thirty (30) days after substantial completion of the irrigation system.

Testing:

1. Leakage test: test all lines for leaks under operating pressure. Repair all leaks and re-test.

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2. Coverage test: perform a coverage test in the presence of the Engineer (notify Engineer at least seven (7) days in advance of scheduled coverage test). Representative will determine if the water coverage is complete and adequate. Readjust heads and/or head locations as necessary or directed to achieve proper coverage.
3. All testing shall be at the expense of the Contractor.

Cleaning and Adjusting

At the completion of the work, all parts of the installation shall be thoroughly cleaned. All equipment, pipe, valves and fittings shall be cleaned of grease, metal cuttings and sludge which may have accumulated by the operation of the system for testing.

Adjust sprinkler heads, valve boxes, and quick coupling valves to grade as required, so that they will not be damaged by mowing operations.

Continue sprinkler coverage adjustment as required by settlement, etc., throughout the guarantee period.

Each control zone shall be operated for a minimum of 5 minutes and all heads checked for consistency of delivering water. Adjustments shall be made to sprinklers that are not consistent to the point that they match the manufacturer's standards. All sprinklers, valves, timing devices or other mechanical or electrical components, which fail to meet these standards, shall be rejected, replaced and tested until they meet the manufacturer's standards.

Acceptance and Operation by City

Upon completion of the work and acceptance by the City, the Contractor shall be responsible for the training of the City's Representative(s) in the operation of the system (provide minimum 48 hours written notice in advance of test). The Contractor shall furnish, in addition to the Record Drawings and operational manuals, copies of all available specification sheets and catalog sheets to the City's personnel responsible for the operation of the irrigation system. The Contractor shall guarantee all parts and labor for a minimum period of one (1) year from date of acceptance.

Conditions for acceptability of work for start of maintenance by City issued by City or Engineer shall include but not be limited to:

1. Punch list items complete and approved by Engineer
2. Landscape and turf irrigation systems complete and in place.
3. Record drawings complete.
4. Maintain installation and watering schedules until all conditions noted above have been completed.

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Submittals

Product Data: submit manufacturer's specifications and installation instructions for drinking fountain.

Shop Drawings: Submit shop drawings for the drinking fountain showing attachment methods, fabrication, casting and hardware:

Samples: submit 3" x 5" powder coat finish sample of the drinking fountain for selection by Engineer.

MATERIALS:

Drinking Fountain

Model GRM45 Barrier-Free Bi-Level, Pedestal Mounted Drinking Fountain, Dual Height with Two Bowls manufactured by Murdock-Super Secur, 2488 River Road, Cincinnati, Ohio 45204, phone # 800.453.7465, or approved equivalent product.

1. 18 Gauge, 304 stainless steel bowls
2. Pedestal: Black powder-coated 11 gauge heavy duty galvanized welded steel
3. Activated by front-mounted self-closing button.
4. Bubblers shall be brass with non-squirt features and operate on water pressure range of 20-105 psig.
5. Mounting: in-ground with concrete foundation
6. Finish and Color: Pedestal and Arm finished with oil based black enamel by manufacturer.

CONSTRUCTION METHODS:

Installation

Install in accordance with fabricator's recommendations and the following:

1. The Contractor shall stakeout the locations for drinking fountain for review and approval by the Engineer prior to installation.
2. Install drinking fountains and securely fasten to substrates.
3. Protect existing construction from damage.
4. Comply with fabricator's recommendations.
5. Install work plumb, level and in proper alignment.
6. Provide work free from tool marks and blemishes.
7. Touch up damaged or abraded finishes. Replace sections which cannot be repaired.
8. The Contractor shall be responsible for timing the delivery of all items so as to minimize on-site storage time prior to installation. Stored materials and items must be protected from weather, careless handling and vandalism.
9. The Contractor shall be responsible for testing the working order of the drinking fountain parts and of the water pressure. The Contractor shall adjust the push-button mechanism and the fountain water pressure as necessary to ensure that it is functioning for optimal use.
10. The Contractor shall be responsible for providing the City with the necessary information to winterize the drinking fountain system.

COMPENSATION:

Drinking Fountains will be measured by the unit each for each type, complete with incidentals. The unit bid price bid per each item shall constitute full compensation for furnishing and installing each item complete in place, including concrete foundation, anchoring hardware and fasteners, cleaning and touch-up, protecting the items from damage, and cutting and patching required to complete the installation as indicated and specified.

32402	DENSE GRADED CRUSHED STONE FOR SUB-BASE	CUBIC YARD
32420	HOT MIX ASPHALT BASE COURSE	TON
32431	HIGH EARLY STRENGTH CEMENT CONCRETE BASE COURSE	SQUARE YARD
32460	HOT MIX ASPHALT AND TEMPORARY TRENCH PATCH	TON
32460.2	HOT MIX ASPHALT OPEN GRADED FRICTION COURSE	TON
32464.51	HOT POURED RUBBERIZED ASPHALT SEALER	FOOT
32472	HOT MIX ASPHALT FOR MISCELLANEOUS WORK	TON

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DESCRIPTION:

Work to be done under these items shall conform to the relevant provisions of Sections 402, 420, 430, 440 and 460 of the MassDOT Standard Specifications and to the following:

The work of this Section also includes (as part of Item 32460) temporary patching of utility excavations.

Placement of asphalt by hand methods where machine placement is impractical in the judgement of the Engineer, and repaving of abutting driveways and private walkways shall be paid under Item 32472. Only private walkway and driveway work which is indicated on the plans or directed by the Engineer shall be paid for under Item 32472.

MATERIALS:

The Hot Mix Asphalt Base Course, Binder Course, and Top Course Pavement shall be Type I-1 as specified in the MassDOT Standard Specifications. The pavement thickness shall be as shown on the drawings and details in full-depth areas, and as directed by the Engineer in overlay areas. In overlay areas designated "2-inch" it is anticipated that a 2-inch thick top course will be placed, following milling of a nominal 2 to 4 inches of pavement and crack sealing as directed by the Engineer.

Hot Mix Asphalt Open Graded Friction Course (OGFC) shall be in accordance with Sections 460 and M3.11.03 (Table B) of the MassDOT Standard Specifications. The Contractor shall pay particular attention to the Standard Special Provisions of December 16, 2011 which introduced modifications to Section M3.11.03. Drain down of the OGFC binder shall be no greater than 0.3% in accordance with ASTM D6390. The mix shall be tested for moisture susceptibility and asphalt stripping from the aggregate by AASHTO T283. If the retained tensile strength is less than 80%, a heat stable additive shall be furnished to improve the anti-stripping properties of the asphalt binder. The amount and type of additive shall be based on the manufacturer's recommendations.

Dense Graded Crushed Stone for Sub-Base shall be in accordance with Section 402 of the MassDOT Standard Specifications.

High Early Strength Cement Concrete Base Course shall be in accordance with Section 430 of the MassDOT Standard Specifications.

CONSTRUCTION METHODS:

Where grades provided on the drawings in milling and overlay areas indicate that proposed grade is to be raised above existing, milling depth and overlay thickness shall be adjusted as directed by the Engineer. Where grades provided on the drawings indicate that proposed grade in milling and overlay areas is to be lowered below existing grade, the Contractor shall excavate test pits to verify whether there is sufficient thickness of

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existing pavement to support a pavement milling and overlay operation. This requirement for test pits may be modified if other work of this Contract (such as water or drainage installation) is judged by the Engineer to provide similar information on pavement thickness. See drawings for additional information.

At proposed raised side street treatments and raised crosswalks, the Contractor shall place the hot mix asphalt in the raised area between the flush granite curbs using hand spreading and finishing methods.

At work locations where proposed finished grades are not indicated on the Drawings, the proposed grades shall be discussed with the Engineer prior to work, in order to address existing and proposed drainage concerns. The Contractor shall be responsible for ensuring that all paved areas are graded to drain, either to existing structures, or new structures.

Crack sealing shall be performed where directed by the Engineer with modified asphalts (e.g. fiber-reinforced asphalt crack sealer). Fiber reinforced asphalt crack sealer materials shall be short-length polyester fibers having the following properties;

Length	0.25 inch
Diameter	0.00087 inch plus or minus 0.0001 inch
Specific Gravity	1.32 to 1.40
Melt Temperature	480 degrees F minimum
Ignition Temperature	1000 degrees F minimum
Tensile Strength	Greater than 80,000 PSI
Break Elongation	33% plus or minus 9% when they are fully drawn

Asphalt Fiber compound shall be mixed at a rate of 6%-8% fiber weight to weight of asphalt cement. The asphalt binder shall conform to a PG 64-28. Fiber reinforced asphalt crack sealer shall be submitted to the Engineer for review and approval.

Prior to sealing a crack, it is absolutely essential that all compressible material be removed by high-pressure air or routing. If grass or vegetation is present in the crack, it may be necessary to inject a liquid herbicide to prevent future growth. For small hairline cracks, an asphalt slurry mixture type SS-1, SS-1h shall be squeegeed over the surface and forced in the cracks. The slurry shall be maintained at a significant fluidity to be able to flow into the hairline cracks. Sealing of cracks shall be considered to be complete upon review and approval by the Engineer.

Liquid Asphalt Emulsion shall be applied prior to installation of asphalt as incidental to this item. Emulsion shall be AC-20 conforming to AASHTO M226 and shall be applied at a temperature over 100 degrees F by an emulsion truck.

The emulsion truck shall have pneumatic tires of such width and number that the load produced on the surface shall not exceed 650 pounds per inch of tire width, and it shall be

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designed, equipped, and operated so that at an even heat the emulsion may be applied uniformly on variable widths of surface at readily controlled rates from 0.05 to .20 gallons per square yard as directed by the Engineer.

The emulsion shall be applied within a pressure range of 25 to 75 pounds per square inch. Distributor equipment shall include a tachometer, pressure gauges, volume-measuring devices, and a thermometer for reading the temperature of tank contents. The distributor shall be self-powered and shall be equipped with a power unit for the pump and full circulation spray bars adjustable laterally and vertically.

At all locations where new asphalt pavement will abut existing pavement, the Contractor shall saw-cut the existing pavement neat and straight as shown on the detail drawings. All joints shall be tacked with Emulsified Asphalt, Type RS-1 before paving. The joint shall be tacked again after paving and sanded.

No diesel shall be used on castings or for cleaning of equipment. Only soap and water shall be allowed.

The Contractor shall take all reasonable measures to assure proper drainage on the final surface of the roadway. Pavement which does not drain properly due to poor workmanship shall not be accepted by the City.

At locations which are not complete at the end of the day, the Contractor shall use paper joints. In no case shall a longitudinal joint be left open to traffic at day's end.

The Contractor shall be required to provide a minimum of two vibratory mechanical rollers. One shall be a steel drum with front and rear rollers and a minimum weight of 10 tons. The other roller shall be a combination roller with four rubber front tires and a rear steel drum. The roller shall be a minimum weight of eight tons. An all rubber tire roller with a minimum weight of eight tons can be substituted for the combination roller.

The Contractor shall supply an approved Dial Type Asphalt Thermometer (Range 50 degrees F to 500 degrees F) for each paving machine in operation on the project. The thermometer shall remain the property of the Contractor upon completion of the project.

Water gate box adapters provided by the City and installed by the Contractor shall be considered incidental to this item. The Contractor shall be responsible for coordinating structure adjustment by other utilities prior to paving.

Note that emulsion truck and rubber tire roller are a requirement for paving. Failure to comply with this requirement will result in the City prohibiting the Contractor from paving. There shall be no additional cost to the City in this event.

Dust Control:

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The Contractor shall perform dust control as directed by the Engineer and in accordance with Section 440 of the MassDOT Standard Specifications. The Contractor shall prevent operations from producing dust in amounts damaging to property, cultivated vegetation, or domestic animals, or causing a nuisance to persons living in or occupying buildings in the vicinity of the Project. The Contractor shall be responsible for any damage resulting from dust originating from its operations. Dust abatement measures shall be continued until the Contractor has completed its work. Dust abatement measures shall include but not be limited to spraying water, applying calcium chloride, and placing temporary pavement on and around trenches and on work sites.

Open-Graded Friction Course (OGFC) at Pervious Pavements (Cycle Track)

Sediment Control: Control of sediment during construction of pervious pavements is critical. It is important that the construction of pervious pavements be undertaken in such a way as to prevent:

1. Compaction of underlying soil beyond the limits specified
2. Contamination of aggregate courses with sediment and fines
3. Tracking of sediment onto pavement
4. Drainage of sediment-laden water onto pervious surface or into underlying pervious materials.

The Contractor shall consider performing pervious pavement construction after all adjacent construction activities are complete, in order to minimize chances of introducing sediment onto pervious asphalt surface or into underlying pervious materials. Should this not be possible, nonwoven geotextile shall be used to cover the pervious pavement until adjacent sites are stabilized.

Surface sediment which is deposited onto the finish pavement shall be removed by vacuum sweeper, and not power-washed into the underlying pervious materials.

Placement of OGFC: OGFC shall be installed in one lift to a compacted thickness as shown on the drawings. Placement shall be in accordance with the MassDOT Standard Specifications. Asphalt shall not be placed on wet surfaces or when the ambient temperature is 60 degrees F or less. Compaction of the asphalt shall take place when the surface is cool enough to resist a 10-ton roller. One or two passes (maximum) shall be performed.

Testing: The full permeability of the pavement shall be tested by application of clean water at the rate of at least 5 gpm over the surface, using a hose or other distribution device. All applied water shall infiltrate directly without puddle formation of surface runoff.

High Early Strength (HES) Cement Concrete Base Course

HES cement concrete base course shall be used where new curbing is to be installed in mill and overlay areas as shown on the Drawings, and at other miscellaneous areas where

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full-depth roadway construction less than 4-feet in width is specified or directed by the Engineer.

Testing

Test in-place base and surface course for compliance with requirements for thickness and surface smoothness. Repair or remove and replace unacceptable work as directed by the Engineer.

Surface Smoothness. Test finished surface for smoothness using a 10 foot straightedge applied parallel with and at right angles to the centerline of the paved area. Surface will not be accepted if gaps or ridges exceed 3/16 of an inch.

COMPENSATION:

Hot Mix Asphalt pavement will be measured for payment as specified in Sections 420 and 460 of the MassDOT Standard Specifications.

Dense Graded Crushed Stone for Sub-Base will be measured for payment as specified in Section 402 of the MassDOT Standard Specifications.

High Early Strength Cement Concrete Base Course pavement will be measured for payment as specified in Section 430 of the MassDOT Standard Specifications.

Dust control will not be measured for payment, and will be considered incidental to the hot mix asphalt items as appropriate.

Payment for work under Items 32420, 32460, 32460.2 and 32472 shall be at the contract unit price per ton and shall include full compensation for labor, materials including emulsified asphalt, equipment, and any other incidentals necessary for the satisfactory completion of this work as specified.

Payment for work under Items 32431 shall be at the contract unit price per square yard and shall include full compensation for labor, materials including emulsified asphalt, equipment, and any other incidentals necessary for the satisfactory completion of this work as specified.

Sealing of cracks as directed by the Engineer will be measured by the foot and will be paid for at the Contract Unit Price bid under Item 32464.5.

NOTES ON EXCLUSIONS:

No work on abutter driveways will be paid for under Item 32472 which is not shown on the plans, nor specifically directed by the Engineer.

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NOTES ON EXCLUSIONS:

Sawcutting associated with utility trenches and curb work will not be measured separately for payment, but will be considered incidental to the appropriate utility and curb items.

32504	GRANITE CURB TYPE VA4 - STRAIGHT	FOOT
32504.1	GRANITE CURB TYPE VA4 – CURVED	FOOT
32509	GRANITE TRANSITION CURB FOR PEDESTRIAN RAMPS - STRAIGHT	FOOT
32509.1	GRANITE TRANSITION CURB FOR PEDESTRIAN RAMPS – CURVED	FOOT
32516	GRANITE CURB CORNER TYPE A	EACH
32517	GRANITE CURB CORNER TYPE B	EACH
32580	CURB REMOVED AND RESET	FOOT

DESCRIPTION:

Work to be done under these items shall conform to the relevant provisions of Sections 501 and 580 of the MassDOT Standard Specifications and to the following:

CONSTRUCTION METHODS:

Where curb is to be installed in mill and overlay areas or other existing paved areas, the Contractor shall neatly sawcut existing adjacent pavement and excavate a trench for the curb or edging that is thirty (30) inches wide and as deep as required to allow the sub-grade to be twenty four (24) inches below the top of the finished curb/edging. The curb/edging reveal shall be as indicated on the Drawings or as directed by the Engineer. At raised side street treatments and raised crosswalks, curb shall be installed transverse to, and flush with, the roadway as shown on the Drawings.

Cement concrete shall normally be installed on the roadway side of curb as shown on the Drawings, and at flush transverse curbs cement concrete shall be installed on both sides of the curb. Cement concrete shall be 4000 PSI at 28 day Test, 3/4" aggregate, 5% air entrainment, and maximum 4" slump.

Curb joints shall be pointed with mortar conforming to Section M4.02.15 of the Standard Specifications. Joints greater than 3/4" shall have a non-shrink caulking applied as directed by the Engineer.

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disposal, and any other incidentals necessary for the satisfactory completion of this work as specified.

32655.31

ORNAMENTAL LOOP FENCE

FOOT

DESCRIPTION

General

The work under this Section shall consist of furnishing and installing a custom fabricated ornamental metal loop fence of the type and quantity indicated on the drawings and as specified. This includes the attachment to the granite curb and associated work.

Submittals: Submit shop drawings for approval prior to fabrication of work under this section.

Product Data: Submit manufacturer's specification and installation instruction for the Paint Finish System

Samples:

1. Materials samples (full size of Metal Loop fence-min. 2 loops.
2. Color finish samples for selection by Engineer for loop fence. Color is to be a black. Exact color of black and finish will be determined based on samples.

Delivery Storage and Handling:

1. Deliver components braced for protection, with finishes and leading edges protected from contamination, damage and moisture.
2. Store components under cover, off ground and without risk of contamination of contact with other metals.
3. Protect finished surfaces and prevent distortion damage or contamination during handling and installation.

MATERIALS

Provide metals free from surface blemishes where exposed to view in the finished unit. Exposed to view surfaces exhibiting pitting, seam marks, roller marks, stains, discoloration, or other imperfections on finished units are not acceptable.

Unless otherwise specifically called for, steel, hardware, and fasteners shall be fabricated of structural steel conforming to ASTM A-36. Steel fence and gate shall be hot-dip galvanized steel bar.

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Connections shall be continuous welded type for rigid construction, with welds ground smooth. Welding shall conform to applicable requirements of AWS D1.1.

Furnish anchors, bolts, and other items as required.

Exposed fastenings shall be of the same material and finish as the metal to which applied, unless otherwise noted.

Welded rods shall conform to AWS Standards and the recommendations of the welding rod manufacturer.

Epoxy

Epoxy for setting anchor bolts/threaded rods and stone: Bonstone A-124/B-414x manufactured by Bonstone Materials Corporation, 5828 Northy 97th Street, Milwaukee, Wisconsin 53224, (414) 463-2580

Grout

Pourable, quick setting, non-metallic and non-shrinking hydraulic cement grout such as "Por-Rok Cement" supplied by Waldo Bros., Roslindale, MA.

Shims

Shims: Stainless Steel, Type 304

Painted Finishes

Painted finish for steel surfaces: as follows:

1. Surface Preparation: Near White Metal Blast Cleaning surfaces as per Paint Council designation SSPC-SP#10 standard.
2. Finishes: Shop applied in accordance with paint manufacturer's recommendations and as follows:
 - A. 2 mils DFT Organic zinc rich paint
 - B. 4 mils DFT epoxy paint
 - C. 3 mils DFT colored urethane paint
3. Prime Coat: One of the following:
 - A. Porter Zinc-Lock 308 Zinc Rick Polyamide Epoxy
 - B. Carboline #676
 - C. Tnemec #93 Tnemec-Zinc
 - D. Sherwin Williams Zinc Clad I
4. Intermediate Coat: One of the following:
 - A. Porter M.C.R.-43 high Build Epoxy 4361
 - B. Carboline #D890 Epoxy
 - C. Tnemec #27 HB-Typoxy
 - D. Sherwin Williams Recoatable Epoxy Primer
5. Finish Coat: One of the following:

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- A. Porter Hythane 4610 polyurethane
- B. Carboline #134 or #133HB
- C. Tnemec #73 Series Endurashield
- D. Sherwin Williams Hi-Bild Aliphatic Polyurethane

CONSTRUCTION METHODS

Fabrication

Form metal work to required shapes and sizes, with true curves, lines and angles. Provide components in sizes and profiles indicated, but not less than required to comply with requirements indicated for structural purposes.

Drill and tap for required fasteners, unless otherwise indicated. Use concealed fasteners wherever possible.

Mill joints to a tight, hairline fit. Cope or miter corner joints. Form joints exposed to weather to exclude water penetration.

Remove mill scale, dirt, grease and other foreign matter due to weld sparks, spatter or tramp metal.

Comply with AWS for recommended practices in shop welding and brazing. Clamp members and alternate welds to prevent warping or misalignment. Provide welds and brazes behind finished surfaces without distortion or discoloration on exposed side Fully weld continuously and ground flush and smooth connections in a uniform manner.

Clean exposed, welded and brazed joints of flux and dress exposed and contact surfaces.

Chip out and replace welding showing cracks, slag inclusion, lack of fusion, bad undercut and other defects ascertained by visual or other means of inspection.

Provide castings that are sound and free of warp, cracks, blow holes, or other defects that impair strength or appearance. Grind, wire brush, sandblast, and buff castings to remove seams, gatemarks, casting flash, and other casting marks.

Finish exposed surfaces to smooth, sharp, well-defined lines and arises.

Assemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.

Finishes - General

Comply with MAAMM "Metal "Finishes Manual" for recommendations relative to applying and designating finishes.

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Protect mechanical finishes on exposed surfaces from damage by applying a strippable temporary covering prior to shipment.

Preparation

Coordinate and furnish anchorages and setting drawings, diagrams, templates, instructions and directions for installing items having integral anchors that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to the site.

Installation

Provide anchorage devices and fasteners for securing ornamental site metal items to in place construction.

Perform cutting, drilling and fitting to install ornamental site metalwork. Set products accurately in location, alignment, and elevation, plumb, level, and true, measured from established lines and levels. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

Fit exposed connections accurately together to form tight, hairline joints or, where indicated, with uniform reveals and spaces for sealants and joint fillers. Where cutting, welding and grinding are required for proper shop fitting and jointing of ornamental site metal items, restore finishes to eliminate evidence of such corrective work.

Do not cut or abrade finishes that cannot be completely restored in the field. Return items with such finishes to the shop for required alterations, followed by complete refinishing, or provide new units.

Install concealed gaskets, joint filler, insulation, and flashings as work progresses.

Restore protective coverings that have been damaged during shipment or installation. Remove protective coverings only when there is no possibility of damage from other work to be performed at the same location.

1. Retain protective coverings intact and remove simultaneously from similarly finished items to preclude non-uniform oxidation and discoloration.
2. Field Welding: Comply with applicable AWS specifications for procedures of manual shielded metal-arc welding, for appearance and quality of welds made, and for methods used in correcting welding work. Weld connections that are not to be left as exposed joints but cannot be shop-welded because of shipping size limitations. Grind exposed welded joints smooth and restore finish to match finish of adjacent surfaces.

Core drill granite curb at locations to receive fence posts.

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Fencing shall be removed in the presence of the Engineer. Where damage is caused to the fencing by the Contractor's operations, the Contractor shall be required to replace damaged components with new components of similar type and composition at no additional cost to the City.

Reset fencing shall be set true to line and grade. Location and layout of fencing shall be approved by the Engineer prior to installations.

COMPENSATION:

Payment under this Item shall be at the Contract unit price bid per foot of removal and resetting of fencing, complete in its final location. Payment shall also include removal of existing cement concrete foundations, and placement of new cement concrete foundations, where required.

32701	CEMENT CONCRETE SIDEWALK	SQUARE YARD
32701.11	CEMENT CONCRETE SIDEWALK AT DRIVEWAYS AND INTERSECTIONS	SQUARE YARD
32701.2	CEMENT CONCRETE PEDESTRIAN RAMP	SQUARE YARD
32701.28	DETECTABLE TILE – CAST IRON	SQUARE YARD
32701.29	DETECTABLE TILE - PRECAST CONCRETE	SQUARE YARD

DESCRIPTION:

Work to be done under these items shall conform to the relevant provisions of Section 701 of the Standard Specifications and to the following:

The work of Items 32701 and 32701.11 also pertains to, and shall be coordinated with the work of Items 32900.01 and 32900.02. See additional requirements herein.

SUBMITTALS

Product Data:

Submit manufacturer's specifications and installation instructions for:

1. Joint Filler
2. Joint Sealant
3. Backer Rod
4. Design Mix for concrete

Sample panel:

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1. Provide one 5'-0" square Sample panel of cement concrete showing full range of surfaces finishes and joint types to be expected in the finished work. Quality of workmanship, joint treatment and surface finish to be approved by Engineer before proceeding with permanent concrete paving. If original sample is not approved, provide additional samples at no cost to the City until an approved sample is achieved. The approved sample will become the standard for the entire project.
2. Sample Panels are not to be constructed in locations becoming part of the final paving. Sample panels are to remain undisturbed until paving is complete and removal is approved by the Engineer.

Certificates:

Submit materials certificates signed by material producer and Contractor.

Provide certifications stating materials comply with requirements. Certification shall be based on independent testing laboratory tests made within last year.

Quality Assurance:

Work under this Section shall be performed by workmen experienced and familiar with required construction procedures and under full time supervision of a qualified foreman.

Delivery and Storage:

1. Store materials on raised platforms. Locate, storage piles or stacks to avoid and be protected from traffic. Store materials under an approved roof or covered with waterproof tarpaulins, except when men are working and using materials.
2. Handle, store, mix and apply setting materials in strict compliance with manufacturer's recommendations and instructions.

Protection:

1. Protect completed sidewalk surfaces from damage or defacement.
2. Protect adjacent surfaces from staining, soiling and other damage.

MATERIALS:

Concrete:

Concrete for sidewalks shall conform to MassDOT Standard Specifications, M4.02.00 through M4.02.12 and be 4000 PSI at 28 day test, 3/4 inch coarse aggregate, 610 pounds cement per cubic yard, 6% air entrained (AASHTO - M154), Type A water reducing admixture (AASHTO - M194), 3 to 4 inch slump, and Type II dark-colored by adding 1-1/2 to 2 lbs. of lamp black per cubic yard at the plant.

The concrete shall contain 1 pound of 100% polypropylene microfiber per cubic yard. Fiber shall be added during batching at the plant to insure uniform distribution. The

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micro-fiber shall be W.R. Grace micro-fiber or equal and shall be used in accordance with the supplier's specifications.

Cast Iron Detectable Tile:

The detectable warning strip at concrete pedestrian ramps, raised side street treatments abutting concrete sidewalks, and raised crosswalks abutting concrete sidewalks shall be the Cast Iron Detectable Warning Plates by East Jordan Iron Works (800-626-4653) or approved equivalent product. The Cast Iron Detectable Plate shall meet all ADA Accessibility Guidelines for Detectable Warnings. Plates should have truncated domes and a slip resistant texture with a coefficient of friction rating greater than 0.80. Warning panels shall be at least 24" deep and 60" wide at the point of crossing.

Size: 24 in. (+/- 1") deep, cut as wide as the pedestrian ramp opening, and as wide of the crosswalk at raised side street treatments and raised crosswalks.

Pre-Cast Concrete Detectable Tile:

The detectable warning strip at raised crosswalks and raised intersections abutting brick sidewalks shall be the Detectable Warning Pavers by Hanover Architectural Products (717-637-0500) or approved equivalent product. The pre-cast concrete detectable paver shall meet all ADA Accessibility Guidelines for Detectable Warnings. Pavers should have truncated domes and a slip resistant texture with a coefficient of friction rating greater than 0.80. Warning panels shall be at least 24" deep and 60" wide at the point of crossing.

Size: Individual pavers shall be nominally 12"x12"x2" deep.

Color: Yellow.

Preformed Expansion Joint Filler:

The preformed expansion material shall conform to ASTM D-1752. The preformed expansion joint filler material data and installation directions shall be submitted to the Engineer for review and approval.

Backer Rod:

Continuous round rod of 100% closed cell polyethylene foam, complying with requirements of ASTM C-272.

Sealant:

The sealant shall be a polyurethane-based, one component, elastomeric sealant complying with Federal Spec. TT-S-00230C, Class A Type 1 for horizontal use and Type 2 for vertical use.. Sealants shall be self-leveling pour grade type for horizontal use and non-sag grade type for vertical use. Color shall match the color of the adjacent materials as approved by the Engineer. Sealant material data and installation directions shall be submitted to the Engineer for review and approval. Application of sealant for site improvements shall be in accordance with approved manufacturers' recommendations.

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CONSTRUCTION METHODS

These items shall include excavation and disposal of the existing material (in existing sidewalk areas) and the fine grading and compaction of the sub-base prior to placement of concrete. In areas which are existing roadway and which are to become sidewalk areas, excavation is paid for elsewhere in the Contract Documents. A jack hammer or saw cut shall be used at the beginning of each excavation and at all “back-of-sidewalk” limits in order to avoid damage to abutting properties and features which are to remain.

If the existing material is unsuitable or more material is needed for sub-base, additional material shall be installed and paid for under Item 2210.5 Imported Gravel Sub-Base as directed by the Engineer. If the existing material is brick, the City reserves the right to direct the Contractor to deliver the bricks to a specified site within the City at no additional cost.

In areas where sidewalks are to be constructed in present roadway areas, the full depth of existing pavement shall be completely removed. Excavation of existing hot mix asphalt, cobble and concrete roadway pavements as required for the work of this section is paid for elsewhere in the Contract Documents.

Where new sidewalk abuts existing-to-remain sidewalk, the limit of work shall be established at the existing nearest existing contraction or expansion joint, where a neat sawcut shall be provided.

The Contractor shall exercise special care when excavating near trees. When major roots are in the way, the Contractor shall go under or between them. In no case shall the Contractor disturb the root structure of the trees without direction from the City Arborist. Exposed roots shall be covered promptly. Excavation of all tree wells shall be done entirely by hand.

All existing traffic signs, trash and recycling receptacles within the limit of work and deemed salvageable by the Engineer shall be removed and delivered to the Cambridge Traffic Department or Cambridge Department of Public Works as directed by the Engineer. All existing sign posts shall be removed and properly disposed of by the Contractor. All trash and recycling receptacles deemed unsalvageable by the Engineer shall be removed and properly disposed of by the Contractor. This work shall be incidental to the various sidewalk items.

New traffic and street name sign posts, including new bases, shall be installed and paid for under Items 32847.1 and 32874. The work shall be sequenced such that regulatory sign messages shall be continuously maintained throughout construction.

The sub-base shall be prepared at the appropriate elevation for the depth of concrete to be installed. The sub-base shall be graded to follow the proposed sidewalk elevations shown on the Drawings. At locations where no proposed grades are indicated, the sub-base shall

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be graded to allow for sidewalks to be sloped from the City right of way towards the street at 1/8 inch to the foot, or as directed by the Engineer.

The Contractor shall raise all water curb stop boxes and drain manholes within the sidewalk limits to final grade and coordinate raising of other public and private utility boxes prior to pouring of concrete. The Contractor shall remove material from curb stop boxes with compressed air, after raising is complete and prior to pouring of concrete. Prior to pouring the concrete, the Contractor shall go over locations where curb boxes have been raised with the Engineer.

Proper compaction shall be obtained by means of plate-type mechanical compactors. The material shall be compacted to ninety-five percent (95%) of the maximum dry density at optimum moisture content as determined by the AASHTO Standard Method of Test T99 Method C.

Installation of Concrete:

Concrete shall be installed to a depth of 6" across driveways, at street intersection corners (5' beyond the point of tangency on either side of the corner curve), and at other locations as directed by the Engineer. At all other locations, concrete shall be installed to a depth of 4". Concrete for all pedestrian ramps shall be installed to a depth of 6".

Finishing shall be as specified in Subsection 701.61B of the MassDOT Standard Specifications. Curing shall be as specified in Section 476.71 of the MassDOT Standard Specifications. Concrete shall be membrane-cured. The curing compound shall not discolor the concrete and shall be applied according to the manufacturer's specifications. The mixture shall be applied immediately after the finishing is complete and free water has left the concrete's surface. The Contractor shall provide the Engineer with the curing compound specification prior to its use.

Expansion joints shall be placed every 30 feet. Expansion joints shall also be placed around all appurtenances such as utility poles, hydrants, manholes, and other obstructions extending into and through the sidewalk. Expansion joints installed around utilities shall be 3/8" foam expansion joint polyethylene at a depth to match the adjacent sidewalk (4" or 6"). It is also required that an expansion joint of 1/4" thick foam at 4" or 6" deep and sealant is placed longitudinally along the granite curb between curb and the concrete; longitudinally between sidewalk and brick feature strip or sidewalk; longitudinally between the pervious asphalt cycle track and the concrete; and also between buildings or retaining walls and the concrete sidewalk as directed by the Engineer. Six-inch expansion joints shall be placed at all locations where six-inch concrete corner slabs or driveways meet four inch concrete walks. Expansion material protruding above the finished sidewalk shall be trimmed flush with a sharp instrument as soon as the concrete has set.

Immediately after brooming concrete, using pressure-spray equipment, the Contractor shall apply a mixture of boiled linseed oil to the new concrete pavement as an anti-spalling seal. The mixture shall consist of 50% double boiled linseed oil and 50%

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petroleum spirits, AASHTO M-233-79. Upon approval by the Engineer, the Contractor may use other products available on the market in accordance with manufacturer's recommendations (2 applications at right angles to each other are required for complete coverage).

Detectable Tile

Cast iron and precast concrete detectable tiles shall be installed at time of sidewalk construction per manufacturer's directions and as shown on the plans and specified herein. Retrofit, bolted, or surface applied installations shall not be accepted.

Sawcut Joints:

Provide sawcut joints with a penetration depth of minimum 1/2" between expansion joints, true and plumb to paving surface, parallel to one another and perpendicular to paving edge and straight within a tolerance of 1/4 inch of a straight edge laid along the joint. Use new saw blades to result in smooth and crisp cuts.

"Don't Dump" Placards:

The work of this Section shall also include the installation of Cast Iron or Steel "Don't Dump" placards, where new sidewalks abut existing or proposed catch basins and inlets. The placards will be furnished by the City at no cost to the Contractor, for installation by the Contractor.

Finish Grades:

At locations where the Drawings do not indicate proposed sidewalk grades, the grades shall be discussed with the Engineer prior to work, in order to address existing and proposed drainage concerns. The Contractor shall be responsible for ensuring that all new sidewalks areas are graded to drain, either to existing structures, or new structures.

Pedestrian ramps and sidewalks shall be installed in strict conformance with the layout and grades shown on the Drawings, current Americans with Disabilities Act (ADA) and Massachusetts Architectural Access Board (AAB) regulations; and the applicable MassDOT details.

The Contractor shall establish grade elevations at all pedestrian ramp and sidewalk locations, and shall set transition lengths according to the tables which are included on the Drawings. The Contractor shall use a digital "Smart Level" to check all sub-base grades for compliance prior to installation of concrete. The Contractor shall not proceed with concrete installation on a sidewalk or ramp that is out of compliance without first contacting the Engineer.

At all pedestrian ramps and driveways, joints and transition sections which define grade changes shall be formed, staked and checked prior to placing cement concrete. All grade changes are to be made at joints. At driveways, a joint shall be located between the sloping portion of the driveway (15% maximum slope), and the level area where pedestrians will cross the driveway (1.5% maximum cross slope).

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The broomed finish on pedestrian ramps shall be perpendicular to the direction of the slope.

Installation of the cast-in-place detectable warning tiles shall be in accordance to the manufacturer's instructions.

Coordination with Item 32900.01 and 32900.02 (Public Art Coordination and Bronze Casting Installation):

It shall be the responsibility of the Contractor to coordinate concrete sidewalk construction with the installation or bronze castings under these items. A minimum of 4-inches of concrete is required beneath all bronze casting installations.

The Contractor shall coordinate with the Artist and Engineer on this issue as specified in Item 900.01, prior to beginning any related sidewalk work.

COMPENSATION

Sidewalk, driveways, and pedestrian ramps will be measured for payment as specified in Section 701 of the MassDOT Standard Specifications, and the following:

Payment for work under these items shall be at the applicable contract unit prices and shall include full compensation for sawcutting, excavation of existing sidewalks of all types, disposal of construction debris (existing sidewalk, concrete, brick, asphalt, etc.), preparation of sub-base, raising of water corporation stop boxes and drain manholes within limits of sidewalk, installation of "Don't Dump" placards, furnishing and placing cement concrete as indicated, furnishing and installing detectable warning tiles, expansion joints and sealant, concrete sealant, sawcutting concrete sidewalk as per the patterns shown on the Drawings, removal and transport of signs and salvageable trash and recycling receptacles, removal and disposal of sign posts and non-salvageable trash and recycling receptacles, and any other incidentals necessary for the satisfactory completion of this work as specified.

The Engineer reserves the right to extend any sidewalk limit of work shown on the plans up to an additional fifteen (15) feet, in order to connect to an existing ADA-compliant sidewalk. The Contractor will be compensated at the appropriate contract unit price for such increased quantities.

NOTES ON EXCLUSIONS:

Disposal of any excavated soil is not included for payment under this item and shall be paid for separately. Changes necessitated to private property due to changes in grade of the sidewalk are not included for payment under this item and shall be paid for separately under the appropriate items; for example: asphalt driveways, granite curb, fencing.

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DESCRIPTION:

The work of this Item consists of furnishing and installing a field of new pre-cast concrete pavers at the raised intersection locations shown on the Drawings and as specified herein.

MATERIALS:

All unit pavers shall meet ASTM C 936, 8,000 pounds per square inch minimum compressive strength and 5 percent maximum water absorption rate when tested in accordance with ASTM C 140, with no individual stone testing more than 7 percent.

Materials used to manufacture the concrete pavers shall conform to the following:

1. Cement: ASTM C150, Portland Cement, Type I.
2. Aggregates: ASTM C 33 (washed, graded sand and natural aggregates, no expanded shale or lightweight aggregates).
3. Admixtures shall be added to mix to reduce efflorescence of pavers.

Provide five (5) year labor and materials warranty.

Surface sealant shall be Paver Seal - SB, a non-yellowing, non-tacky acrylic co-polymer sealant manufactured by Addiment, Inc., Atlanta, GA, 30362, or approved equal.

Concrete pavers used on raised cross intersections shall be Optiloc hydraulically precast concrete pavers, manufactured by Unilock Inc. 35 Commerce Drive, Uxbridge, MA 01569, telephone (508)278-4536; or approved equivalent product.

1. Pavers size shall be 10-1/4" x 10-1/4" (L-shape)
2. Paver thickness on asphalt base shall be 3-1/8"
3. Pavers shall have a minimum compressive strength of 60 MPa.
4. Water absorption shall be 5 percent or less.
5. Finish of pavers shall be Standard.
6. Colors shall be Rustic Red.

CONSTRUCTION METHODS:

The final grade of the raised paver area shall be as shown on the Drawings. Granite curbing shall be placed as shown on the Drawings and Details to act as a restraining edge for the pavers. The top of the granite curb shall be flush with the adjacent roadway and paver finished grade on either side. An expansion joint shall be placed between the granite curb and the concrete pavers (see Item 32701 for expansion joint requirements).

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Hot mix asphalt pavement material shall be placed which conforms to the details shown on the Drawings for Raised Crosswalks and Intersections.

Bedding Sand:

Sand shall conform to the grading requirement of ASTM C33. Mason sand or stone dust shall not be used due to the high amount of material passing the #200 sieve. The sand shall be screeded to an even thickness of 3/4" over the hot mix asphalt surface.

Pavers Installation:

The patterns shall be 90 degree herringbone patterns with a Boston Colonial Paver Border. Prior to border installation a straight line shall be established in the pavement with a wet saw, and a granite curb shall be installed with top flush to the proposed finish roadway grade, to act as a restraint for the pavers.

Once the pavers are placed in their specified patterns, they shall be compacted into the bedding sand with a plate compactor. The compactor shall have a minimum force of 5000 lb. and a frequency of 75 to 90 cycles per second.

After the pavers are compacted, sand shall be swept and vibrated into the joints until they are full.

COMPENSATION:

Concrete pavers on hot mix asphalt surface will be measured by the square yard, complete in place.

Payment for this Item will be per square yard and shall include bedding sand, concrete pavers and any other incidentals to complete the work. Casting adjustment will be paid for under the appropriate items of the Contract. Hot mix asphalt base will be paid for under Item 32472. Granite curb for paver restraint will be paid for under Item 32504.

32706.9	BRICK WALK ON 4" HMA BASE	SQUARE YARD
32706.91	BRICK WALK ON 6" HMA BASE	SQUARE YARD

DESCRIPTION:

Work to be done under these items shall conform to the relevant provisions of Sections 440, 460 and 700 of the MassDOT Standard Specifications and the following:

The work of these items includes installation of clay brick sidewalks on a treated sand-asphalt setting bed over an HMA base with a gravel borrow subbase. The work also

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includes the installation of steel edging where the brick abuts a mulch tree pit or other non-rigid edge.

Submittals for the work of these items shall include product data and test results certifying compliance with specified standards and actual samples of the bricks of the shape, pattern, and color specified.

MATERIALS:

Brick

All brick shall be wire-cut. Wire cut brick shall be a full dimension paver conforming to the quality standards, size and color range of: "Pathway Full Range" brick paver as manufactured by Pine Hall Brick, Winston-Salem, NC or an equal approved by the Engineer. Size shall be 4"W by 8"L by 2 1/4 "D.

The brick shall be clay brick, uniform in size and evenly burned, and when broken shall show a dense structure free from lime, air pockets, cracks and lamination. Laminated bricks will not be accepted.

The bricks shall be for exterior paving and shall meet the requirements of ASTM C-902-Class SX Type I, Application PS with average water absorption of not more than 5% with the five hour boil and an average compressive strength of 8,000 PSI or more. Brick shall pass a minimum of 100 freeze thaw cycles.

Sand-Asphalt Setting Bed

Asphalt cement shall conform to ASTM D 946, penetration grade 85-100. Sand shall be clean, hard sand with durable particles uniformly graded from coarse to fine and all passing the No. 4 sieve and conforming to ASTM C 144. The asphalt cement and sand shall be mixed at an asphalt plant in the proportion of seven percent (7%) asphalt and 93% sand. The mix shall be heated to 300 degrees F.

Mastic Adhesive

Adhesive shall consist of two percent (2%) neoprene (grade WM1) oxidized asphalt with 155 degrees F softening point (80 penetration) and ten percent (10%) asbestos-free fibers and 88% asphalt.

Sand-Cement Joint Filler

Joint fillet for butt-jointed brick shall be composed of a dry sand-cement mix at a ratio of 4:1. Mix shall be kept dry until application is completed and surface excess is swept clean.

Sand shall be a clean, washed uniformly well-graded masonry sand conforming to the requirements of ASTM C-144-70 with the further requirements that the fineness modulus shall be maintained at 2.25 plus/minus 0.10. Sand shall be from a single source meeting these requirements and as approved by the Engineer after laboratory test. Source of

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supply shall not be changed during the course of the job without written consent of the Engineer.

Portland Cement shall conform to the requirements of AASHTO M85.

Metal Paving Iron edge

Metal Paving Edge: Provide at tree pits and continuously at locations where paving does not abut a hard edge and as directed by the Engineer and as shown on the drawings. . Steel edging to continue at 90 degree angle for minimum distance of 18” on one side around the corner at concrete pavement condition to insure adequate tie-in condition to prevent edge from moving upward and creating a trip hazard or maintenance hazard.

Specifications shall be as follow: Height: 4", Flange: 1.75", Lengths: 6'0" or 8' 0", Thickness: 3/16” Material: Galvanized steel.

Spikes: 15" stakes every 12".

Iron Edge Specification: Galvanized steel paver restraint. Sections are to be L-shaped galvanized. Sections are to be notched to provide for smooth curves and crisp angles. Spikes are to be galvanized spiral not less than 15” in length

Iron Edge to be supplied by Border Concepts, Inc., P. O. Box 471185, Charlotte, NC 28241, Telephone numbers: 1-800-845-3343 or 1-704-541-5509, Fax Number: 1-704-541-5610 or approved equal.

Preformed Expansion Joint Filler:

The preformed expansion material shall conform to ASTM D-1752. The preformed expansion joint filler material data and installation directions shall be submitted to the Engineer for review and approval.

Sealant:

The sealant shall be a polyurethane-based, one component, elastomeric sealant complying with Federal Spec. TT-S-00230C, Class A Type 1 for horizontal use and Type 2 for vertical use.. Sealants shall be self-leveling pour grade type for horizontal use and non-sag grade type for vertical use. Color shall match the color of the adjacent materials as approved by the Engineer. Sealant material data and installation directions shall be submitted to the Engineer for review and approval. Application of sealant for site improvements shall be in accordance with approved manufacturers’ recommendations.

CONSTRUCTION METHODS:

Excavation and Subgrade Preparation

These items shall include excavation and disposal of the existing material and the fine grading and compaction of the sub-base prior to placement of HMA base. A jack hammer

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or saw cut shall be used at the beginning of each excavation and at all “back-of-sidewalk” limits in order to avoid damage to abutting properties and features which are to remain.

If the existing material is unsuitable or more material is needed for sub-base, additional material shall be installed and paid for under Item 2210.5 Imported Gravel Sub-Base as directed by the Engineer. If the existing material is brick, the City reserves the right to direct the Contractor to deliver the bricks to a specified site within the City at no additional cost. No existing brick shall be reused in the performance of these items.

In areas where sidewalks are to be constructed in present roadway areas, the full depth of existing pavement shall be completely removed. Excavation of existing hot mix asphalt, brick and concrete pavements as required for the work of this section is included under these items.

Where new sidewalk abuts existing-to-remain sidewalk, the limit of work shall be established at the existing nearest existing contraction or expansion joint, where a neat sawcut shall be provided.

The Contractor shall exercise special care when excavating near trees. When major roots are in the way, the Contractor shall go under or between them. In no case shall the Contractor disturb the root structure of the trees without direction from the City Arborist. Exposed roots shall be covered promptly. Excavation of all tree wells shall be done entirely by hand.

All existing traffic signs, trash and recycling receptacles within the limit of work and deemed salvageable by the Engineer shall be removed and delivered to the Cambridge Traffic Department or Cambridge Department of Public Works as directed by the Engineer. All existing sign posts shall be removed and properly disposed of by the Contractor. All trash and recycling receptacles deemed unsalvageable by the Engineer shall be removed and properly disposed of by the Contractor. This work shall be incidental to the various sidewalk items.

New traffic and street name sign posts, including new bases, shall be installed and paid for under Items 32847.1 and 32874. The work shall be sequenced such that regulatory sign messages shall be continuously maintained throughout construction.

The sub-base shall be prepared at the appropriate elevation for the depth of sidewalk to be installed. The sub-base shall be graded to follow the proposed sidewalk elevations shown on the Drawings. At locations where no proposed grades are indicated, the sub-base shall be graded to allow for sidewalks to be sloped from the City right of way towards the street at 1/8 inch to the foot, or as directed by the Engineer.

The Contractor shall raise all water curb stop boxes to final grade and coordinate raising of other public and private utility boxes prior to placing HMA base. The Contractor shall remove material from curb stop boxes with compressed air, after raising is complete and

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prior to pouring of concrete. Prior to placing HMA base, the Contractor shall go over locations where curb boxes have been raised with the Engineer.

Proper subgrade compaction shall be obtained by means of plate-type mechanical compactors. The material shall be compacted to ninety-five percent (95%) of the maximum dry density at optimum moisture content as determined by the AASHTO Standard Method of Test T99 Method C.

HMA Base and Setting Bed Placement

The HMA base shall be placed in accordance with the applicable requirements of Section 400 of the MassDOT Standard Specifications.

Asphalt prime coat and sand-asphalt setting bed shall be applied only when the base material is thoroughly dry and weather conditions will allow application of these materials and brick paving before adverse temperature drops to 35 degrees F or precipitation of any type may occur. Contractor shall schedule application of these materials when temperature drops or precipitation are not expected for 48 hours. Forecasts shall be based upon National Weather Service (NOAA website: www.noaa.gov). Contractor shall provide a printout of forecasted weather to the Engineer for approval prior to application of these materials.

Apply prime coat of emulsified asphalt to HMA base.

In the placement of the sand-asphalt setting bed over the surface of the HMA base, $\frac{3}{4}$ inch deep solid steel depth control bars shall be placed directly over the base. If grades must be adjusted, set wood chocks under depth control bars to proper grade. Depth control bars greater than $\frac{3}{4}$ inch deep may be used in these areas. Set bars parallel to each other to serve as guides for the striking board. The depth control bars shall not be set carefully to bring the bricks, when laid, to proper grade.

Place sand-asphalt bed between the parallel depth control bars. Pull this bed with the striking board over these bars several times. After each passage, low porous spots shall be showered with fresh sand-asphalt material to produce a smooth, firm, and even setting bed. As soon as this initial panel is completed, advance the first bar to the next position in readiness for striking the next panel. Carefully fill depressions that remain after removing the depth control bars and wood checks.

The setting bed shall be rolled with a power roller to a nominal depth of $\frac{3}{4}$ inch while still hot. This thickness shall be adjusted so that when the bricks are placed and compacted, the top surface of the bricks will be at the required finished grade.

Brick Installation

A coating of mastic adhesive shall be applied by mopping, squeezing, or trowelling over the top surface of the setting bed so as to provide a bond under the bricks. If it is trowelled, the trowel shall be serrated with serration not to exceed 1/16 inch.

A wet saw is required for cutting of bricks and filling in pieces where needed. No other method will be acceptable.

Once the bricks are placed in their specified patterns, they shall be compacted with a plate compactor. The compactor shall have a minimum force of 5000 lbs. and a frequency of 75 to 90 cycles per second. All utility castings and other protrusions shall be absolutely flush with the brick upon completion of compaction.

Work shall proceed within an area only when that area can be completed within the work period. Secure all loose materials and provide temporary accessible edges of partially completed areas of brick that will be accessible to the public.

Newly laid bricks shall be protected at all times by panels of plywood. These may be advanced as work progresses; however, the plywood protection shall be left in areas that will be subjected to continued movement of materials and equipment. All necessary precautions shall be taken in order to avoid depressions and protect brick alignment.

After the brick pavers are in place, when the brick is thoroughly dry, apply dry sand/cement and sweep into the joint voids around the bricks. Re-apply a minimum of three times until all the voids are filled and sweep away all extraneous material.

Prior to acceptance, the brick paved area shall be flooded with water to assure that there are no depressions. Remove and reset bricks as required until surface is true to line and grade. Refill stone dust joints as necessary until all joints are filled to finish grade.

“Don’t Dump” Placards:

The work of this Section shall also include the installation of Cast Iron or Steel “Don’t Dump” placards, where new sidewalks abut existing or proposed catch basins and inlets. The placards will be furnished by the City at no cost to the Contractor, for installation by the Contractor.

COMPENSATION:

Brick walk will be measured by the square yard, complete in place.

Payment for work under these items shall be at the contract unit price per square yard and shall include full compensation for sawcutting, excavation, (including removal of existing pavement in present roadway areas), disposal of construction debris (existing sidewalk, concrete, brick, asphalt, etc.), preparation of subbase, raising of water corporation stop boxes, hot mix asphalt, new bricks, iron edge, expansion joints and sealant, installation of “Don’t Dump” placards, labor, tools, equipment, and any other incidentals necessary for the satisfactory completion of this work as specified.

All existing traffic signs, trash and recycling receptacles within the limit of work and deemed salvageable by the Engineer shall be removed and delivered to the Cambridge Traffic Department and Cambridge Department of Public Works. All existing sign posts

ROADWAY AND STREETSCAPE CONSTRUCTION

shall be removed and properly disposed of by the Contractor. All trash and recycling receptacles deemed unsalvageable by the Engineer shall be removed and properly disposed of by the Contractor. This work shall be incidental to the various brick sidewalk items.

The Engineer reserves the right to extend any sidewalk limit of work shown on the plans up to an additional fifteen (15) feet, in order to connect to an existing ADA-compliant sidewalk. The Contractor will be compensated at the appropriate contract unit price for such increased quantities.

NOTES ON EXCLUSIONS:

Disposal of any excavated soil is not included for payment under this item and shall be paid for separately. Changes necessitated to private property due to changes in grade of the sidewalk are not included for payment under this item and shall be paid for separately under the appropriate items; for example: asphalt driveways, granite curb, fencing.

32655.2	ORNAMENTAL HANDRAIL	FOOT
32707.11	CUSTOM WOOD BENCH	EACH
32707.21	TRASH COMPACTOR	EACH
32707.22	TRASH/RECYCLING COMBINATION	EACH
32707.9	BICYCLE RING AND POST	EACH

DESCRIPTION:

This section specifies requirements for miscellaneous site furniture, as shown on the Drawings and as specified herein:

Submittals:

Product Data: For bicycle ring and post, trash compactor and trash/recycling combination, provide manufacturers' product data showing installation and limitations in use. Include construction details, material descriptions, dimensions of individual components and profiles, finishes, field-assembly requirements, and installation details and maintenance data. Supply Certificates of Compliance for all materials required for fabrication and installation.

1. Include Product Data for grout, silicone sealant, anchoring cement and anchoring attachment.

ROADWAY AND STREETScape CONSTRUCTION

Shop Drawings: submit shop drawings of the ornamental handrail and custom wood bench. Shop drawings shall indicate size, dimensions, materials, finish, connections, foundations and anchorage, and all other items required for complete installation. All measurements shall be field verified. Shop drawings to be reviewed and stamped by structural Engineer registered in Commonwealth of Massachusetts.

Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of at least five similar completed projects with project names and addresses, names and addresses of Owner's Representatives and owners, and other information specified.

Welding Certificates: Submit copies of certificates for welding procedures and personnel.

Quality Assurance

Installation of all Site Furnishings shall be done only after excavation and construction work which might damage them has been completed.

Damage caused during installation shall be repaired and /or replaced prior to acceptance and at the Contractors cost.

Existing paving areas shall, if damaged or removed during the course of this work, shall be repaired or replaced per the specifications. Workmanship and materials for such repairs and replacement, except as otherwise noted, shall match as closely as possible those employed in existing work.

Site Furnishings shall be installed in a workmanlike manner.

Fabricator Qualifications: A firm experienced in producing fabrications similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

Coordination

The Contractor shall be responsible for coordinating the installation of anchorages for site furnishings. This shall include obtaining manufacturer setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete. All such items shall be delivered to project site in time for installation.

Warranty

Provide manufacturer's standard written warranty for each item specified.

Acceptance Criteria:

Work must meet the requirements of this Specification and the details indicated on the Drawings.

ROADWAY AND STREETSCAPE CONSTRUCTION

Products or materials delivered to the project site which are damaged or otherwise fail to meet the requirements of this section will upon notice to the Contractor be rejected and shall be removed from the Project Site and replaced with acceptable products within accordance with the Contract Documents.

Products or materials installed which are damaged or otherwise fail to meet the requirements of this section will upon notice to the Contractor be rejected and shall be removed from the Project Site and replaced with acceptable products in accordance with the Contract Documents.

MATERIALS:

Ornamental Handrail

Steel shapes, plates and bars: ASTM A36

Finish:

Paint Finish System

Custom Wood Bench

Wood: Clear ipe heartwood, as available from www.certifiedwood.com or equal. Wood shall be Forest Stewardship Council certified, Washington, DC, www.fsc.org, and submittals shall include chain-of-custody paperwork and certification numbers. Wood shall be true to shape, smooth 4 sides, and free of splinters, cracks and splits. Edges shall be eased as indicated,. Predrill all openings for attachments. Supplier of custom bench to be: Landscape Forms www.landscapeforms.com, or approved equal.

Wood Fasteners:

Furnished by Fabricator and reviewed for approval by Engineer.

Wood to Metal Connections:

Shop drill holes through steel and wood to accommodate fasteners.

Wood Finish:

Penofin – Hardwood formula. 99% ultraviolet protection. 2 coats. First coat – soaked. Second coat – rag wipe

Wood Bench supports, spacers, attachment and anchoring components:

1. Steel shapes, plates and bars: AISI grade 304L Stainless Steel
2. Finish: Omnidirectional DA finish. Finish grit sand paper: 80 grit. Final DA finish with Scotchbrite. Passivate after finishing.

Hardware: AISI grade 304L Stainless Steel.

Nylon spacers, sleeves or pads: provide between dissimilar metals to separate from direct contact.

Metal Finish and Color: Polyester Powdercoat /Black.

In-ground Fasteners: Stainless Steel 304L.

Trash Compactor and Trash/Recycling Combination:

Shall be Big Belly Solar Trash Compactor, and Big Belly Single Stream Recycling Compactor as manufactured by BigBelly Solar, 50 Brook Road, Needham MA, phone 888/820-0300, or approved equivalent product. Color shall be black, as approved by the Engineer. Volume of each unit (trash and recycling) shall be 32 gallons. City of Cambridge Standard.

Bicycle Ring and Post

Shall be "Bike Hitch" model as manufactured by DERO Bike Racks or approved equivalent product. Centerbeam shall be 2" schedule 40 pipe (2.375" OD) and the ring shall be 1.5" OD, 11 gauge tube with an outside diameter of 16.5". Finish shall be hot dip galvanized. All attachment hardware shall be hot dip galvanized. City of Cambridge Standard.

Miscellaneous Metal Materials

Welding Electrodes and Filler Metal: Type and alloy of filler metal and electrodes as recommended by producer of metal to be welded, complying with applicable AWS specifications, and for color match, strength, and compatibility in fabricated items.

Fasteners:

Use fasteners of same basic metal as fastened metal, unless otherwise indicated. Do not use metals that are corrosive or incompatible with materials joined.

Dissimilar Metals:

When dissimilar metals abut one another, use neoprene washers or sleeves to create a separation between the surfaces.

Metal Fabrication

Form metalwork to required shapes and sizes, lines and angles. Provide components in sizes and profiles indicated, but not less than required to comply with requirements indicated for structural purposes.

Drill and tap for required fasteners, unless otherwise indicated. Use concealed fasteners wherever possible.

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Mill joints to a tight, hairline fit. Cope or miter corner joints. Form joints exposed to weather to exclude water penetration.

Remove mill scale, dirt, grease and other foreign matter prior to welding. Protect adjacent surfaces from damage due to weld sparks, spatter or tramp metal.

Comply with AWS for recommended practices in shop welding and brazing. Clamp members and alternate welds to prevent warping or misalignment. Provide welds and brazes behind finished surfaces without distortion or discoloration or exposed side. Fully weld continuously and ground flush and smooth connections in a uniform manner.

Clean exposed, welded and brazed joints of flux and dress exposed and contact surfaces.

Chip out and replace welding showing cracks, slag inclusion, lack of fusion, bad undercut and other defects ascertained by visual or other means of inspection.

Provide castings that are sound and free of warp, cracks, blow holes, or other defects that impair strength or appearance. Grind, wire brush, sandblast, and buff castings to remove seams, gatemarks, casting flash, and other casting marks unless part of the intended finish.

Finish exposed surfaces to smooth, sharp, well-defined lines and arrises.

Assemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.

Finishes - General

Comply with MAAMM "Metal Finishes Manual" for recommendations relative to applying and designating finishes.

Protect mechanical finishes on exposed surfaces from damage by applying a strippable temporary covering prior to shipment.

Stainless Steel Finishes

Finish designations with AISI conform with the system established by the American Iron and Steel Institute for designating finishes for stainless steel sheet.

Remove or blend tool and die marks and stretch lines into finish.

Fasteners And Hardware - General

Fasteners and hardware shall be that which is furnished by the manufacturer. If additional hardware is required, it shall comply to the following:

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Fasteners and metal components shall be stainless steel AISI 304L.

Expansion Bolts shall be a minimum of 0.5inch diameter with minimum 3 inches embedment into concrete.

Structural Bolts shall be ASTM A325 for structural bolts, steel, heat treated, 120/105 ksi minimum tensile strength.

Paint Finish System

Paint finish for ferrous metal surfaces consisting of: Custom Wood Bench and spacers and Ornamental Handrail

High Performance Paint Coatings: Provide products of one of the following manufacturers that meet or exceed specified requirements:

1. DuPont.
2. Porter International (Porter).
3. Tnemec Company, Inc. (Tnemec).

Materials used shall be best grade products of their respective kinds. The Painting Schedule is based on products the above named manufacturers. These are specified to establish a standard of quality and kind of material desired. Provide these products, or equals as approved by the Engineer.

Note:

If substitutes are proposed, submit complete schedule showing materials specified and equivalent materials proposed as substitutes. Provide complete manufacturer's product data on proposed materials. Substitutes must be approved by the Engineer before commitment for materials is made.

The following finish system refers to produces of Tnemec Company, unless otherwise indicated. Provide these systems or comparable systems from specified manufacturers.

Non-shrink epoxy grout

Shall be Five Star Epoxy Grout as manufactured by Five Star Products, Fairfield, CT; Sika Corp. Lyndhurst, NJ or Fosroc-Preco Industries Ltd, Plainview, NJ.

Sealant

Shall be a polyurethane-based, one component, elastomeric sealant complying with Federal Spec. TT-S-00230C, Class A Type 1 for horizontal use and Type 2 for vertical use. Color shall match the color of the adjacent materials as approved by the Engineer. Sealants shall be self-leveling pour grade type for horizontal use and non-sag grade type for vertical use. Application of sealant for site improvements shall be in accordance with approved manufacturers' recommendations.

For horizontal use:

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1. Vulkem 45, as manufactured by Mameko International, Cleveland, Ohio
2. Urexpan NR-201, as manufactured by Pecora Corporation and supplied by Waldo Bros., Boston, MA
3. PRC-6006, as manufactured by Products Research and Chemical Corporation, Gloucester City, NJ.

For vertical use:

1. Vulkem 45, as manufactured by Mameko International, Cleveland, Ohio
2. Sikaflex 1-A, as manufactured by Sika Corp., East Hartford, CT
3. Dynatrol 1, as manufactured by Pecora Corporation, Philadelphia, PA.

Concrete for foundations

Shall be 4000 psi 28 day compressive strength with ¾" aggregate in compliance with requirements of Section 900 of the MassDOT Standard Specifications.

Reinforcing steel

Shall have a recycled content of 30% or greater and shall conform to the following standards;

1. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.
2. Low-Alloy Steel Reinforcing Bars: ASTM A 706/A 706M, deformed.
3. Plain-Steel Wire: ASTM A 82, as drawn.
4. Plain Steel Welded Wire Fabric: ASTM A185, fabricated from as-drawn steel wire into flat sheets.
5. Reinforcing shall be uncoated unless indicated otherwise on the Contract Drawings.

CONSTRUCTION METHODS:

Installation, General

Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal fabrications to in-place construction. Include threaded fasteners for concrete inserts, through-bolts, and other connectors. Manufacturer-provided hardware shall be used in all cases where it is furnished.

Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing site furnishing. Set site furnishings accurately in location, alignment, and elevation, measured from established lines and levels and free from rack.

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1. Do not weld, cut, or abrade surfaces of components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.

Provide temporary bracing or anchors in formwork for items that are to be built into concrete or similar construction.

Corrosion Protection: Coat concealed surfaces of metal that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint.

Site furnishings shall be erected as indicated on the Drawings, plumb, level, snug, and free from rocking. Make necessary shimming and final adjustments.

1. Shims shall be stainless steel sized so that they do not protrude beyond the base of the item so as to be visible in completed installation.

Protect furnishings from paint splatter, splashed concrete and other construction damage by wrapping and taping in place plastic sheeting or heavy kraft paper around all site furnishings until adjacent work is completed. Repair any damage to finish in a manner consistent with manufacturer's recommendations.

Bicycle Ring and Post, Trash Compactor and Trash/Recycling Combination

Coordinate and furnish anchorages and setting drawings, diagrams, templates, instructions and directions for installing items having integral anchors that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to the site.

Provide concrete foundations and install at proper elevation to allow paving to be installed over foundations. Install in accordance with manufacturer's recommendations and shown on Drawings. Grout anchorages and seal joint at pavement surface. Install plumb.

Items shall be located as indicated on the Drawings.

Items shall be positioned in the required location and firmly secured to the pavement in accordance with manufacturer's recommendations.

Ornamental Handrail and Custom Wood Bench

Shop fabricate wood components with openings and attachments to minimize cutting, drilling and other field adjustments.

Perform cutting, drilling and fitting to install site metalwork. Set products accurately in location, alignment, and elevation, plumb, level, and true, measured from established lines and levels. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

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Fit exposed connections accurately together to form tight, hairline joints or, where indicated, with uniform reveals and spaces for sealants and joint fillers. Where cutting, welding and grinding are required for proper shop fitting and jointing of site metal items, restore finishes to eliminate evidence of corrective work.

Do not cut or abrade finishes that cannot be completely restored in the field. Return items with such finishes to the shop for required alterations, followed by complete refinishing, or provide new units.

Provide concrete foundations and maintenance strips, anchorage devices and fasteners for securing site furnishings items in place.
Install concealed gaskets, joint filler, insulation, and flashings as work progresses.

Restore protective coverings that have been damaged during shipment or installation. Remove protective coverings only when there is no possibility of damage from other work yet to be performed at the same location.

Retain protective coverings intact and remove simultaneously from similarly finished items to preclude non-uniform oxidation and discoloration.

Field Welding: Provide in accordance with Fabricator's recommendations. Field welds heli-arc only. Weld size: exposed architectural application. No grinding required. Weld should reflect smooth even finish. Fillet shall be no more than 1/8". Specified length of weld shall be longer than target zone on bollards. Weld seam shall be wired brushed with stainless steel brush after completion of weld.

Protection

Fabricator to wrap all components with protective wrap prior to leaving Fabricator's shop.

Protect finishes from damage during construction period with temporary protective coverings. Remove protective covering at the time of Substantial Completion.

Restore finishes damaged during installation and construction so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit; or provide new units.

Adjusting and Cleaning

Clean surfaces by washing thoroughly with clean water and soap followed by thorough rinsing with clean water.

Touch-Up Painting for Shop Painted Surfaces: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up

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shop-painted surfaces. Apply by brush or spray to provide a minimum 2.0 mil (*0.05-mm) dry film thickness.

COMPENSATION:

The items of this subsection will be measured per each or per foot as specified, installed complete-in-place including excavation, surface mounting appurtenances, pipe, hardware, concrete, reinforcement, concrete slab and footings, blocking, solid surfacing, cleaning and touch-up painting, protecting the items from damage, and cutting and patching required to complete the installation as indicated and specified.

32708	6 INCH GRANITE PLANTER CURB	LINEAR FOOT
32709.1	GRANITE STAIRS	SQUARE FOOT
32709.11	GRANITE RETAINING WALL NO. 1	LUMP SUM

DESCRIPTION

This work under these items shall include the furnishing and installation of granite stairs and granite retaining walls as detailed on the Drawings and as directed by the Engineer. The work shall consist of granite stairs and walls, with grouted joints on concrete foundations in accordance with these specifications and in close conformity with the lines and grades established by the Engineer.

Submittals

Product Data: Submit manufacturer's specifications and installation instructions for:

1. Granite Samples including granite types and finishes.
2. Anchorages.
3. Mortar materials

Shop Drawings: Submit

1. Layout and detailing of granite indicating sizes, dimensions, layout, finishes joint locations and types, concrete foundations and relationship to adjacent items. Drawings to show interface of granite components with concrete foundations including elevation changes in top of concrete and bottom of granite.
2. Prepare drawings based on field verified dimensions.

Samples: submit prior to mock-up erection:

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1. Mortar: color samples of each type of mortar for setting bed and pointing in - 6 inch long by 1/2 inch wide samples strips of mortar set in aluminum or plastic channels.

MATERIALS

Site Granite

Site Granite shall be Deere Isle Granite supplied by www.swensongranite.com or approved equal. tel. 603.225.4322 fax 603.228.2915.

Site Granite Mortar

Setting bed mortar mix for site granite:

1. Cement: conform to ASTM C 150, Type I, complying with the staining requirements of ASTM C 91 for not more than 0.03% water soluble alkali. Furnish Type I, except Type III may be used for setting granite in cold weather.
2. Hydrated Lime: ASTM C 207, Type S.
3. Mortar aggregate: complying with ASTM C144, well graded, except for very thin joints (less than 1/8 inch) use gradation with 100% passing No. 16 sieve.
4. No calcium chloride or admixtures containing calcium chloride shall be used.
5. Mortar Proportions:
 - A. 1 part white Portland cement, 3/4 part lime, 4-3/4 to 5-1/4 parts bulked sand.

Grout for anchors

Grout for anchors: comply with ASTM C476 and with consistency appropriate to conditions so grout will completely fill spaces intended to receive grout. Grout shall be quality controlled hydraulic cement, quick setting, non-metallic grout.

Portland Cement Concrete Foundation

Portland cement paving mixes: Design mix to be Class D, Type 11, 4,000 PSI according to the classification defined complying with requirements of Section 901 and M4 of Standard Specifications. 4,000 psi compressive strength at 28 days, 3/4 aggregate, 660 pounds per cubic yard cement content for course aggregate and 5% to 7% air-entrained with 2" to 4" maximum slump.

CONSTRUCTION METHODS

Preparation

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Coordinate layout and installation of site granite with concrete foundations, layout and installation of adjacent paving, other site improvements and building to ensure proper alignments.

Make corrections to subgrade and aggregate base course to proper sections and elevations.

Concrete Foundation Installation

Formwork: Set forms accurately to maintain specified tolerances. Remove loose material and clean forms immediately before concrete placement.

Reinforcing: provide reinforcing as required. Provide reinforcing in longest practical lengths. Unroll wire mesh for reinforcement flat before placing in concrete. Minimum concrete covering of 2" over wire mesh and reinforcing bars. Secure reinforcing against displacement during concrete placement.

Granite Installation

General Installation Requirements: comply with quarry/ fabricator's instruction and recommendations and instructions and recommendations of setting materials manufacturers, except where more restrictive requirements are specified in this section. If crane is required for installation of wall pieces, etc., cost shall be at contractor's expense.

Anchors:

Securely fix in place supporting anchors and inserts and other items

Set stonework:

1. Clean stone before setting by thorough scrubbing clean water and Tampico fiber brushes only.
2. Do not use granite with chips, cracks, voids, stains and other defects visible in finished work and structurally impair stone.
3. Set stone in strict compliance with approved Shop Drawings. Provide anchors, supports, fasteners and attachments. Shim and adjust stone true to lines and grades with accurately aligned joints of uniform width. Unless indicated otherwise, joints shall be 3/8 inch wide. Direct bearing contact between granite pieces shall be prohibited.
4. Follow manufacturer's instructions for mixing and applying mortar, pigment, grout and polymer additive according to manufacturer's instructions.
5. Set stone in full mortar or grout bed with setting buttons to prevent extrusion of mortar or grout and to control joint width. Before setting, back of granite pieces to be dampened and receive slurry of mortar or grout to ensure maximum contact with mortar or grout bed. Carefully bed pieces in full bed of mortar or grout and tap with rawhide mallet to full

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- and solid bearing. Exercise particular care to equalize bed and joint openings and eliminate need for redressing of exposed surfaces.
6. Keep exposed surfaces free from mortar and grout. Immediately remove mortar and grout smears with clean sponge and clean water before polymer modified mortar or grout sets.
 7. Before joints and setting beds set, rake out joints 3/8 inch deep to allow space for pointing mortar, grout, sealant and backer rod. Pointing of raked out stone joints shall be continuous operation in order to assure a consistent color for entire job. Point stone joints by placing pointing mortar and grout in three layers with each of first and second layers filling approximately two thirds of joint depth and third layer remaining one third. Fully compact each layer and allow becoming thumbprint hard before applying next layer. Tool joints with a 1/2 inch round tool to produce a glassy hard concave joint free from drying cracks. During tooling of joints, enlarge voids or holes and completely fill with pointing mortar. No pointing shall be done in freezing weather nor in locations exposed to hot sun, unless properly protected.
 8. Anchor stones to supporting construction with specified anchors, grouted and shimmed to maintain proper stone position and alignment.
 9. Provide caulked joints wherever granite abuts dissimilar material and at locations noted in drawings and approved by Engineer. Extend joint filler full depth of joint and allow 1/2 inch minimum space at top for insertion of backer rod and sealant. Protect top edge of joint filler with metal cap or other temporary protection. Remove protection per manufacturer's recommendations.

Repair, Cleaning and Protection

Remove and replace damaged work, providing new stone pieces to match as approved by Engineer. Make new joints to match so there is no evidence of replacement.

Clean exposed surfaces using clean water and soft Tampico brushes only, unless otherwise approved by Engineer. Do not change stone finish. Remove and replace work that cannot be successfully cleaned.

Provide temporary protection to ensure work being without damage or deterioration at time of final acceptance. Remove protections and reclean immediately before final inspection.

COMPENSATION

The items of this subsection will be measured per foot, square foot, or on a lump sum basis as indicated, complete-in place. Item 32708 6" Granite Planter Curb will be paid for at the contract unit price per foot. Item 32709.1, Granite Stairs will be paid for at the contract unit price per square foot. Item 32709.11 Granite Retaining Wall #1 will be paid

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for at the contract unit price Lump Sum which prices shall include full compensation for granite excavation, labor, equipment, materials, safe transportation including loading at storage site and unloading at site of installation, securing and installation on concrete foundations disposal of construction debris (existing sidewalk, concrete, asphalt, etc.), and other incidentals necessary for the satisfactory completion of this work as specified.

32709.2	SMALL NATURAL STONE BOULDER	EACH
32709.3	MEDIUM NATURAL STONE BOULDER	EACH
32709.4	LARGE NATURAL STONE BOULDER	EACH
32709.5	GRANITE SEATING STONE – TYPE A	EACH
32709.6	GRANITE SEATING STONE – TYPE B	EACH
32709.7	GRANITE SEATING STONE – TYPE C	EACH
32709.8	ROUNDED ROCK RIP RAP AT SHORELINE	(INCIDENTAL)

DESCRIPTION

The work under these items shall include the furnishing and installation of granite boulders and granite boulder seats, of various types and sizes, as detailed on the Drawings and as directed by the Engineer. Rounded riprap at shoreline is referenced in this specification section. For riprap related to the outfall infrastructure, refer to specification section 02271.

Submittals

Product information for source materials.

MATERIALS

Boulders

Provide select quality natural Cape Ann Granite boulders with character and lichen the quantities shown on the drawings. Supplier to be “Olde New England Granite, A Reed Corporation Company, contact Bradley Parker telephone 781.389.2157 for boulder selections or approved equivalent product and supplier.

Provide boulders in three sizes:

1. Small: up to 1.25 tons
2. Medium: 1.5 to 3 tons
3. Large: 3.5 to 5.0 tons

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See Plans for Boulder location and orientation. Boulders shall be selected by the Engineer and the City.

Crushed Stone for sub-base:

As detailed on Drawings and as specified elsewhere in the Contract Documents.

Granite Seating Stones

Granite Seating Stones are to be supplied by Old New England Granite (10 Kimball Lane-Rear, Lynfield, MA 01940; Tel 781-334-4805 fax 781-334-2362 Contact: Biz Reed) for granite seating stone selections, or approved equivalent product and supplier:

1. Type A: 24" x 24" x 27" length
2. Type B: 24" x 27" x 48" length
3. Type C: 24" x 27" x 72" length

See Plans for seating stone location and orientation. Seating stones shall be selected by the Engineer and the City.

Crushed Stone for sub-base:

As detailed on Drawings and as specified elsewhere in the Contract Documents.

Rounded Rock Rip Rap at Shoreline

Rip Rap Stone should be of a size and shape as shown on the Drawings and Details. The design intent is to minimize excess erosion caused by wave action from water craft. Exact material is to be determined by the Engineer through the submittal process and should be compatible with existing stone materials already existing along the river shoreline near the proposed area of work.

Materials to be used along the shore line in non-engineered areas will be planted with plant plugs. Rounded Rock Rip Rap shall be submitted by the Contractor for review and approval by the Engineer and the City.

CONSTRUCTION METHODS

Field Measurements

Verify dimensions and field measurements to ensure items are located and secured and function properly when installed. Submit details of proposed departures due to field conditions or other causes to the Engineer for approval.

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General Installation

Time delivery of site improvement items to minimize on-site storage time prior to installation. Protect stored materials from weather, careless handling, and vandalism. If crane is required for installation of boulders or seating elements, etc., cost shall be contractor's expense.

Boulders and Stone Seating Installation

Deliver, off-load and place boulders and stone seating in locations and orientations approved by the Engineer being careful not to scratch boulders.

Excavate locations as directed such that boulders and stone seating are set partially buried and appear "naturalistic." Boulders and stone seating shall be placed under the direction of the Engineer. Provide necessary equipment, chains and labor for picking stones, conveying them to their locations, shimming the stones to be at the intended heights and orientations. Stones shall be carefully picked up with chains. Stones shall be secured with wood blocking to keep chains and adjacent stones from scratching weathered surface of stones.

Purchase, load, secure, and deliver stones from the site of selection to the project site. Contractor shall notify the Engineer one month in advance of anticipated selection date and delivery date.

Install and secure rocks in place in an approved manner and as shown on drawings. Contractor shall anticipate the necessity for use of a crane and/or heavy machinery to lift and place stone.

No dumping of boulders and seating stones is permitted. Stones shall be carefully off-loaded by picking them up with chains and carefully placing stones to minimize scraping. Provide proper positive drainage around boulders and stone seating.

COMPENSATION

Boulders and stone seating elements will be measured by the unit each for each type, complete with incidentals. The unit bid price bid per each item shall constitute full compensation for furnishing and installing each item complete in place, including cleaning, protecting the items from damage, and cutting and patching required to complete the installation as indicated and specified.

Rounded rock rip-rap will not be measured for payment, and will be considered incidental to the work of Item 3411.3 Outfall.

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DESCRIPTION:

The work shall consist of furnishing and installing a pedestrian bus shelter at the locations shown the Plans or as directed by the Engineer.

MATERIALS:Shelter

Shelter shall have a nominal 2' x 12' footprint, nominal manufactured by Daytech, Type: BBC04X12N "Avanti" Dome Roof, or approved equivalent product.

The shelter shall be surface mounted on adjustable feet for leveling on a 12-inch reinforced concrete pad with thickened edges 18-inches around entire perimeter, with steel fasteners at ground and other key connections.

Shelter shall have aluminum extrusion framework with premium polyester powder coat finish in standard black.

Walls shall be tempered safety Glass, 3/8" thick clear, with fired-in 2-inch yellow safety dots. Wall panels shall be continuous over back of shelter and both 2' sides. The front of the shelter shall be open. The shelter will not have a wall ad/display panel.

The roof shall be an overhanging dome roof composed of aluminum roof ribs and 1/4-inch clear multiwall polycarbonate sheeting. The roof frame shall have 3-way keyed corners with 4-inch deep sockets for corner posts, integral gasketed glazing channel in underside of the roof framework, and pressure-fit glazing on vertical posts with no exposed fasteners.

The shelter shall have a bench installed and secured per manufacturers recommendations. The bench along the back wall shall be 88-inch "Easy Access" benches, 4-seater with dividers.

No interior lighting will be provided.

Concrete Pad

No separate concrete pad for anchoring shelter is required, as shelter may be anchored directly to cement concrete sidewalk conforming to the requirements for concrete sidewalk construction as found elsewhere in the Contract Documents.

CONSTRUCTION METHODS:

The Contractor shall submit manufacturer’s descriptive literature for materials specified and shop drawings showing procedures for installation of the bus shelter and all specified components.

Prior to placement of concrete sidewalk in the areas where shelters are to be located, the Contractor shall stakeout the locations of shelters for view and approval by the Engineer. Concrete shall be placed in accordance with the requirements for concrete found elsewhere in the Contract Documents. Shelters shall be installed in accordance with manufactures instructions and recommendations. Shelters shall be installed plumb, level, and in proper alignment. Damaged or abraded finishes shall be touched-up, and damaged sections which cannot be repaired shall be replaced.

The Contractor shall be responsible for coordination of sidewalk construction with any embedments which may be required, and all other items requiring coordination between field and factory items.

The Contractor shall be responsible for timing the delivery of all items so as to minimize on-site storage time prior to installation. All stored items must be protected from weather, careless handling and vandalism. Material damaged due to the Contractor’s negligence shall be replaced with new materials at no cost to the City.

COMPENSATION:

Bus shelters will be measured by the unit each, complete in place. The unit price bid per each shall constitute full compensation for furnishing and installing the shelter, including excavation, coordination and placement of required embedments in concrete sidewalk, and furnishing and installation of shelter including seating.

32751	LAWN SOIL	CUBIC YARD
32751.41	SAND BASED STRUCTURAL SOIL	CUBIC YARD
32751.42	PLANTING BED SOIL	CUBIC YARD
32751.43	RAIN GARDEN PLANTING SOIL	CUBIC YARD

DESCRIPTION:

The work shall consist of furnishing and installing Lawn Soil, Sand Based structural Soil, Planting Bed Soil, and Rain Garden Planting Soil, including, but not limited, to the following work:

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1. Planting soil material acquisition.
2. Testing and analysis for specification conformance.
3. Inspection and testing of subgrade for preparation of subgrade.
4. Preparation of mixes and testing for conformance.
5. Installation and placement of soils.
6. De-compaction and Re-compaction of subsoils.
7. Final in-place testing of soils.
8. Clean-up.

Quality Assurance/Definitions

1. Definitions: ASA: American Society of Agronomy.
2. Testing/Testing Agency: Refer to this section
3. Contractor shall submit written documentation of at least five years of contracting and landscape construction experience completing projects of similar scope, complexity, and value.
4. Contractor shall submit at least three project references including project address, dollar value, owner's name, owner's email and phone number.

Testing, Submittals And Mock-Ups

1. Certificates: Submit certification that soil blend components and soil blends meet all environmental standards of the State of Massachusetts for use in residential zones.
2. Testing for Lawn Root Zone Medium , Sand-Based Structural Soil and Planting Bed Medium: Testing is required at the following intervals:
 - A. Testing of individual components for all soil mixes as described herein.
 - B. After test results for components have been accepted, create sample mixes of each horticultural soil and perform tests described herein.
 - C. After the test results for the soil blends have been accepted, and during the placement of horticultural soils, test every 200 cubic yards of soil mix delivered to the job site. Testing applies to soil layers of the planting profile.
 - D. In-place tests: Compaction tests of soil blends in accordance with requirements herein.
3. Test Reports: Submit certified reports for tests as described in this Section.
 - A. Mechanical gradation (sieve analysis) shall be performed and compared to the USDA Soil Classification System. Using the following Sieve Sizes: #10, #18, #35, #60, #140, and #270. Percent clay (0.002 mm) shall be reported separately in addition to silt (ASTM D-422-63, hydrometer method).

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- B. The silt and clay content shall be determined by a Hydrometer Test of soil passing the #270 sieve.
 - C. Chemical analysis shall be undertaken for Nitrate Nitrogen, Ammonium Nitrogen, Phosphorus, Potassium, Calcium Magnesium, Aluminum, Iron, Manganese, Lead, Cation Exchange Capacity, Soluble Salts, acidity (pH) and buffer pH.
 - D. Tests shall be conducted in accordance with Recommended Soil Testing Procedures for the Northeastern United States, 2nd Edition, Northeastern Regional Publication No. 493; Agricultural Experiment Stations of Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont and West Virginia; Revised - December 15, 1995. Referenced Document may be obtained on the web at http://ag.udel.edu/extension/Information/Soil_Testing/title-95.htm.
4. Tests include the following:
- A. Test for soil Organic Matter by loss of weight on ignition, as described in Northeastern Regional Publication No. 493, p. 59.
 - B. Test for soil CEC by exchangeable acidity method as described in Northeastern Regional Publication No. 493, p. 64.
 - C. Test for soil Soluble Salts shall be by the 1:2 (v:v) soil:water Extract Method as described in Northeastern Regional Publication No. 493, p. 74.
 - D. Test for Buffer pH by the SMP method as described in Northeastern Regional Publication No. 493, p.
 - E. Saturated hydraulic conductivity according to ASTM D2434.
5. Certified reports on analyses from producers of composted organic materials are required, particularly when sources are changed. Analyses will include all tests for criteria specified herein.
6. Density Tests: Placed planting soils must be inspected for compaction level by the soil scientist or by the following acceptable Density Test methods: ASTMD1556. Density of soil and rock in place using Sand Cone Method. ASTMD6398-10. Nuclear Methods, ASTMD2167-08 Rubber Balloon method, or ASTMD698. Test Methods for Laboratory Compaction characteristics of soil using standard effort.
7. In-place density tests shall be carried out at a rate of one test per 5,000 square feet for each type of material placed.
8. Testing Agencies: The following firms are acceptable testing agencies for the various components.
- A. Leaf Yard Waste Compost Stability Test and Pathogens/ Metals/ Vector Attraction: Woods End Research Laboratory, P.O. Box 297, Mt. Vernon, ME, 04352, tel: 201.293.2457, fax: 201.293.2488.

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- B. Leaf Yard Waste Compost/ All other tests except those listed above: University of Massachusetts, West Experiment Station, Amherst, MA 01003, tel: 413.545.2311, fax: 413.545.1931.
 - C. Mechanical Gradation and Chemical Analysis, All Components and Soil Mixes: University of Massachusetts, West Experiment Station, Amherst, MA 01003, tel: 413.545.2311, fax: 413.545.1931.
 - D. Approved equivalent.
9. Mock up and Inspection:
- A. At the beginning of site work the contractor shall demonstrate in the presence of the Landscape Architect or Soil Scientist, subgrade preparations, including de-compaction, installation of drainage blanket and re-compaction methods that achieve the requirements of this section. It must be demonstrated that the prepared subgrade is capable of infiltrating water at a rate of at least one inch per hour. All subsequent subgrade preparations shall be in accordance with approved methods.
 - B. The contractor shall not place Lawn Soil, Sand Based Structural Soil, Planting Bed Soil, or Rain Garden Planting Soil on prepared subgrade or drainage blanket prior to inspection and approval of Landscape Architect and Soil Scientist for compliance with depth, compaction and percolation rate, The Contractor shall request inspection before proceeding at least ten working days prior to placement of soils.
 - C. Do not place $\frac{3}{4}$ inch Crushed Stone in Sand Based Structural Soil prior to compaction testing, inspection and compaction specifications, The contractor shall request inspection before proceeding.
10. Samples: Prior to ordering the below listed materials, submit representative samples to the Engineer for selection and approval. Do not order materials until Engineer's approval has been obtained. Delivered materials shall closely match the approved samples.
- A. Organic amendment: duplicate samples of 1 gallon.
 - B. Base Loam: duplicate samples of 1 gallon.
 - C. Coarse Sand: duplicate samples of 1 gallon.
 - D. Lawn Soil, Based Structural Soil, Planting Soil and Rain Garden Planting Soil after approval of individual components: duplicate samples of 1 gallon.
 - E. $\frac{3}{4}$ -inch Crushed Stone: duplicate samples of 1 gallon.
11. Sources for Soil Components and Soil Mixes: Submit information identifying sources for all soil components and the firm responsible for mixing of soil mixes.
- A. Engineer shall have the right to reject any soil supplier.
 - B. Soil mix supplier shall have a minimum of five years of experience at supplying custom planting soil mixes.

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- C. Submit supplier name, address, telephone and fax numbers and contact name.
- D. Submit certification that accepted supplier is able to provide sufficient quantities of materials and mixes for the entire project.

12 Delivery, Storage and Handling

- A. Material shall not be handled or hauled, placed or compacted when it is wet as after a heavy rainfall or is frozen. Soil shall be handled only when the moisture content is less than at field capacity. The Engineer shall be consulted to determine if the soil is too wet to handle.
- B. Store and handle packaged materials in strict compliance with manufacturer's instructions and recommendations. Protect all materials from weather, damage, injury and theft.
- C. Sequence deliveries to avoid delay. On-site storage space is permissible only with written notice from Engineer. Deliver materials only after preparations for placement of planting soil have been completed.
- D. Prohibit vehicular and pedestrian traffic on or around stockpiled planting soil.
- E. Soil that is to be stockpiled longer than two weeks, whether on or off site, shall not be placed in mounds greater than six feet high. If soil stockpiles greater than six feet high are present longer than two weeks then the contractor shall break down and disperse soil so that mounds do not exceed the six foot height restriction for longer than two weeks.
- F. Cover stockpiles of soil media to protect from wind erosion and saturation.

MATERIALS:

Soil Materials

- 1. General
 - A. Soil material blends shall fulfill the requirements as specified and be tested to confirm the specified characteristics.
 - B. Samples of individual components of soil mixes in addition to blended soil mixes including mulch materials shall be submitted by the Contractor for testing and analysis to the approved testing laboratory. Comply with specific materials requirements specified.

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- a. No base component material or soil components for soil mixes shall be used until certified test reports by an approved agricultural chemist have been received and approved by the Engineer.
- b. As necessary, make any and all soil mix amendments and resubmit test reports indicating amendments until approved.
- C. The Engineer may request additional testing by Contractor for confirmation of mix quality and/or soil mix amendments at any time until completion.

2. Base Loam

- A. Base Loam as required for the work shall be free of subsoil, large stones, earth clods, sticks, stumps, clay lumps, roots or other objectionable, extraneous matter or debris. Base Loam shall also be free of quack-grass rhizomes, Agropyron repens, and the nut-like tubers of nutgrass, Cyperus esculentus, and all other primary noxious weeds. Base Loam shall not be delivered or used for planting while in a frozen or muddy condition. Base Loam for mixing shall conform to the following grain size distribution for material passing the #10 sieve:

U.S. Sieve Size Number	Percent Passing	
	Minimum	Maximum
10	---	100
18	85	100
35	70	95
60	50	85
140	36	53
270	32	42
0.002mm	3	6

- B. The ratio of the particle size for 80% passing (D80) to the particle size for 30% passing (D30) shall be 8 or less. (D80/D30 < 8) Maximum size shall be one inch largest dimension. The maximum retained on the #10 sieve shall be 20% by weight of the total sample. Tests shall be by combined hydrometer and wet sieving in compliance with ASTM D422 after destruction of organic matter by ignition.
- C. The organic content shall be between 4.0 and 8.0 percent by weight.
- D. Chemical analysis shall be undertaken for Nitrate Nitrogen, Ammonium Nitrogen, Phosphorus, Potassium, Calcium Magnesium, Aluminum, Iron, Manganese, Lead, Cation Exchange Capacity, Soluble Salts, acidity (pH) and buffer pH.

3. Uniformly Graded Coarse Sand

- A. Sand for Drainage, Lawn Soil, Sand Based Structural Soil, Planting Bed Soil and Rain Garden Planting Soil shall be uniformly graded medium to

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coarse sand consisting of clean, inert, rounded to sub-angular grains of quartz or other durable rock free from loam or clay, mica, surface coatings and deleterious materials with the following gradation.

U.S. Sieve Size Number	Percent Passing	
	Minimum	Maximum
10	100	--
18	60	80
35	25	45
60	8	20
140	0	8
270	0	3
0.002mm	0	0.5

- B. Maximum size shall be one inch largest dimension. The maximum retained on the #10 sieve shall be 20% by weight of the total sample. The ratio of the particle size for 70% passing (D70) to the particle size for 20% passing (D20) shall be 3.5 or less. (D70/D20 <3.5) Tests shall be by combined hydrometer and wet sieving in compliance with ASTM D422 after destruction of organic matter by ignition.
- C. pH shall be less than 7.5.

4. 3/4-inch Crushed Stone

- A. 3/4-inch Crushed Stone shall conform to MassDOT Standard Specification M2.01.4. Crushed Stone (3/4-inch) shall be used above the Sand-Based Structural Soil as shown on the Drawings.

5. Organic Amendment

- A. Organic Matter for amending planting soils shall be a stable, humus-like material produced from the aerobic decomposition and curing of Leaf Yard Waste Compost, composted for a minimum of one year (12 months). The leaf yard waste compost shall be free of debris such as plastics, metal, concrete or other debris. The leaf yard waste compost shall be free of stones larger than 1/2", larger branches and roots. Wood chips over 1" in length or diameter shall be removed by screening. The compost shall be a dark brown to black color and be capable of supporting plant growth with appropriate management practices in conjunction with addition of fertilizer and other amendments as applicable, with no visible free water or dust, with no unpleasant odor, and meeting the following criteria as reported by laboratory tests.
 - a. The ratio of carbon to nitrogen shall be in the range of 12:1 to 25:1.

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- b. Stability shall be assessed by the Solvita procedure. Protocols are specified by the Solvita manual (version 4.0). The compost must achieve a maturity index of 6 or more as measured by the Solvita scale. Stability tests shall be conducted by Woods End Research Laboratory, Mt. Vernon, Maine.
- c. Pathogens/Metals/Vector Attraction reduction shall meet 40 CFR Part 503 rule, Table 3, page 9392, Vol. 58 No. 32, and Commonwealth of Massachusetts 310 CMR 32.00 (for applications to soils with human activity).
- d. Organic Content shall be at least 20 percent (dry weight). One hundred percent of the material shall pass a 1/2-inch (or smaller) screen. Debris such as metal, glass, plastic, wood (other than residual chips), asphalt or masonry shall not be visible and shall not exceed one percent dry weight. Organic content shall be determined by weight loss on ignition for particles passing a number 10 sieve according to procedures performed by the West Experiment Station at the University of Massachusetts, Amherst or equal as follows.
- e. pH: The pH shall be between 6.5 to 7.2 as determined from a 1:1 soil-distilled water suspension using a glass electrode pH meter American Society of Agronomy *Methods of Soil Analysis*, Part 2, 1986.
- f. Salinity: Electrical conductivity of a one to five soil to water ratio extract shall not exceed 2.0 mmhos/cm (dS/m).
- g. The compost shall be screened to 1/2 inch maximum particle size and shall contain not more than 3 percent material finer than 0.002mm as determined by hydrometer test on ashed material.
- h. Nutrient content shall be determined by the University of Massachusetts Soil Testing Laboratory or equivalent laboratory and utilized to evaluate soil required amendments for the mixed soils. Chemical analysis shall be undertaken for Nitrate Nitrogen, Ammonium Nitrogen, Phosphorus, Potassium, Calcium, Aluminum, Magnesium, Iron, Manganese, Lead, Soluble Salts, Cation Exchange Capacity, soil reaction (pH), and buffer pH.

Planting Soil Mixes

1. General

- A. Uniformly mix ingredients by windrowing/tilling on an approved hard surface area. Organic Amendment shall be maintained moist, not wet, during mixing. Amendments shall not be added unless approved to extent

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and quantity by the owner and additional tests have been conducted to verify type and quantity of amendment is acceptable. Percentages of components, unless otherwise noted, will be established upon completion of individual test results for components of the various mixes.

- B. After component percentages are determined by the Engineer, each planting soil mix shall be tested for physical and chemical analysis.

2. Lawn Soil

- A. Lawn Soil shall be combined in an approximate blend ratio of two parts by volume Coarse Sand, to one and one half parts by volume Base Loam and one part by volume Organic Amendment(2S:1.5L:0.5C) to create a uniform blend which meets the following requirements.

- a. The following gradation for material passing a Number 10 Sieve shall be achieved in the final mix.

U.S. Sieve Size Number	Percent Passing	
	Minimum	Maximum
10	100	
18	70	90
35	45	72
60	26	40
140	18	25
270	13	17
0.002 mm	2	5

- b. Maximum size shall be one inch largest dimension. The maximum retained on the #10 sieve shall be 20% by weight of the total sample.
- c.. Ratio of the particle size for 80% passing (D80) to the particle size for 30% passing (D30) shall be 5.0 or less. (D80/D30 <5.0)
- d. Saturated hydraulic conductivity of the mix: not less than 4 inches per hour according to ASTM D5856-95 (2000) when compacted to a minimum of 88% Standard Proctor, ASTM 698.
- e. Organic content: between 4.0 and 5.0 percent by weight.

- B. Sand-Based Structural Soil Planting Medium shall consist of a blend of approximately seven parts by volume of Coarse Sand, one and one half parts by volume of Base Loam and two parts by volume of Organic Amendment. Blending of the components shall be carried out with earth moving equipment prior to placement. The components shall be blended to create a uniform mixture as determined by the Engineer.

- C. The final blended Sand-Based Structural Soil Planting Medium shall conform to the following grain size distribution for material

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passing the #10 sieve:

U.S. Sieve Size Number	Percent Passing	
	Minimum	Maximum
10	100	-
18	68	90
35	38	63
60	18	39
140	10	18
270	7	9
0.002mm	1	2

- D. Maximum size shall be one inch largest dimension. The maximum retained on the #10 sieve shall be 15% by weight of the total sample.
- E. The ratio of the particle size for 70% passing (D70) to the particle size for 20% passing (D20) shall be 3.5 or less. (D70/D20 <3.5).
- F. Tests shall be by combined hydrometer and wet sieving in compliance with ASTM D422 after destruction of organic matter by ignition.
Organic content shall be between 2.0 and 3.0 percent.

3 Planting Bed Soil

- A. Planting Bed Medium shall be combined in an approximate mix ratio of one part by volume Sand to one and one half parts by volume Base Loam to one part by volume Compost (1S:1.5L:1C) to create a uniform blend which meets the following requirements.
 - a. The following gradation for material passing a Number 10 Sieve shall be achieved in the final mix.

U.S. Sieve Size No.	Percent Passing	
	Minimum	Maximum
10	100	
18	73	90
35	54	74
60	38	54
140	26	38
270	20	26
0.002 mm	2.5	6
 - b. Maximum size shall be one inch largest dimension. The maximum retained on the #10 sieve shall be 20% by weight of the total sample.
 - c.. Ratio of the particle size for 80% passing (D80) to the

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particle size for 30% passing (D30) shall be 8 or less.
(D80/D30 <8)

- d. Saturated hydraulic conductivity of the mix: not less than 2 inches per hour according to ASTM D5856-95 (2000) when compacted to a minimum of 86% Standard Proctor, ASTM 698.
- e. Organic content: between 5.0 and 7.0 percent by weight.

4. Rain Garden Soil

- A. Rain Garden Soil shall be combined in an approximate mix ratio of three part by volume Sand to one and one half parts by volume Base Loam to one part by volume Compost (3S:5L:1C) to create a uniform blend which meets the following requirements.
- B. The following gradation for material passing a Number 10 Sieve shall be achieved in the final mix.

U.S. Sieve Size No.	Percent Passing	
	Minimum	Maximum
10	100	
18	73	90
35	45	72
60	26	40
140	14	20
270	11	13
0.002mm	1	3

- C. Maximum size shall be one inch largest dimension. The maximum retained on the #10 sieve shall be 20% by weight of the total sample.
- D. Ratio of the particle size for 70% passing (D70) to the particle size for 20% passing (D20) shall be 5 or less. (D70/D20<5).
- E. Saturated hydraulic conductivity of the mix: not less than 5 inches per hour according to ASTM D5856-95(2000) when compacted to a minimum of 86% Standard Proctor. ASTM698.
- F. Organic Content: between 2.5 and 3.5 percent by weight.

CONSTRUCTION METHODS:

- 1. Pre-Installation Examination and Preparation.
The Engineer will inspect the subgrade prior to the start of soil placement and planting, and the Contractor shall correct any deficiencies noted. Deficiencies include, but shall not be limited to the following:
 - A. Construction debris present within the planting areas.
 - B. The subgrade is at incorrect depths for installing the designed soil profile.
 - C. Incomplete subsurface drainage installation.
 - D. Subgrade not properly compacted.

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- E. Subgrade fails to infiltrate water at specified rate.
2. General site Subgrade Compaction Mitigation for all general lawn and planting areas.
- A. Immediately prior to placing Planting Soils, the entire subgrade shall be loosened to a minimum depth of 6-inches using the teeth of a backhoe or other suitable equipment, then re-compacted with the tracks of small construction equipment, the bucket of a backhoe, or other approved equipment. Vibratory compaction of subgrade in planted areas is prohibited.
 - B. After the subgrade soils have been loosened, re-compressed and inspected. Planting soil may be spread by using a wide track bulldozer size D-5 or smaller or may be dumped or spread with the bucket of a backhoe from the edge of the loosened area. No rubber-tired equipment or heavy equipment except for a small bulldozer shall pass over the subsoils (subgrade) after they have been loosened and recompressed. If the Contractor plans to utilize such areas for any use of heavy equipment, this work should be carried out prior to beginning the process of loosening soils or filling in that area.
3. Subgrade Inspection and Percolation Testing
- A. After subgrade levels have been reached, the Landscape Architect or Soil Scientist shall inspect soil conditions to evaluate subsurface drainage conditions. The Contractor shall carry out percolation tests according to the following procedures in locations identified by the Landscape Architect. The Contractor shall conduct one test per 300v square feet, and provide written results to the Project Engineer.
 - B. Percolation tests shall be performed according to the following test procedures:
 - a. Utilize perforated canisters or buckets seven to ten inches in diameter and a maximum of six inches high.
 - b. A test hole shall be hand dug at the soil horizon to be tested approximately one inch larger than the diameter of the test canister and approximately six inches deep. The sides of the test hole shall not be smoothed.
 - c. Place one-half inch of clean coarse sand in the bottom of the hole and place the canister firmly into the hole. The space around the canister shall then be filled with coarse sand. Tap the coarse sand to firmly fill any void space around the test canister.
 - d. Fill the canister with water to the soil horizon level and allow to drain until approximately one inch of water remains, or a minimum of 1 hour.
 - C. Refill the canister to the soil horizon level. After the water level drops approximately one inch, start the test. Record time versus water level as the water level drops. The percolation rate is the length of time for the water level to drop per inch. The field scientist shall record the rate of

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Percolation for a minimum of two hours or until the water level has dropped a minimum of three inches after the start of measurements. Prepared subgrade must infiltrate water at a minimum rate of one inch per hour.

4. Mixing Of Planting Soil Mixes
 - A. Soil mixtures shall be produced with equipment that blends together each component in a thorough and uniform manner. Examine soil and remove foreign materials, stones and organic debris over ½” in size. Mix-in fertilizers and amendments as required by tests and as approved by the Engineer. Preparation and mixing shall be accomplished when the soil moisture content is less than field capacity and at a moisture content approved by the Engineer. If lime is to be added, it shall be mixed with dry soil before fertilizer is added and mixed.

Backfilling Of Planting Soil Layers

1. Soil Placement Preparation:
 - A. Notify the Engineer of soil placement operations at least seven calendar days prior to the beginning of work.
 - B. Prevention of compacted soils can be accomplished by beginning the work in corner, against walls and progressing outwards towards the borders.
 - C. Planting Bed Soil and Sand-Based Soil shall never be moved or worked when wet or frozen.
 - D. The Contractor shall place barricades as required to prevent any unnecessary compaction of planting soil from vehicles, equipment, or pedestrian traffic.

2. Placement of Planting Bed Soil, Rain Garden Soil, and Lawn Soil:
 - A. Planting Bed Soil, Rain Garden Soil, and Lawn Soil shall be placed in lifts not to exceed 8 inches in thickness and compacted to meet minimum and maximum requirements as specified below:
 - a. Planting Bed Soil and Rain Garden Soil shall be compacted to between 82 and 85 percent Standard Proctor.
 - b. Soil shall be compacted to between 84 and 87 percent Standard Procter
 - c.. In all cases, the soil being placed shall be in a dry to damp condition. No wet soils shall be placed. All testing of in-place density for Planting Soil materials shall be made according to ASTM D1556.

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3. Placement of Sand-Based Structural Soil.
 - A. After subgrade levels have been reached, and immediately prior to placing Sand-Based Structural Soil the entire subgrade area shall be thoroughly compacted. Sand-Based Structural Soil shall be spread in lifts not greater than eight inches and compacted with a minimum of two passes of vibratory compaction equipment to a density between 92 and 96 percent Standard Proctor. Sand-Based Structural Soil shall be placed within the areas shown on the Drawings.
 - B. A layer of 3/4-inch crushed stone shall be placed over the Sand-Based Structural Soil to thicknesses as shown on the Drawings. A minimum of eight inches shall be placed and compacted by two passes of vibratory compaction equipment.

PROTECTION:

1. Protect newly graded areas from traffic, freezing and erosion. Keep free of trash, debris or construction materials from other work.
2. Repair and re-establish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or compaction due to subsequent construction operations or weather conditions. Scarify or remove and replace material to a depth as directed by the Owner's Representative; reshape and re-compact at optimum moisture content to the required density.
3. Where settling occurs before placement of concrete base, before final acceptance or during the warranty period, remove finish surfacing, backfill with additional approved material, compact to specified rates, and restore any disturbed areas to a condition acceptable to the Owner.
4. Post-Installation Testing
 - A. In-place density testing is required in all areas. Placed planting soils must be inspected for compaction level by the soil scientist or by the following acceptable density testing methods: ASTM D1556 Density of soil and rock in place using Sand Cone Method, ASTM D6398-10 Nuclear Methods. ASTM D2167-08 Rubber Balloon method, and ASTM D698 Test Method of Laboratory Compaction Characteristics of Soil using Standard effort.
 - a. Sand Based Structural Soil must be tested for compaction level according to the ASTM Methods provided above at a minimum frequency of one test per planting bed for each lift placed.
 - B. Percolation Testing of Placed Planting Soil is required in all areas. Percolation tests of all Planting Soils shall be performed using Turf Tec. In 2-W Infiltrometer utilizing manufacturer's operating instructions.

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- a. Tests shall be conducted each 1,000 square feet for each soil type including Sand Based Structural Soil after each soil type has been placed.
 - b. Soil Scientist or Engineer may direct additional testing in locations subject to compaction or adverse Contractor operations.
- C. Any planting soil that fails to meet the minimum infiltration rate of one-inch per hour must be re-worked and re-compacted until the soil meets the minimum infiltration capacity at no additional cost to the owner.

COMPENSATION:

Item 32751, Lawn Soil, Item 32751.41 Sand-Based Structural Soil, Item 32751.42 Planting Bed Soil, and Item 32751.43 Rain Garden Soil will be measured by the unit cubic yard for each item. Payment for these items will be made at the unit price bid per cubic yard for each item, which price shall constitute full compensation for completing the work as shown on the Drawings and as specified herein, including all labor, materials, and tools required.

32765.91 HYDROSEEDED NATIVE PLANTING AT WESTERN OUTFALL (INCIDENTAL)

32765.92 CUSTOM FESCUE LAWN MIX (INCIDENTAL)

32770 SODDED LAWN SQUARE YARD

DESCRIPTION:

The work performed under this Item shall conform to the relevant provisions of Sections 765 and 770 of the MassDOT Standard Specifications and the following:

Description Of Work

The work shall consist of the provision of all labor, materials, equipment, and transportation required to complete the seeded lawn and sodded lawn, in strict accordance with the conditions and specifications of these Contract Documents. The work shall include, but is not necessarily limited to the following:

- 1. Seeded Lawn.
- 2. Sodded Lawn
- 3. Hydroseeded native mix on slope at Western Outfall
- 4. Custom Fescue lawn mix at Multi-Use Path at Western Outfall

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5. Watering, fertilizing and mowing and maintenance.

References

Comply with applicable requirements of:

1. MassDOT, Standard Specifications for Highways and Bridges, latest edition, Boston, Massachusetts.
2. American Association of Nurserymen, American Standards for Nursery Stock, (ANSI Z60.1), latest edition, published by the American Association of Nurserymen, 1250 I Street, N.W., Suite 500 Washington, D.C. 20005.
3. ASTM: American Society of Testing Materials.
4. ANSI: American National Standards Institute.
5. AOAC: Association of Official Agricultural Chemists.
6. USDA: United States Department of Agriculture.

Submittals

Product Data: Submit manufacturer's information for:

1. Maintenance Fertilizer
2. Protective fencing materials.
3. Erosion control blanket.

Certificates: Submit:

1. Seed certification. Submit certificate of compliance with each shipment indicating grass seed species, source, grower location, date of harvest and shipment. Certificate from seed supplier shall indicate seed is true to variety indicated on packaging. Certificates shall include guaranteed percentages of purity, weed content and germination of seed, net weight and date of shipment. No seed may be sown until certificates have been submitted.
2. Sod grower's certification. Submit certificate with each shipment of sod indicating certification of grass species, source, grower location, date of harvest and shipment. No sod may be placed until certificates have been submitted.

Schedules: Submit:

1. Seeding schedule for approval.
2. Sod installation schedule for approval.

Quality Assurance

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Qualifications: Contractor shall have minimum five years of experience in seed installation.

Regulatory Requirements

1. Secure permits, licenses, and pay fees including traffic control.
2. Comply with laws, regulations, and quarantines for agricultural and horticultural products.

Delivery Storage and Handling of Sod

Cut, deliver, and install sod within a 24-hour period.

Do not harvest or transport sod when moisture content may adversely affect sod survival.

Protect sod from sun, wind, and dehydration prior to installation.

Do not tear, stretch, or drop sod during handling and installation.

Delivery, Storage and Handling of Seed, Fertilizer, and Soil Amendments

Packing and Shipping: deliver materials in unopened containers bearing the manufacturer's name and guaranteed statement of analysis. Transport materials without damage. Protect finishes from abrasion, dirt, oils, grease, and chemicals. Pack materials to protect from weather.

Acceptance at Site: verify in writing that delivered materials conform to specifications and approved submittals.

Storage and Protection:

1. Materials shall be uniform in composition, dry and free flowing.
2. Store materials in dry place, on pallets, off the ground; protect from sun. Store materials in a manner, which does not diminish their usability and effectiveness.
3. Protect materials from theft, damage, weather, dirt, oils, grease, and construction.

Project Conditions

Environmental Requirements: do not deliver, handle or place soils when dry, wet, or frozen.

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1. Field Test
 - a. Form soil in palm of hand, if soil retains shape and crumbles upon touching, the soil may be worked.
 - b. If soil will not retain shape it is too dry and should not be worked.
 - c. If soil retains shape and will not crumble, it is too wet and should not be worked.

2. Seed and Sod Planting Seasons:
 - a. Spring (April 15 to June 1)
 - b. Autumn (August 15 to November 1)
 - c. Seeding outside of the above seasons shall be permitted when ordered by the Engineer or when Contractor submits written request and permission is granted. Sodding outside dates established above shall be at Contractor's risk.

Sequence and Scheduling

Perform lawn work only after planting and other work affecting ground surface has been completed.

The irrigation system will be furnished and installed prior to sodding. Locate, protect, and maintain irrigation system during seeding operations. Repair irrigation system components damaged during operations at Contractor's expense.

Substantial Completion

Upon establishment of seeded lawn, request Engineer's review to determine if work is substantially complete. Submit request a minimum of five days prior to anticipated inspection date. If work is substantially complete, Engineer will issue a Substantial Completion letter identifying commencement of 90 day Maintenance Period.

1. If work is not substantially complete, Engineer will issue a written list of outstanding work to be done on a timely schedule agreed upon by Contractor and Engineer.
2. Contractor shall notify Engineer when outstanding work is completed and ready for review. When outstanding work is complete, as determined by Engineer, a letter of Substantial Completion will be issued.

120 Day Maintenance Period

Maintain lawn areas for a minimum 90 day period of active growing season as determined by the Engineer until Final Acceptance.

Final Acceptance

After the 120 day maintenance period lawn areas will be reviewed for final acceptance.

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Conditions of Final Acceptance

1. Lawn acceptance shall be given for entire completed lawn area. No partial acceptance shall be given.
2. Lawns shall exhibit uniform, thick, well- developed stand of grass. Lawn areas shall have no bare spots.
3. No lawn areas shall exhibit signs of damage from erosion, washouts, gullies, or other causes.
4. Pavement surfaces and site improvements adjacent to lawn areas shall be clean and free of spills from placing or handling of loam borrow and sodding operations

Inspection and Final Acceptance

1. Upon completion of 120 Day Maintenance Period, request Engineer’s review to determine if work is acceptable. Submit request a minimum of five days prior to anticipated inspection date. If work is acceptable, Engineer will issue a Final Acceptance letter. From this date forward, lawn maintenance will be the responsibility of the City. Following acceptance of lawns, City will be given access to lawn areas for maintenance work.
2. If work is not accepted, Engineer will issue a written list of outstanding work. Maintenance period to be extended until completion of work.
3. Contractor shall notify Engineer when outstanding work is completed and ready for review. When work is complete, as determined by Engineer, a letter of Final Acceptance will be issued.

MATERIALS:

Post Planting Fertilizer

Post Planting Fertilizer to be mixed with soil:

1. Complete, fertilizer made from all-natural ingredients complying with State and Federal fertilizer laws. Fertilizer shall contain the following available plant food by weight, unless soils test indicate a need for different composition:

	Nitrogen	Phosphorus	Potash
Lawns	5%	3%	4%

2. Fertilizer: Pro Gro 5-3-4 manufactured by North Country Organics, Bradford, Vermont 05033, ph# 802.222.4277.
3. Fertilizer to be delivered in original unopened standard size bags showing weigh, analysis ingredients and manufacturer’s name.

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Water

Water: furnished by Contractor, suitable for irrigation and free from ingredients harmful to plant life. Hose and other watering equipment furnished by Contractor.

Seed Mixture

Seed mixture: fresh, clean, new crop seed. Seed can be mixed by an approved method on site or can be mixed by dealer. If seed is mixed on site, each variety shall be delivered in original containers bearing dealer's guaranteed analysis. If seed is mixed by dealer, Contractor shall furnish to the Engineer the dealer's guaranteed statement of composition of mixture and percentage of purity and germination of each variety.

Seed at Charles River multi-use path, and at incidental landscape areas along Western Avenue (but excluding overseeding at Western Outfall area) to consist of Triplex Kentucky Bluegrass Mix and Triplex Perennial Ryegrass mixed at a ratio of 1:1 by volume as follows:

1. Triplex Bluegrass Mix:

	Proportion of mix after purity	Minimum germination
Baron Kentucky bluegrass	40%	80%
Merit Kentucky bluegrass	50%	80%
Georgetown Kentucky Bluegrass	10%	80%

2. Triplex Perennial Ryegrass Mix:

	Proportion of mix after purity	Minimum germination
Palmer Perennial Ryegrass	40%	90%
Prelude Perennial Ryegrass	40%	90%
Yorktown III Perennial Ryegrass	20%	90%

3. If cultivars as listed are not available, others can be substituted with Engineer's approval.

Over-Seeding at Western Outfall slope to consist of New England Dry Site Mix as follows:

1. New England Dry Site Mix

	Proportion of mix	Minimum
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	after purity	germination
Creeping Red Fescue	28%	80%
Canada Wild Rye	27%	80%
Annual Ryegrass	15%	80%
Protocol II (turf type) Perennial Ryegrass	13%	80%
Bad River Blue Grama	5%	80%
Little Bluestem, CT Ecotype	5%	80%
Indiangrass, LI NY Ecotype	4%	80%
Ticklegrass (Rough Bentgrass), PA Ecotype	2%	80%
Autumn Bentgrass, APB	1%	80%

Sod for James Cronin Park

Sod: nursery grown sod composed of two or more proprietary Kentucky bluegrass cultivars with a 30 percent minimum composition of fine leaf fescues (chewings, creeping red, of hard fescues). Submit cultivar names to Engineer for approval. Sod to be 1 year old minimum from time of original seeding.

Provide well-rooted, healthy sod, free of diseases, nematodes and soil borne insects. Provide sod uniform in color, leaf texture, density, free of weeds, undesirable grasses, stones, roots, thatch and extraneous material; viable and capable of growth and development when planted.

Machine cut sod at uniform soil thickness of 3/4 inch, plus or minus 1/4 inch at time of cutting. Thickness measurement excludes top growth and thatch. Cut individual pieces to supplier's standard width and length with maximum allowable deviation of 5%. Broken pads and torn or uneven ends are unacceptable.

Install sod as follows:

1. In linear sod strips measuring 12 inches or 16 inches in width and 4 feet to 6 feet long. Stored in rolls with grass topside inverted so topsoil is to the exterior.

Temporary Protective Fencing

Protect lawn areas with snow fencing or other approved temporary fencing material. Maintain fence in place.

CONSTRUCTION METHODS:

Lawn Work Schedule

Lawn work shall proceed on schedule in conformance with project phasing. These requirements will be strictly adhered to.

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Lawn work must be completed on schedule to allow at least one full growing season prior to Final Acceptance.

Contractor responsible for maintenance work on installed lawn until an acceptable lawn is established for a minimum of 60 days.

Examination

Verification of Conditions: in the event field conditions are not in conformance with Contract Documents, notify Engineer in writing.

1. Spot and Invert Elevations: verify field elevations of site improvements such as drainage and utility fixtures, pavements, existing plantings, and subsurface piping conform to Drawings.
2. Finish Grades: verify specified elevations to ensure that fine grading operations have shaped, trimmed, and finished sod bed true to elevation with smooth sloped parallel to finished grade.

Preparation and Placement of Planting Soils

See requirements of Items 32751 and 3275.41.

Thoroughly irrigate areas to receive lawn.

Scarification: cross rake areas to receive lawn so surface of soil will be receptive to holding seed.

Grade lawn areas smooth, free draining and even surface with a loose, uniformly fine texture. Roll and rake; remove ridges and fill depressions to drain.

Restore prepared areas to specified condition if eroded, settled, or otherwise disturbed after fine grading and prior to seeding.

Preparation of Lawn Installation

Protection:

1. Dust Control: upon acceptance of finish grade provide dust control.
2. Erosion Control: upon acceptance of finish grade provide erosion control.
3. Agricultural Chemicals: protect site improvements from contact with agricultural chemicals, soil amendments, and fertilizers.

Surface Preparation:

1. Clean seed bed, pavement or other site improvements prior to installation.

Application of Pre Planting Fertilizer

Preplant Fertilizer application: See Item 32751.

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Seed Installation

Seeding: Seeding shall consist of soil preparation, seeding, raking, rolling, weeding, watering and otherwise providing labor and materials necessary to secure establishment of acceptable turf.

Sowing of Seed: Immediately before seed is sown, ground shall be scarified, or raked lightly until surface is smooth, friable, and of uniformly fine texture. No seeding shall be done during windy weather. Sow seed in two directions right angles to each other, applying 3 lbs. of seed per 1,000 sq. feet in each direction. Sow seed evenly using a cultipacker or approved seeding device (if cultipacker is not used, cover seed with thin layer of landscape soil by dragging, light raking or other approved method). Roll in both directions with hand roller weighing approximately one hundred pounds per foot of width, and water with fine spray. Provide protective fencing where required to keep area undisturbed until grass is established.

On slopes of 3:1 or greater, Contractor shall use erosion control blanket pre-seeded with specified mixtures. Erosion control blanket shall be installed with two staples minimum per square yard.

Sod Installation

Install initial row of sod in a straight line and place subsequent rows parallel to previously installed row. Lay sod edge to edge with tightly fitted joints with longest dimension parallel to contours. Stagger strips to offset joints in adjacent courses. Top of sod thatch line to be flush with surface of adjacent finished grade.

On sloped areas (slopes greater than 4:1), lay sod with length perpendicular to slope, starting at base and continuing upwards with every length pegged.

Immediately after laying, roll sod firmly into contact with sod bed with 100 pound per foot of width hand roller or other approved method to eliminate air pockets.

Finish surface to be uniformly, smooth and even.

Water sod with a fine spray at a rate of 5 gallons per square yard until the underside of new sod pad and soil below sod are thoroughly wet.

Watering

First Week: Water to establish acceptable lawn. In absence of adequate rainfall, water daily during first week to maintain moist soil to two inch minimum depth.

Second and Subsequent Weeks: Water lawn to maintain moisture in upper 5 inches of soil.

Water with uniform coverage while preventing erosion due to application of excessive quantities over small areas, and prevent damage to finished surface by watering

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equipment. Provide sufficient watering equipment to apply one complete coverage to seeded areas in eight-hour period.

Maintenance

Maintenance begins immediately after sod is installed and continues until Final

Acceptance as follows:

A uniform, thick, well-developed stand of grass is established.

Mow sod at seven-day intervals.

First mowing: when grass has grown to 2" to 2 1/4" height. Cut grass to 1 3/4" height.

Subsequent mowings shall cut grass to 1 3/4" height.

Mow in Autumn until growth of grass ceases, and resume in Spring when grass grows to 2 1/4" height.

Remove and properly dispose of grass cuttings off site after each mowing.

Apply uniform application of maintenance fertilizer (5-3-4) at rate of 20 per 1000 square feet 30 days after new lawn has been installed.

Continue watering as described above.

After grass has started, areas failing to show uniform, thick, well-developed stand of grass shall be immediately re-sodded until areas are covered with satisfactory growth of grass as determined by Engineer.

Repair damage from erosion, gullies, washouts, or other causes immediately by filling with loam borrow, tamping, re-fertilizing and re-seeding.

Cleaning

Wash and sweep clean paving, site improvements and building surfaces. Clean spills and oversprays immediately. Remove and dispose off-site excess planting mixture, soil and debris.

Following Final Acceptance of lawn areas, remove materials and equipment not required for other planting or maintenance work. Materials and equipment remaining on site shall be stored in locations that do not interfere with City's maintenance of accepted lawns or other construction operations.

Protection

Protect lawn areas against damage with fencing. Fencing to remain in place for minimum 30 days or as directed by owner to ensure complete establishment of sodded lawn.

Contractor to maintain fencing in upright position, stretched tightly, and neatly.

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COMPENSATION:

Item 32770 Sodded Lawn will be measured by the unit square yard. Payment for this item will be made at the unit price bid per square yard, which price shall constitute full compensation for completing the work as shown on the Drawings and as specified herein, including all labor, materials, and tools required.

Items 32765.91, Hydroseeded Native Planting and 32765.92, Custom Fescue Lawn Mix will not be measured for payment and will be considered incidental to Item 3411.3 Outfall.

32767.6	PLANTING MULCH	CUBIC YARD
32767.7	SALT MARSH HAY MULCH AT WESTERN OUTFALL(INCIDENTAL)	

DESCRIPTION:

The work performed under this Item shall conform to the relevant provisions of Section 767 of the MassDOT Standard Specifications and DCR Standards (at Memorial Drive Landscape at the Western Ave. Outfall area) and the following:

General

The work shall consist of the provision of all labor, materials, equipment, and transportation required to complete the planting mulch, in strict accordance with the conditions and specifications of these Contract Documents. The work shall include, but is not necessarily limited to the following:

1. Furnishing and spreading planting mulch.

Submittals

Samples: Submit sample of Planting Mulch: Submit one cubic foot sample and manufacturer/supplier's name.

MATERIALS:

Planting Mulch

Planting mulch: shredded granular outer bark of evergreen trees and minimum of hardwood bark and shall be aged for period of at least 6 months and not longer than two years. Bark mulch shall not have been subjected to anaerobic conditions and must be partially decomposed and dark brown in color, bark chunks shall average 1/2 inch to 2

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inches in length and no chunks three inches or more in size and thicker than 1/4 inch shall be left on site. Moisture content shall be 40 percent or more, retained with normal watering and/or rainfall. Mulch shall be free of dirt, leaves, twigs, and other materials deleterious to plant life. Mulch shall not contain chipped construction materials.

CONSTRUCTION METHODS

Mulching

Immediately after planting operations are completed, cover tree and shrub pits and planting beds with a three inch layer of organic mulch. Taper depth of mulch to be two inches at mulched perimeter and decreasing in depth toward trunk to be flush where trunk or stem meets root ball. Do not place mulch against trunk or stem. Cover tree, shrub and groundcover planting beds with bark mulch.

Cleaning

Wash and sweep clean paving, site improvements and building surfaces, clean spills and over-sprays immediately. Remove and dispose off-site excess mulch.

COMPENSATION:

Item 32767.6, Planting Mulch will be measured by the unit cubic yard for each item. Payment for these items will be made at the unit price bid per cubic yard for each item, which price shall constitute full compensation for completing the work as shown on the Drawings and as specified herein, including all labor, materials, and tools required.

Item 32767.7, Salt Marsh Hay Mulch at Western Outfall will not be measured for payment and will be considered incidental to Item 3411.3 Outfall.

LANDSCAPE PLANTINGS

(note: These Items pertain to Streetscape Areas only. See Drawing LA-2 for Plant List pertaining at Slope and Shoreline areas at the Memorial Drive Outfall location)

TREES

32771.10	ACER RUBRUM ‘OCTOBER GLORY’ 3-3 ½” CAL.	EA
32771.11	BETULA NIGRA ‘HERITAGE’ 3-3 ½” CAL.	EA
32771.12	GINGKO BILOBA 3-3 ½” CAL.	EA
32771.13	GLEDITSIA TRIACANTHOS ‘HALKA’ 3-3 ½” CAL.	EA
32771.14	QUERCUS PALUSTRIS 3-3 ½” CAL.	EA

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32771.15	ZELKOVA SERRATA 'GREEN VASE 3-3 ½' CAL.	EA
<u>SHRUBS</u>		
32771.20	CLETHRA ALNIFOLIA 18"-24" HT.	EA
32771.21	CORNUS SERICEA 'ARTIC FIRE' 18"-24" HT.	EA
32771.22	ILEX GLABRA 'DENSE' 18"-24" HT.	EA
32771.23	ILEX VERTICILLATA 'RED SPRITE' 18"-24" HT.	EA
32771.24	ROSA 'RADKOPINK 18"-24" HT.	EA
32771.25	TAXUS BACCATA 'REPANDENS' 18"-24" HT.	EA
32771.26	XANTHORHIZA SIMPLICISSIMA 12'-15' HT	EA
<u>GRASSES</u>		
32771.30	CALAMAGROSTIS 3 GAL.	EA
32771.31	CHASMANTHIUM LATIFOLIUM 1 GAL.	EA
32771.32	DESCHAMPSIA CAESPITOSA	EA
32771.33	LIRIOPE SPICATA 1 GAL.	EA
FERNS		
32771.34	ONOCLEA SENSIBILIS 1 GAL.	EA
<u>PERENNIALS & GROUNDCOVERS</u>		
32771.40	EUPATORIUM FISTULOSUM 1 PLUG	EA
32771.41	IRIS VERSICOLOR 1 QUART	EA
32771.42	NEPETA RACEMOSA 'LITTLE TECH' 1 GAL.	EA
32771.43	LIATRUS SPICATA 1 GAL.	EA
32771.44	RUDBECKIA HIRTA 1 GAL.	EA

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DESCRIPTION:

Summary

The work under this Item includes but is not limited to the following:

1. Furnish materials, equipment, and labor required to install the planting of materials indicated on the Drawings and as specified.
2. Furnish, install and mark tree-staking systems.
3. Provide maintenance to plants.
4. Provide guarantee on plant material.
5. Provide temporary water source as needed during Guarantee Period.

Applicable Standards

American Standard for Nursery Stock, ANSI Z60.1-2004. American Nursery and Landscape Association, 1250 Eye Street. NW, Suite 500, Washington, D.C. 20005.

Best Management Practices: Tree Planting. International Society of Arboriculture, P.O. Box 3129, Champaign, IL 61826-3129. 2005.

American Standard for Pruning, ANSI A300-2001. American National Standards Institute, Inc. 1819 L Street, NW, Sixth Floor, Washington, DC 20036.

Pre-Construction Meeting

At the project pre-construction meeting, the following items relating to the work of this Item shall be specifically discussed:

1. Nursery sources for plant materials.
2. Schedule of plant tagging, delivery and installation.
3. Review benchmark dates at which time Engineer's designated Landscape Architect should make site visits.

Quality Control

Qualifications: Landscape planting and related work shall be performed by a firm with a minimum of five years of experience specializing in this type of work. Contractors and their Sub-Contractors who will be performing landscape work included in this section of the Specification shall be approved by the Engineer. Pruning shall be performed by a Massachusetts certified and/or an International Society of Arboriculture certified arborist. Pruning shall comply with ANSI A300 pruning standards.

Care & Handling: Evidence of inadequate protection following digging, carelessness while in transit, or improper handling or storage, shall be cause for rejection. Improper

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handling of plant material includes, but is not limited to, moving plants by other than their rootball.

Planting Season

1. Planting shall only be performed when weather and soil conditions are suitable for planting the material specified in accordance with locally accepted practice. Plant material shall not be installed when soils are frozen or wet.
2. Planting seasons are as indicated
 - a. Deciduous Plants: Planting seasons are from April 15 to May 30 for Spring planting, and September 15 to November 15 for Fall planting.
3. Variance: If special conditions exist that warrant a variance in the above planting dates, a written request shall be submitted to the Engineer a minimum of 4 weeks prior to the scheduled planting date stating the special conditions and the proposed variance. Permission for the variance will be given if warranted in the opinion of the Engineer and upon condition that the Guarantee Period be extended for an additional period of up to 12 months at no additional cost to the City.

Selection of Plant Materials

1. Plant material shall be approved by the Engineer prior to purchase and planting.
2. Source Limitations:
 - a. Plants shall come from the same nursery.
 - b. Grow plants under climatic conditions similar to those in the locality of the project for at least the previous two years. Unless approved by the Engineer, plants shall have been grown at a latitude not more than 325 km (200 miles) north or south of the latitude of the project unless the provenance of the plant can be documented to be compatible with the latitude and cold hardiness zone of the planting location.
 - c. B&B plants shall have been freshly dug (during the most recent favorable harvest season).
3. Contractor responsible for locating plant material in a timely manner. Contractor must present identified sources by January 1 of the planting year for Spring plantings, and July 1 for Fall plantings. Source information shall state the place of growth and the approximate quantity of plants available for inspection. The Engineer may refuse inspection at this time if, in his or her judgment, sufficient quantities of plants are not available for inspection.

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4. The initial sources for procuring of plant material shall be as follows. If the Engineer deems material from these sources unacceptable, the Contractor must find alternate nursery sources of un-dug plant material.
 - a. Select Horticulture, Lancaster, MA (T 978-365-6555, F 978-365-4343)
 - b. Halka Nursery, Englishtown, NJ (T 732-462-8450, F 732-409-2705).
 - c. Whitmores Tree Farm, East Hampton, NY (T 631-329-0446, F 631-329-0599)
 - d. Hammel Nurseries Honey Brook, PA 19344 (T610-942-8733, F 610-942-9320)
5. Color photographs of representative plant material shall be submitted for initial review of alternate nursery sources. Photographs are to include a scale rod or other measuring device and be taken from an angle that depicts the size and condition of the typical plant to be furnished. Photographs must show actual plant material available for selection at that time.
6. If nurseries and/or stock submitted for review are not acceptable to Engineer, Contractor shall submit alternate sources within seven (7) business days.
7. If the Contractor cannot locate the plant material specified in the Drawings, the Contractor shall enlist a plant broker to locate the material. The Contractor shall submit a report from the plant broker describing alternate sources of availability or lack thereof for the specified plant material and sizes.
 - a. Trips to nurseries shall be efficiently arranged to allow Engineer to maximize his/her viewing time. Four (4) days of viewing/tagging have been allotted for the materials listed on the Drawings. Only undug trees (trees that are in the ground) shall be considered for approval.
 - b. The Engineer may choose to attach their seal to each plant, or representative samples. Each tree may have a specific location and orientation on the proposed plan that the Contractor shall follow closely during installation.
 - c. Plant material that has been sealed shall be secured by the Contractor within ten (10) business days of Engineer having reviewed or sealed the material.
 - d. Plants shall be subject to inspection for conformity to Specification requirements and approval by the Engineer at their place of growth and upon delivery. Viewing and/or sealing of plant materials by the Engineer at the nursery does not preclude the Engineer's right to reject material at the job site during progress of the Work.

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- e. Engineer's seals shall not be removed until all plantings have been approved by the Engineer. Removal of seals prior to Engineer's review of plantings shall be considered grounds for rejection of plant material.
- f. Contractor shall refer to the Drawings for various digging schedule limitations.

Water Quality – The Contractor shall be responsible for providing its own potable water source for use in maintaining plantings until Acceptance.

Submittals

Schedule: Immediately following the Notice to Proceed, submit a schedule for review of plant sources, plant tagging dates, on-site layout review dates, and plant installation dates.

The Contractor shall provide the following samples:

1. Tree Staples for staking
2. Non-biodegradable flagging tape for marking Tree Staples.
3. Two (2) 1lb. bags of crushed stone mulch for review and approval of color and size. Furnish two different color samples in the medium gray range.

Product Data: Submit manufacturer's product data for work of this Section. Provide complete product description and specifications, catalog cuts, and other descriptive data.

Maintenance Schedule as described in this specification.

Guarantee Period

Plant material shall be guaranteed for a period as described below after the date of Acceptance by the Engineer. Plant material of 3"-4" caliper shall be guaranteed for three (3) years from date of Acceptance.

If a Planting Season Variance is granted, the Guarantee Period for the affected plant materials shall extend through the spring (June 30) of the 12-month period following the initial Guarantee Period, without further cost to the City.

Maintain plants for the duration of the Guarantee Period (see Maintenance of Planting description).

Dead plants and plants not in a vigorous, thriving condition, as determined by the Engineer during and at the end of the Guarantee Period, shall be immediately removed and replaced as soon as weather conditions permit and within the specified planting period, without cost to the City. To be considered acceptable, plants shall be free of dead or dying branches and branch tips and shall bear foliage of normal density, size, and color. Replacements shall closely match adjacent specimens of the same species in all qualities. Replacements shall be subject to all requirements stated in this Specification.

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The guarantee of replacement plants shall extend for an additional one (1) year period from the date of their Acceptance after replacement. In the event that a replacement plant is not acceptable during or at the end of the said Extended Guarantee Period, the City may elect one more replacement or full credit for each item not accepted.

Make periodic inspections during the Guarantee Period to monitor the status of the plantings. If any changes in the maintenance program are recommended, they shall be submitted in writing to the Engineer.

At the end of the Guarantee Period, reset grades in planting beds that have settled below the proposed grades on the Drawings.

At the end of the Guarantee Period, the Contractor shall reset trees that have settled below the planting heights specified or are out of plumb.

Final Inspection And Final Acceptance

At the end of the Guarantee Period and upon written request of the Contractor, the Engineer will inspect all guaranteed work for Final Acceptance. The request shall be received at least ten calendar days before the anticipated date for Final Inspection. Upon completion and re-inspection of all repairs or renewals necessary in the judgment of the Engineer at that time, the Engineer shall certify, in writing, that the project has received Final Acceptance.

MATERIALS:

Plants

General - The Engineer shall approve plant material prior to installation. Plants shall be of specimen quality, exceptionally heavy, symmetrical, and so trained or favored in development and appearance as to be unquestionably and outstandingly superior in form, compactness, and symmetry. They shall be sound, healthy, vigorous, well branched, and densely foliated when in leaf; free of disease and insects, eggs, or larvae; and shall have healthy, well-developed root systems. They shall be free from physical damage or other conditions that would prevent vigorous growth. Except as otherwise specified, size and grade of plant materials shall conform to the referenced standards. In no case shall rootball size be less than 10 inches in diameter for each inch of caliper.

1. The size, color, and appearance of leaves shall be typical for the time of year and stage of growth for the particular species/cultivar. Leaves shall not be stunted, misshapen, tattered, discolored (chlorotic or necrotic), or otherwise atypical.
2. The root systems shall be free of injury from biotic (insects, pathogens, etc.) and abiotic agents (herbicide toxicity, salt injury, excess irrigation, etc.). Root distribution shall be uniform throughout the growing media. The trunk and root flare shall be free of circling, girdling, or kinked roots.

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3. Plants shall conform to the measurements specified, except that plants larger than those specified may be used if approved by the Engineer. Use of larger plants shall not increase the contract price. If larger plants are approved, the root ball shall be increased in proportion to the size of the plant, but shall not exceed 50 inches in diameter.
4. Height and spread dimensions specified refer to the main body of the plant and not from branch tip to branch tip. Plants shall be measured when branches are in their normal position. If a range of sizes is given, no plant shall be less than the minimum size. Measurements specified are minimum sizes acceptable after pruning, where pruning is required. Plants that meet measurements but do not possess a standard relationship between height and spread, according to the *American Standards for Nursery Stock*, ANSI Z60.1, shall be rejected.
5. Plants designated B&B shall be properly dug with firm, uncracked, natural balls of soil retaining as many fibrous roots as possible, in sizes and shapes as specified in the *American Standard for Nursery Stock, ANSI Z60.1*. Balls shall be firmly wrapped with non-synthetic, rottable burlap and secured with nails and heavy, non-synthetic, rottable twine. The root collar shall be apparent at surface of ball. Trees with loose, broken, processed, or manufactured root balls will not be accepted.
6. If the depth of the rootflare within the packaged rootball is equal to or greater than $\frac{1}{4}$ the overall depth of the rootball, plant material will be rejected.
7. If discrepancies exist between the plant list and plant materials as shown on the Drawings, quantities shown on the Drawings shall prevail. Plant materials shown on the Drawings are included in his or her bid.
8. Immediately after harvesting plants, protect from drying and damage until shipped and delivered to the planting site. Rootballs shall be checked regularly and watered sufficiently to maintain root viability. Rootballs shall not be permitted to dry out.
9. Roots and rootballs shall show no signs of excess soil moisture conditions as indicated by poor root growth, root discoloration, distortion, death, or foul odor.

Trees

1. Tree canopies should be symmetrical, free of large voids, and typical of the species or cultivar. Crown shall not be significantly deformed by wind, pruning practices, pests, or other factors. Live crown ratio (distance which supports healthy foliage from bottom of canopy to the top/tree height) should be at least 60%.
2. The trunk and main branches shall be free of wounds (except for properly-healed pruning wounds), damaged bark or branches, abrasions, disfiguring knots, sunscald, conks, bleeding, galls, signs of insects or disease, and girdling ties.

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3. As is appropriate for the species, trees shall have a single, relatively straight central leader and tapered trunk, free of co-dominant stems and vigorous upright branches that compete with the central leader. If the original leader has been headed, a new leader at least one-half the diameter of the original leader shall be present.
4. Trees shall stand erect without a supporting stake.
5. Main scaffold branches shall be less than $\frac{2}{3}$ the trunk diameter, free of bark inclusions (places where bark is embedded within the crotch preventing the formation of a normal branch bark ridge), and well-spaced. They should be distributed radially around and vertically along the trunk, forming a generally symmetrical crown typical for the species.
6. Caliper measurements shall be taken on the trunk 6 in. above the natural ground line for trees up to and including 4 in. in caliper, and 12 in. above the natural ground line for trees over 4 in. in caliper.
7. Prior to digging, the north orientation shall be marked on all trees with a small white dot of spray paint at the rootflare. When planting, efforts shall be made to position the tree with the same orientation with which it was growing in the nursery.

Transportation and Storage of Plant Material

1. Plants shall be lifted and handled with suitable support of the soil ball to avoid damage to the plant. Trees shall not be moved by grasping the trunk only.
2. Branches shall be tied with rope or twine only, and in such a manner that no damage or breakage will occur to the bark or branches.
3. Plants must be protected at all times from sun and drying winds.
4. During transportation of plant material, the Contractor shall exercise care to prevent injury and drying out of the plants. Should the roots, foliage, buds, or branch tips be dried out, large branches broken, balls of earth broken or loosened, or areas of bark torn or damaged, the Engineer may reject the injured plant(s) and order them replaced at no additional cost to the City. All loads of plants shall be adequately and appropriately covered at all times with tarpaulin or canvas. Loads that are not protected will be rejected.
5. Those plants that cannot be planted immediately upon delivery shall be kept in the shade, well protected with soil, wet mulch, or other acceptable material, and kept well watered. Due to the urban nature of the project site, it is not anticipated that a temporary holding location on-site will be available and plants shall not be delivered to the site unless they will be planted during the same calendar day.
6. Storage of plant material on-site beyond the day of delivery requires written permission of the Engineer a minimum of five working days prior to the delivery of plant materials to the site. If a holding period is approved, plant branches shall be untied during this holding period and

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spaced no closer together than plants were growing in the nursery production field. The Contractor shall be entirely responsible for the condition and maintenance of the plants while on-site, including but not limited to: watering, and damage to plant materials by the construction activities of other trades. After planting, the Contractor shall be responsible for clean-up and necessary repairs to return the on-site storage location to its prior condition.

Commercial Fertilizer

Fertilizers shall be applied according to ANSI A300 - Standard Practices for Tree, Shrub and other Woody Plant Maintenance.

Bio-stimulant

Bio-stimulants shall contain soil conditioners, VAM (vesicular-arbuscular mycorrhizae), and endomycorrhizal and ectomycorrhizal fungi spores and soil bacteria appropriate for existing soil conditions and plant material specified. Submit manufacturer's literature for approval.

Bio-stimulant shall be watered in at the root zone to promote root growth.

Tree Stabilizing Materials

Staples – To secure trees, Contractor shall use staples (www.treestaples.com) provided by A.M. Leonard (www.amleo.com) or approved equivalent. Use 42" staples for 4-6" caliper trees. Install per manufacturer's instruction.

Crushed Stone Mulch

Crushed Stone Mulch shall be 3/8" crushed stone free from foreign material. The stone shall be angular in shape.

1. Color to be light gray. Contractor to supply a minimum of (2) color choices of medium warm gray tones to L.A. for final approval.

CONSTRUCTION METHODS:

Proximity To Existing Utilities

When planting, trees shall never be placed directly over utility lines which are less than four (4) feet below finish grade. If plans or test pits indicate such, notify Engineer for direction.

Layout Confirmation

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Locations for plants and/or outlines of areas to be planted are to be staked out on the site, and confirmed during excavation for placement of planting soils. Approval of the stakeout by the Engineer is required before excavation of planting pits begins.

Excavation

Tree pits are to be excavated to the depth and widths indicated on the Drawings and per the concrete layout on site.. If the planting area under any tree is initially dug too deep, the soil added to bring it up to the correct level should be thoroughly compacted to avoid settling.

1. The sides of the excavation of all planting areas shall be sloped at 45 degrees.
2. Do not excavate compacted subgrades of adjacent proposed pavement or structures.
3. Excavations shall not be left uncovered or unprotected overnight.

Planting

Plants shall be delivered to the site and set on the ground in the locations shown on the Drawings and marked on site. Plants comprising one oasis shall be delivered at the same time, unless otherwise directed. The Engineer shall determine the specific location of each tree and may adjust locations of plants in the field if deemed necessary.

Review proper tree planting techniques with the Engineer prior to planting.

Solar Orientation: Trees marked on the north side of the trunk while growing at the Nursery shall be planted with the same orientation as they originally grew to reduce trunk damage due to sun-scald, wherever feasible.

Plants shall not be installed until planting layout has been approved by the Engineer.

Walls and bottoms of plant pits shall be sloped. Set plants on flat-tamped or unexcavated pads and must be set plumb and braced in position until Planting Mix has been placed and tamped around the base of the root ball.

Lower plants into planting hole using mesh strapping. While root ball is suspended over planting hole, remove wire basket. Keep mesh strapping on plant until the next step (finding the root flare) is completed.

Plants shall have the root flare set slightly above finished grade of planting soil per notations on the Drawings. Soil overburden on the root flare shall be removed by an experienced plants person only. Planting shall be reviewed by the Owner's Representative before the 3/8" crushed stone mulch is applied.

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Ropes or strings on top of rootball shall be cut and removed. Burlap wrapping shall be left intact around the base of the ball except those portions of wrap that are exposed at top of ball shall be cut back and removed (not buried). Non-biodegradable ball wrapping shall be totally removed from ball and planting pit.

Fertilizers shall be applied according to ANSI A300 - Standard Practices for Tree, Shrub and other Woody Plant Maintenance.

Pits shall be backfilled with specified and approved Planting Mix. Soil shall be worked carefully into voids and pockets, tamping lightly after every 6 in. lift. When pit is two-thirds full, plants shall be watered thoroughly, and water left to soak in before proceeding.

Improper compacting of the soil around the root ball may result in the tree settling or leaning. Trees that settle out of plumb due to inadequate soil compaction either under or adjacent to the root ball shall be excavated and reset. In no case shall trees that have settled out of plumb be pulled upright using guy wires.

Lift plants only from the bottom of the root balls or with belts or lifting harnesses of sufficient width not to damage the root balls. Do not lift trees by their trunk or use the trunk as a lever in positioning or moving the tree in the planting area.

After installed planting has been reviewed and approved by the Engineer all nursery and plant identification tags shall be removed by the Contractor.

Anti-desiccant shall be applied to planting subject to excessive wind or freezing temperatures, as directed by the Engineer.

Tree Stabilizing

Each tree shall be stabilized with two to three tree staples immediately following planting. Plants shall stand plumb after staking or guying.

Staples shall be tied at the top with non-biodegradable neon orange flagging tape so that they will be noticeable in the event of tree removal and stump grinding.

Pruning of Newly Planted Trees

Plants shall not be heavily pruned at the time of planting. In no case shall more than one-quarter of the branching structure be removed.

Pruning is required at planting time to correct defects in the tree structure, including removal of injured branches, double leaders, waterspouts, suckers, and interfering branches. Healthy lower branches and interior small twigs should not be removed except as necessary to clear walks and roads. Retain the normal or natural shape of the plant.

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Pruning shall be completed using clean, sharp tools and carried out by an experienced plants person. Cuts shall be clean and smooth, with the bark intact with no rough edges or tears. Small cuts shall be made with bypass pruners, anvil-type pruners shall not be used.

Pruning above head height shall be done from a hydraulic man-lift or using other mechanisms such that it is not necessary to climb the tree.

Maintenance Of Planting

Submit a Maintenance Schedule for the entire Guarantee Period that outlines watering, monitoring for health, applying sprays (as necessary), etc. as required per the Maintenance program specified.

Maintenance shall begin immediately after each plant is planted and shall continue until the end of the Guarantee Period.

Maintenance shall consist of pruning, weeding, mulching, removal of dead wood, repairing and replacing of tree stakes, resetting plants to proper grades and upright position, and furnishing and applying such sprays as are necessary to keep plantings free of insects and disease, and in a healthy growing condition.

Water plants as required to maintain vigorous and healthy growth until the end of the Guarantee Period.

Planting areas and plants shall be protected against trespassing and damage for the duration of the maintenance period. If a plant becomes damaged or injured, it shall be treated or replaced as directed by the Owner's Representative at no additional cost.

Overwatering or flooding shall not be allowed. Monitor, adjust, and furnish any additional material, equipment, or water to ensure adequate irrigation.

The City will not provide a potable water source for this project.

COMPENSATION:

Plantings of various types will be measured by the unit Each. The unit bid price per each item shall constitute full compensation for providing materials, equipment, labor and incidentals required to perform the work of this Item, including but not limited to coordinating the work with other relevant items; locating sources of plants; excavation of previously placed planting soils; furnishing and installing plant materials and crushed stone mulch; providing potable water; performing initial pruning; providing inspection and maintenance on plant materials and replacing dead plants during guarantee period; resetting plants which have settled during guarantee period.

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ITEM 32798**LANDSCAPE MAINTENANCE****LUMP SUM**

This work under this item shall include the Landscape Maintenance and shall conform to relevant provisions of Standard Specifications Section 771 and these Special Provisions, and as detailed on the Drawings and as directed by the Engineer.

Submittals

Materials List: provide list of materials to be used in maintenance; materials shall be the same as approved in related sections:

1. Fertilizers, soil amendments, testing see subsection 32751.
2. Plant materials, mulch, and related materials, see subsection 32771.

Pest and Disease Treatment

Submit plan for pest and disease treatment; identify proposed materials and methods. Explain why a problem does or may exist.

Maintenance Manual – Site Landscape

Provide a maintenance manual to Engineer describing operations for on-going upkeep of the installed plants. The manual shall address itself to specified types and uses of plants installed, and provide information for care of both newly installed plants and long-term maintenance.

Provide specific information on the following items:

1. Watering: Watering season; diagnosis of watering need; frequency of watering; amount; time of day; methods and equipment; equipment maintenance.
2. Fertilization: Fertilizing seasons; analysis for fertilizer selection; application rates and methods; preparation and conditions; application times; application equipment; post-application operations and care; precautions for fertilizer use.
3. Liming: Liming season; analysis for liming; application rate; method and equipment for application.
4. Pruning: Pruning goals and purposes; methods and techniques (relate to species); equipment; season; cleanup and disposal; precautions.
5. Mulching of beds: Depths of mulch; refreshment and replacement of mulch.
6. Miscellaneous plant maintenance: Weeding and weed control; pest and disease control; leaf and litter removal; bed edging; professional assistance for plant care; and plant replacement as necessary.

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Include a month-by-month calendar of maintenance procedures, indicating operations listed above.

Submit a copy of maintenance manual to the Engineer for approval. Submit prior to planting completion. The Engineer may request revisions to manual to meet intent of project design.

Submit three copies of manual to Engineer at acceptance meeting for planting work. Acceptance shall not be granted until manual has been submitted and approved.

Quality Assurance

Qualifications: contractor shall have minimum five years of experience in landscape maintenance.

Quality Assurance

Qualifications: contractor shall have minimum five years experience in landscape maintenance.

Regulatory Requirements

1. Secure permits, licenses, and pay fees including traffic control.
2. Comply with laws, regulations, and quarantines for agricultural and horticultural products.

Delivery, Storage and Handling

Packing and Shipping: deliver materials in unopened containers bearing the manufacturer's name. Transport materials without damage. Protect finishes from abrasion, dirt, oils, grease, and chemicals. Pack materials to protect from weather.

Acceptance at Site: verify in writing that delivered materials conform to specifications and approved submittals.

Storage and Protection:

Store materials in dry place, on pallets, off the ground; protect from sun. Protect materials from theft, damage, weather, dirt, oils, grease, and construction.

Project / Site Conditions

Environmental Requirements: do not work soils when dry, wet, or frozen.

Field Test

1. Form soil in palm of hand, if soil retains shape and crumbles upon touching, the soil may be worked.
2. If soil will not retain shape it is too dry and should not be worked.
3. If soil retains shape and will not crumble, it is too wet and should not be worked.

Planting Season

For planting season for deciduous and evergreen plant materials, see "Landscape Planting" items above.

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Substantial Completion

Upon completion of planting, request Engineer's review to determine if work is substantially complete. If work is complete, Engineer will issue a Letter of Substantial Completion that establishes the effective date of the start of the 120-day Maintenance Period.

1. If work is not substantially complete, Engineer will make a list of outstanding work to be done on a timely schedule agreed upon by Contractor and Engineer.
2. Contractor shall notify Engineer when outstanding work is accomplished and ready for review. When outstanding work is complete, in the judgment of Engineer, a Letter of Substantial Completion will be issued.

120 Day Maintenance Period

Maintain planting until the end of 120-day maintenance period and until the receipt of the Letter of Preliminary Acceptance.

Preliminary Acceptance

After the 120-day Maintenance Period, work will be reviewed for completeness and start of 1-year Guaranty Period for plantings.

Plantings shall be in thriving and vigorous condition at the time of review for Preliminary Acceptance. If plantings are acceptable, Engineer will issue a Letter of Preliminary Acceptance establishing the effective date of the one-year Guaranty Period.

1. If plantings are not thriving, in the judgment of Engineer, remedial actions by Contractor will be required to repair or replace plantings.
2. Remedial work shall be done immediately and in accordance with related work of other sections.
3. At the conclusion of remedial work, Engineer will review work and extend the Maintenance Period another 90 days to incorporate new plantings.

Final Acceptance

After the 1-year Guaranty Period, plantings will be reviewed.

Plantings shall be in thriving and vigorous condition at the time of review for Final Acceptance. If plantings are acceptable, Engineer will issue a Letter of Final Acceptance.

1. If plantings are not thriving, in the judgment of Engineer, remedial actions by Contractor will be required to replace plantings.
2. Remedial work shall be done immediately and in accordance with related work of other sections.
3. At the conclusion of remedial work, Engineer will review work and extend the Guaranty Period until plantings are deemed acceptable.

MATERIALS

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Materials

Materials utilized during the maintenance period shall be the same specified in the work of the related sections:

1. Fertilizers, soil amendments, testing, see subsection 32751.
2. Plants, mulch, and related materials, see "Landscape Plantings" section above.

Biological, Horticultural, Herbicidal and Other Pest Control

Material Specification: shall be by a licensed pest control operator, with authority to purchase, utilize, and specify agricultural chemicals and agricultural products.

Use the least hazardous, least intrusive materials and methods.

Equipment

Vehicles: in good working order so oil and grease does not stain pavements and poison plantings. Signs identifying the vehicles shall be clearly displayed.

Machinery: in good working order so oil and grease does not stain pavements and poison plantings.

Water

Water: Furnished by Contractor, suitable for irrigation and free from ingredients harmful to plant life. Hose and other watering furnished by Contractor.

CONSTRUCTION METHODS

Examination

Verification of Conditions: in the event field conditions are not as shown on Drawings and outlined in the Specifications, notify Engineer in writing.

Preparation

Protection:

1. Agricultural Chemicals: protect site improvements from contact with agricultural chemicals, soil amendments, and fertilizers.

Pruning of Newly Planted Trees

Pruning: prune with approval of Engineer.

1. Remove dead branches, rubbing branches, and branch work growing towards the center of the tree.

Drainage

Observe drainage in plant pits with hand soil augur.

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Verify plant pits are draining; plant pits not draining shall be identified on the plan and brought to the attention of Engineer.

Plants

Maintain plants in vigorous condition throughout the Maintenance and Guaranty Periods.

Replace plants that are missing, dead, not true to name or size as specified, or not in satisfactory growth, as determined by Engineer. Replace plants found unacceptable within one month or in first month of next growing season, whichever comes first.

Plants must show a minimum of 75% healthy head with obvious growth since planting. Signs of disease, injury, or damage shall have been successfully treated or plant shall be rejected as determined by Engineer.

Replacements plants shall be same kind and size as specified in plant list. Furnish and plant. Cost of replacement borne by Contractor except where it can be shown loss resulted from vandalism, fire, theft, or other causes beyond Contractor's control. Restore areas damaged or disturbed by replacement operations to their original condition.

Irrigation

Water at a rate of one inch of water every five to seven days. Apply water such that it penetrates the soil to a depth of 6". Trees require a minimum of ten gallons each and shrubs a minimum of five gallons each per week. If spring or fall months experience below average rainfall, periodic watering could be extended as requested by Engineer. If natural rainfall provides water to meet watering requirements, weekly watering could be reduced but only at the request of Engineer.

Plant Basins

Keep foot tamped and shaped earth dikes around plantings.

Tree Guys

Tree stakes: maintain plumb; adjust flexible ties.

Guys: maintain wires taut; adjust turnbuckles; keep flags on wires.

Finish Grade

Maintain finish grades around plantings, at pavement edges, and at irrigation fixtures.

Mulch

Maintain mulch at 2" depth in shrub and perennial areas with the exception of at stems and trunks of plants where mulch to be placed to a 0" depth and increasing to a depth of 2" at edge of rootballs and beyond and 1" in areas of low groundcover.

Treatment of Pests and Diseases

Spray for both insect pests and diseases during maintenance period with permission of Engineer. Apply herbicides, insecticides and fungicides as prescribed by their

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manufacturer and in accordance with The Commonwealth of Massachusetts laws. Contractor shall possess from the Commonwealth of Massachusetts the proper registrations and permits for application of materials or have applications made by approved, qualified firm holding registrations and permits. Furnish copies of permits in connection with materials to Engineer. Spraying to be considered only after full consideration has been given to alternative pest control strategies. The least toxic approach to pest control shall be used.

Field Quality Control

See requirements under “Landscape Plantings” specifications.

Adjusting

Re-set settled plants to proper grade and position.

Restore planting saucer and adjacent material.

Cleaning

Clean up, remove and dispose off-site excess planting mixture, soil and debris generated under work of this section.

Remove and dispose of stakes, guys and other accessories at end of Guaranty Period.

Wash and sweep clean site improvements and building surfaces. Clean spills and over-sprays immediately.

Repair damage caused by maintenance operations.

Protection

Protect work of this section until Final Acceptance

Protect planted areas and soils from compaction by construction traffic and from contamination by construction materials.

COMPENSATION:

Item 327798, Landscape Maintenance will be paid for at the contract unit price, per lump sum, which price shall include full compensation for labor, equipment, materials and incidental costs to complete the work.

NOTES ON EXCLUSIONS:

Protection and maintenance of existing trees is not included in this item and is paid for elsewhere.

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32804.11	ELECTRICAL CONDUIT (SINGLE) CONCRETE ENCASED (LIGHTING)	FOOT
32804.12	ELECTRICAL CONDUIT (DOUBLE) CONCRETE ENCASED (LIGHTING)	FOOT

DESCRIPTION:

Work to be done under this item shall consist of performing trench excavation and backfill operations, as well as furnishing and installing PVC (polyvinyl chloride) conduit and fittings. All installations shall be encased in a minimum of 3” of concrete as shown on the drawings. This work shall be performed in accordance with the National Electrical Code, the details shown in the Contract Specifications and as may be directed by the Engineer.

Conduits between lighting control enclosures or utility manhole to electric hand holes or lighting control enclosures shall be 4 inches.

Conduits between hand holes and light bases or receptacles shall be 2 inches.

MATERIALS:

Rigid non-metallic conduit and fittings shall be high-quality polyvinyl chloride conduit (PVC). PVC conduit shall be heavy-wall Type 40, shall conform to industry standards and Commercial Standard CS207-60, shall be listed by Underwriters' Laboratories for direct burial underground use, and shall conform to or exceed all property requirements of UL651 and NEMA TC-2, 1970. All conduit shall be furnished with plain ends.

CONSTRUCTION METHODS:

The perimeter of the paved area to be removed for conduit installation shall be sawcut.

The depth of excavation shall be sufficient to allow passing the conduit beneath curb as necessary and encasing the conduits as specified herein and as shown on the plans. Conduits shall have a minimum of thirty inches (30”) of cover in the public way. Any deviation from this requirement must be approved by the City of Cambridge Electrical Department and Engineer prior to installation.

Porous base material shall be wet as directed before placing the concrete. Unless otherwise directed, the concrete shall be compacted to the level as shown on the plans.

A 6-inch wide magnetic marker tape shall be placed approximately 2-feet above underground conduit. This tape shall be colored and serve as a warning device to

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personnel who may be involved in future excavations that 600 volt cable is located below and should be avoided if possible. It will serve as a general warning that hand digging is required beyond this point in order that the rigid non-metallic conduit below the tape is not damaged or otherwise penetrated.

PVC conduit shall be jointed by means of solvent cement joints. Conduit shall be cut square and deburred. All surfaces shall be wiped clean and dry. Using a natural bristle brush of width about equal to conduit size, the Contractor shall apply a coat of cement to the outside of the conduit end. (Note: Cement should be flowed on and not brushed out). Conduit and coupling shall then be firmly pressed together and the fitting turned a quarter turn to distribute the cement evenly. The time elapsed between applying the cement and completing the joint should not exceed 60 seconds. All conduit and fittings shall be watertight.

All conduits shall be free of foreign materials prior to the installation of conductors

A polypropylene or nylon pull rope shall be installed in all empty conduits.

Conduits shall be sealed after installation, prior to installing conductors.

COMPENSATION:

The items of this subsection will be measured by the foot installed complete, which price and payment shall constitute full compensation for complete compliance with requirements of this item, including all labor, equipment, materials, tools, incidental work, excavation, concrete, backfill, compaction, surface restoration and construction methods.

Payment for work under these items shall include full compensation for sawcutting; excavation of existing pavement in roadway areas and asphalt, brick and concrete sidewalk pavements; and disposal of construction debris (existing sidewalk, concrete, brick, asphalt, etc.). Encased conduit runs will be paid for under the appropriate bid item based only on the number of conduits in the run, regardless of individual conduit size or sizes in the run.

No separate payment shall be made for marking tape, pull rope, concrete, or any incidental materials, but all costs in connection therewith shall be included in the Contract unit price per foot for these Items.

NOTES ON EXCLUSIONS:

Disposal of any excavated soil not suitable for re-use is not included for payment under this item and shall be paid for separately.

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32804.3

**3 INCH ELECTRICAL CONDUIT TYPE NM –
PLASTIC (UL) (SIGNAL)**

FOOT

DESCRIPTION:

Work under this item shall conform to Section 800 of the MassDOT Standard Specifications and the following:

The 3 inch Electrical Conduit, Type NM shall be installed as indicated on the plans and as directed by the Engineer. This item shall be used for the interconnect conduit between Howard Street, Putnam Avenue, and Memorial Drive as shown on the plans.

Conduit to be installed into signal bases, pull boxes, traffic signal control box foundations, and mast arm foundations shall be installed in accordance with the plans and details shown on the MassDOT Standard Drawings.

Conduit in grass or in planted areas

Where new conduits are installed in grass and planted areas, work shall include placement of a minimum of 6 inches of loam borrow, seed, and any other materials replaced in kind to restore disturbed areas to their original condition. Any existing plants (bushes, flowers, etc.) removed or damaged as a result of this project shall be replaced in kind. No separate payment shall be made for this work, but all costs in connection therewith shall be included in Item 32804.3.

Conduit under sidewalk

Where conduit is installed in sidewalk areas, the work shall include excavating and restoring the existing surface in kind. No separate payment shall be made for this work, but all costs in connection therewith shall be included in Item 32804.3.

Conduit in Roadways

Trenches in existing bituminous concrete pavements shall be sawcut to 18 inches wide. The existing pavement shall be sawcut through their full depth and the pavement removed.

Trench bed shall be prepared in accordance to detail shown on Traffic Signal Plan(s) including sand bedding and marking tape. After conduit installation, the trench shall be backfilled with controlled density fill (CDF). CDF shall be Type 2E and shall be as specified in Section M4.08.0 of the MassDOT Standard Specifications. The finished grade of the CDF shall be 4 inches below existing pavement surface or at the sidewalk subgrade elevation, as appropriate. Two 2-inch lifts of hot mix asphalt (top course material) shall be placed over the CDF when hardened in roadway locations.

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COMPENSATION:

Items 32804.3 will be measured by the Foot installed complete, which price and payment shall constitute full compensation for complete compliance with requirements of this item, including all labor, equipment, materials, tools, incidental work, excavation, backfill, compaction, surface restoration and construction methods.

Payment for work under these items shall constitute full compensation for sawcutting; excavation of existing pavement in roadway areas and asphalt, brick and concrete sidewalk pavements; and disposal of construction debris (existing sidewalk, concrete, brick, asphalt, etc.).

No separate payment shall be made for sand bedding, marking tape, Controlled Density Fill, binder and top course hot mix asphalt pavement, or any incidental materials, but all costs in connection therewith shall be included in the Contract unit price per foot for Item 32804.3.

NOTES ON EXCLUSIONS: Disposal of any excavated soil not suitable for re-use is not included for payment under this item and shall be paid for separately.

32811.22 ELECTRIC HANDHOLE – SD2.022 (TRAFFIC) EACH

DESCRIPTION:

Work under this Item shall consist of furnishing and installing 24” x13” traffic signal handholes in accordance with the Contract Drawings, as specified in these Specifications, and as directed by the Engineer.

Materials and methods shall comply with Section 801.40 and 801.61 of the MassDOT Standard Specifications with the exception of excavation. All or any excavation relative to this item shall be included as part of this Item. Units shall be precast concrete as shown on MassDOT Standard Drawings SD2.022. Handhole covers shall be clearly marked “TRAFFIC”.

COMPENSATION:

Payment under this Item shall be at the Contract unit price bid per each, complete in place, and shall be full compensation for furnishing and setting handhole, frame and cover, excavation, backfill and with all materials, labor, equipment necessary to complete the work.

Payment for work under these items shall constitute full compensation for sawcutting; excavation of existing pavement in roadway areas and asphalt, brick and concrete

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sidewalk pavements; and disposal of construction debris (existing sidewalk, concrete, brick, asphalt, etc.).

NOTES ON EXCLUSIONS: Disposal of any excavated soil not suitable for re-use is not included for payment under this item and shall be paid for separately.

32811.27

ELECTRIC HANDHOLE (LIGHTING)

EACH

MATERIALS:

Handholes for lighting shall be precast reinforced concrete in accordance with Section 801 of the MassDOT Standard Specifications, and shall conform to the details shown on the Drawings and the following:

Precast handhole units for lighting shall be 12"W x 24"L x 20" D and shall otherwise meet the requirements of MassDOT Standard Specifications Section M4.02.14. Covers shall be clearly marked "LIGHTING".

CONSTRUCTION METHODS:

In general, the locations of lighting handholes are shown diagrammatically on the drawings. In general, it is the intent that a lighting handhole with ground rod be located between two adjacent light fixtures.

A handhole must be installed prior to the streetlight control cabinet for the service connection. No conductors other than the service entrance conductors shall be permitted in this handhole.

Each lighting installation shall be fused in the handhole associated with the fixtures. Fusing shall be provided by means of an in-line fuse holder, Tron HEB Series Single Pole Breakaway or approved equal, 10 ampere fuse. No fusing shall be allowed in the base of light poles.

COMPENSATION

Item 32811.27 will be measured by the unit Each installed complete, which price and payment shall constitute full compensation for complete compliance with requirements of this item, including all labor, equipment, materials, tools, incidental work, excavation, backfill, compaction, surface restoration and construction methods.

Payment for work under these items shall constitute full compensation for sawcutting; excavation of existing pavement in roadway areas and asphalt, brick and concrete sidewalk pavements; and disposal of construction debris (existing sidewalk, concrete, brick, asphalt, etc.).

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NOTES ON EXCLUSIONS:

Disposal of any excavated soil not suitable for re-use is not included for payment under this item and shall be paid for separately.

32812.09 LIGHT STANDARD FOUNDATION (STANDARD PRECAST) EACH

DESCRIPTION:

Work under this item shall conform to the requirements of Section 801 of the MassDOT Standard Specifications, the details shown on the Drawings, and the following:

MATERIALS:

Precast units shall meet the requirements of MassDOT Standard Specifications Section M4.02.14.

Steel reinforcing bars shall be deformed bars rolled from new billet steel conforming to the requirements of ASTM A615, Grade 60.

The Contractor shall provide 2" rigid galvanized steel conduit to stub out of base.

CONSTRUCTION METHODS:

All foundations shall be installed at the location as shown on the plan except as approved deviations are required to meet field conditions. All locations must be approved by the Engineer prior to installation.

Anchor bolts shall be set according to the template furnished by the light pole manufacturer. All foundations will be set plumb and true to grade.

The Contractor shall carefully mark the proposed location of the concrete foundation and then shall determine if any utilities or underground or overhead obstruction will prevent the installation at this location. Similar marking shall be done for the conduit runs to the foundation. If such an obstruction is evident, the Contractor shall request permission from the Engineer to move or adjust the location of the foundation.

If no obstruction is apparent at the proposed foundation location, the Contractor shall make an excavation in order to install the foundation as detailed on the drawings, to be accomplished with hand digging. Mechanical excavating equipment may be used if approved by the Engineer. The Contractor must provide a compacted 6-inch cushion of gravel borrow under the foundation and shall backfill using acceptable excavated material or gravel borrow compacted in 6-inch layers around the foundation. A compaction of 95% for the backfill material of the excavation is required.

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The backfill shall be thoroughly compacted by tamping with a pneumatic hammer equipped with a round dirt tamping pad with a minimum diameter of 6-inches driven by an air compressor with a minimum of 100 psi pressure.

The use of an impactor attachment on a standard back hoe with a dirt tamping pad may substitute for the pneumatic hammer with the permission of the Engineer. Use of a vibrator type compactor around pre-cast foundations or handholes is prohibited.

If the Contractor encounters no difficulty in the excavation and the soil conditions are suitable to support the foundation, the Contractor shall install the pre-cast concrete foundation. The top of the foundation must be level and installed as indicated on the detail plans. If difficulty is encountered in excavation due to underground obstructions, ledge, rock or when, in the opinion of the Engineer, the soil conditions require, the Contractor may install an approved precast short foundation or cast-in-place foundation (Item 32812.99) with the approval of the Engineer.

Where foundations are placed adjacent to straight sections of roadway curb, the bolts and face of foundation shall be parallel with the face of the curb. When adjacent to curvbed curb, the bolts may be adjusted with the approval of the Engineer to allow proper placement of the pole when installed.

COMPENSATION:

Item No. 32812.09, will be measured by the unit Each installed complete, which price and payment shall constitute full compensation for complete compliance with requirements of this item, including all labor, equipment, materials, tools, incidental work, excavation, backfill, compaction and construction methods.

Payment for work under these items shall constitute full compensation for sawcutting; excavation of existing pavement in roadway areas and asphalt, brick and concrete sidewalk pavements; and disposal of construction debris (existing sidewalk, concrete, brick, asphalt, etc.).

NOTES ON EXCLUSIONS:

Disposal of any excavated soil not suitable for re-use is not included for payment under this item and shall be paid for separately.

32812.99 LIGHT STANDARD FOUNDATION (CAST-IN-PLACE) CUBIC YARD

DESCRIPTION:

The work under this Item consists of the construction of reinforced cast-in-place shallow spread footing lighting foundations where underground utilities or other obstructions

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prevent the installation of standard pre-cast foundations. This item may only be used with the prior approval of the Engineer.

The work under this Item shall conform to the requirements of Section 900 of the MassDOT Standard Specifications, the requirements of Item 32812.09, and the following:

MATERIALS:

Concrete shall meet the requirements of MassDOT Standard Specifications Section 901, and shall be 1 ½” aggregate with 565 cement with a minimum compressive strength at 28 days of 4,000 psi.

Steel reinforcing bars shall be deformed bars rolled from new billet steel conforming to the requirements of ASTM A615, Grade 60, epoxy coated.

The Contractor shall provide 2” rigid galvanized steel conduit to stub out of base.

CONSTRUCTION METHODS:

The top of the pedestal and foundation must be level and installed as indicated on the detail plans which will be provided by the Engineer prior to installation. If difficulty is encountered in excavation due to underground obstructions, the Contractor shall submit a request for information detailing the obstructions encountered. A bond break shall be provided between the footing and adjacent materials.

COMPENSATION

Item 32812.99 will be measured by the unit CUBIC YARD installed complete, which price and payment shall constitute full compensation for complete compliance with requirements of this item, including all labor, equipment, materials, tools, incidental work, excavation, backfill, compaction and construction methods.

Payment for work under these items shall constitute full compensation for sawcutting; excavation of existing pavement in roadway areas and asphalt, brick and concrete sidewalk pavements; and disposal of construction debris (existing sidewalk, concrete, brick, asphalt, etc.).

No separate payment shall be made for formwork, steel reinforcement, or any incidental materials, but all costs in connection therewith shall be included in the Contract unit price per cubic yard for Item 32812.99

NOTES ON EXCLUSIONS: Disposal of any excavated soil not suitable for re-use is not included for payment under this item and shall be paid for separately.

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32813.30 WIRE TYPE 7 NO. 10 GENERAL PURPOSE	FOOT
32813.33 WIRE TYPE 7 NO. 4 GENERAL PURPOSE	FOOT
32813.36 WIRE TYPE 7 NO. 1/0 GENERAL PURPOSE	FOOT

DESCRIPTION:

The work of these Items shall conform to the requirements of Section 813 of the MassDOT Standard Specifications and the following:

MATERIALS:

The minimum size wire from the circuit breaker to all hand holes shall be Two (2) No.1/0 A.W.G. type THHN copper. 1 Black, 1 White and 1 No.4 A.W.G. THHN copper. Green for grounding conductor

The minimum size wire from the handholes to each light fixture luminaire, shall be two No. 10 A.W.G. type THHN copper for each service and one No. 10 A.W.G. type THHN copper for grounding. 1 Black, 1 White and 1 Green for grounding conductor

The minimum size wire from the handholes to each receptacle mounted at top of light pole, shall be two No. 10 A.W.G. type THHN copper for each service and one No. 10 A.W.G. type THHN copper for grounding. 1 Black, 1 White and 1 Green for grounding conductor

The minimum size grounding conductor from handhole or light fixture to ground rod shall be No. 4 AWG THHN copper with an approved type connection at each ground rod and light fixture.

Wires shall be continuous where practicable and where splices are made pressure connectors suitable for the purpose shall be used.

CONSTRUCTION METHODS:

Runs of wire and cable from the handholes to each light fixture shall be continuous with no splices except as required for branch connections. Splices, where required, shall be made in the handholes with compression type fittings suitable for the application. Shop drawings of the compression splice fittings shall be submitted for approval, by the Engineer, prior to any order being placed.

Runs of wire and cable from the lighting load center to the handholes shall be continuous with no splices except as required for branch connections. Splices, where required, shall

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be made in the handholes with compression type fittings suitable for the application. Shop drawings of the compression splice fittings shall be submitted for approval, by the Engineer, prior to any order being placed.

COMPENSATION:

Items 32813.30 thru 32813.35, will be measured by the Foot installed complete, which price and payment shall constitute full compensation for complete compliance with requirements of this item, including all labor, equipment, materials, tools, incidental work, and construction methods.

32813.71

GROUND ROD 8 FT. LONG

EACH

DESCRIPTION:

The work of this Item shall conform to the requirements of Section 813 of the MassDOT Standard Specifications and the following:

An 8 foot long, 3/4 inch copper-clad ground rod shall be provided for all light control enclosures, light fixtures and handholes. The minimum size grounding conductor shall be No. 4 AWG with an approved type connection at each ground rod and light fixture. All steel conduit where used shall be bonded. The grounding conductor shall be continuous and where connections are made, pressure connectors suitable for the purpose shall be used. The conductor shall provide connection between the associated handhole cover frame and the ground rod and between the handhole ground rod and the lighting pole. This connection will be made with an exothermic weld.

CONSTRUCTION METHODS:

Connections from the ground wire to the ground rod will be made with an exothermic weld at the ground rod. Connections to street lighting cabinets and light poles shall be made by means of a compression lug.

COMPENSATION:

Item 32813.71 will be measured by the Each installed complete, which price and payment shall constitute full compensation for complete compliance with requirements of this item, including all labor, equipment, materials, tools, incidental work, and construction methods.

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DESCRIPTION:

The work of this Item shall conform to the requirements of Sections 813 and 815 of the MassDOT Standard Specifications and to the following:

The Contractor shall provide all labor, materials, tools; field-test instruments and installation equipment required for the complete installation of a new outdoor 12 strand single mode fiber optic cable in new and existing conduits as shown in the Contract Documents.

The work shall include furnishing and installation of a complete underground fiber interconnect system, in proposed conduit including wiring and incidental work between traffic signal controllers on Western Avenue within the project area. Two runs shall be installed as follows:

Run No. 1 From Western Avenue at Memorial Drive (controller) to Western Avenue at Putnam Avenue (master controller).

Run No. 2 From Western Avenue at Putnam Avenue (controller) to Western Avenue at Howard Street (controller).

Run No. 3 From Western Avenue at Howard Street (controller) to River Street at Green Street (handhole)

MATERIALS AND CONSTRUCTION METHODS:

The Contractor shall install labels on the cable at each manhole or hand hole using permanent water proof tags describing the terminating locations.

All communications cable shall be installed in accordance with the plans, these Special Provisions, all industry standards and safety practices for communications cable. All communications cable shall be installed in the presence of the Engineer.

The cables shall be terminated only on patch panels located inside controller cabinets. The Contractor shall provide as-built wiring lists for each terminal point as part of the required documentation. The jacket color and associated function of each communication wire shall be clearly indicated. The Contractor shall be responsible for the complete installation and proper wiring of the communication cable, including any necessary accessories such as surge protectors, patch panels, etc. No cable splices shall be allowed between controller cabinets.

All communication cable installed under this Contract shall be identified with permanently attached plastic labels at each controller cabinet. The labels shall either be embossed or printed with permanent non-fading ink, indicating the name of the

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intersection that is at the other end of the cable and bearing the legend "TRAFFIC COMMUNICATIONS CABLE." The Engineer shall approve the label format and attachment mechanism before label installation. Requirements of the local utility companies and pole owners for clearances between communications cables and other cable, such as electric power cable, shall be strictly followed at all times.

FIBER OPTIC CABLE SYSTEMS

Products

1. Fiber Optic Cable - General
 - a. Fiber optic cable shall be of a loose tube buffer type; containing 12 strands of single mode optical fiber.
 - b. The fiber optic cable shall be suitable for the use to which it is intended and shall be compatible with any other existing fiber segments to which it will be spliced or connected.
 - c. The fiber optic cable shall be suitable for use at wet locations and at all locations where it is intended to be installed.
 - d. The fiber optic cable shall meet the following requirements:
 - e. Maximum Tensile Loads:
 - i. Short-Term: 2700 N (600 lbf)
 - ii. Long-Term: 810 N (180 lbf)
 - f. Temperatures:
 - iii. Storage: -40° to +70°C (-40° to +158°F)
 - iv. Installation: -30° to +60°C (-22° to +140°F)
 - v. Operation: -40° to +70°C (-40° to +158°F)
 - g. Approvals and Listings: National Electrical Code® (NEC®) OFN-LS, CSA OFN FT-4-ST1, IEEE-383 flame test.
 - i. Approved Installations: Outdoor aerial and duct, suitable for wet areas.
 - ii. Design and Test Criteria ANSI/ICEA S-104-696.
2. Single Mode Optical Fiber (9/125 μm) Specifications
 - a. The optical fibers shall be enhanced to provide full spectrum performance between the 1260 nm to 1650 nm wavelength spectrum.
 - b. The optical fibers shall comply with ITU Recommendation G.652.D defining full spectrum, low water peak fiber.
 - c. The optic fibers shall comply with the following standards:
 - i. IEC International Standard 60793-2-50 Type B.1.3 Optical

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Fiber Specifications

- ii. Telcordia GR-20-CORE
 - iii. ANSI/ICEA S-87-640
 - iv. RUS 7CFR 1755.900
3. The optical fibers shall have the following attenuation characteristics, or better:
- a. Attenuation at 1310 nm 0.33 – 0.35 dB/km.
 - b. Attenuation at 1383 nm 0.32 – 0.35 dB/km.
 - c. Attenuation at 1460 nm 0.25 dB/km.
 - d. Attenuation at 1550 nm 0.19 – 0.21 dB/km.
 - e. Attenuation at 1625 nm 0.20 – 0.23 dB/km.
4. The optical fibers shall have the following Chromatic Dispersion characteristics, or better:
- a. At 1285 - 1330 nm $\leq |3|$ ps/[nm.km]
 - b. At 1550 nm ≤ 18 ps/[nm.km]
 - c. At 1625 nm ≤ 18 ps/[nm.km]
5. The optical fibers shall have the following Polarization Mode Dispersion (PMD) characteristics, or better:
- a. At 1285 - 1330 nm $\leq |3|$ ps/[nm.km]
 - b. At 1550 nm ≤ 18 ps/[nm.km]
 - c. At 1625 nm ≤ 18 ps/[nm.km]
6. Fiber Optic Cable Construction Specifications
- a. The Fiber Optic Cable shall be an accepted product of the United States Department of agriculture rural Utilities Service (RUS) 7 CFR 1755.900 (PE-90) and meet the requirements of ANSI/ICEA Standard for Fiber Optic Outside Plant Communications Cable, ANSI/ICEA S-87-640-2006.
 - b. The Fiber Optic Cable shall be of a Double Jacket type with the following material specifications:
 - i. Jackets shall be polyethylene (PE)
 - ii. Cable shall include water swellable tape and yarn
 - c. Optical fibers shall be placed inside a loose buffer tube.
 - d. Each buffer tube shall contain up to 12 fibers.
 - e. The fibers shall not adhere to the inside of the buffer tube.
 - f. Each fiber shall be distinguishable by means of color coding in accordance with TIA/EIA-598-B, "Optical Fiber Cable Color Coding".
 - g. The fibers shall be colored with ultraviolet (UV) curable inks.
 - h. Buffer tubes shall be distinguishable by means of color coding in accordance with TIA/EIA-598-B, "Optical Fiber Cable Color Coding".
 - i. In buffer tubes containing multiple fibers, the colors shall be stable

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across the specified storage and operating temperature range and not subject to fading or smearing onto each other or into a gel filling material, if present.

- j. The buffer tubes shall be resistant to external forces and shall meet the buffer tube cold bend and shrinkback requirements of 7 CFR 1755.900.
- k. The central member shall consist of a dielectric, glass reinforced plastic (GRP) rod to provide tensile strength and prevent buckling. The central member shall be overcoated with a thermoplastic material when required to achieve dimensional sizing to accommodate buffer tubes and fillers.
- l. Each buffer tube shall be filled with a non-hygroscopic, non-nutritive to fungus, electrically non-conductive, homogenous gel. The gel shall be free from dirt and foreign matter. The gel shall be readily removable with conventional nontoxic solvents.
- m. The cable jacket shall be free of holes, splits and blisters.
- n. The cable jacket shall contain no metal elements and shall be of a consistent thickness.
- o. Cable jackets shall be marked with the manufacturer's name, month and year of manufacture, sequential meter or foot markings, a telecommunications handset symbol as required by Section 350G of the National Electric Safety Code, fiber count and fiber type. The print color shall be white.

7. Fiber Optic Cable Performance Specifications

8. When tested in accordance with FOTP-82, "Fluid Penetration Test for Fluid-Blocked Fiber Optic Cable," a one meter length of unaged cable shall withstand a one meter static head or equivalent continuous pressure of water for one hour without leakage through the open cable end.

9. When tested in accordance with FOTP-81, "compound Flow (Drip) Test for Filled Fiber Optic Cable," the cable shall exhibit no flow (drip or leak) of filling and/or flooding material at 70-degrees C.

10. All optical fibers shall be 100% attenuation tested. The attenuation of each fiber shall be provided with each fiber optic cable reel.

11. Fiber Optic Cable Packaging Requirements

a. The completed cable shall be packaged on non-returnable wooden reels.

b. Top and bottom ends of the cable shall be available for testing.

c. Both ends of the cable shall be sealed to prevent ingress of moisture.

d. Each cable reel shall have a weather resistant reel tag attached

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identifying the reel and cable. The reel tag shall include at a minimum the following information:

- i. Cable number
 - ii. Gross weight
 - iii. Cable length
 - iv. Date cable was tested
 - v. Cable length markings
 - Top (inside end of cable)
 - Bottom (outside end of cable)
12. Each cable shall be accompanied by a cable data sheet that includes at a minimum the following information:
- a. Cable number
 - b. Customer name
 - c. Shipped length
 - d. Measured attenuation for each fiber
13. Fiber Optic Cable Wrap-Around Identification Labels
14. The Contractor shall provide and install Fiber Optic Cable Wrap-Around Identification Labels at 50-foot intervals along each segment of Outdoor Fiber Optic Cable installed, at all locations.
15. The Fiber Optic Cable Wrap-Around Identification Labels shall be of a snap around type for installation around fiber optic cables and shall be of the following dimensions:
- a. 2" x 2" for ¼" to ½" diameter cables
 - b. 4" x 4" for ½" to 1" diameter cables
 - c. 7" x 7" for 1" to 2" diameter cables
16. The Fiber Optic Cable Wrap-Around Identification Labels shall be yellow in color with black capital letters stating, "TRAFFIC COMMUNICATING CABLE".

REFERENCES

1. Insulated Cable Engineers Association (ICEA)
2. National Electric Code (NEC)
3. Electronic Industries Association (EIA)
4. Telephone Industries Association (TIA)
5. Institute of Electrical and Electronics Engineers (IEEE)
6. Telcordia (formally BellCORE)
7. International Telecommunications Union (ITU)
8. Underwriters Laboratory (UL)

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SUBMITTALS

1. Submit descriptive literature and manufacturer specification sheets for all fiber optic cables and equipment proposed for use in accordance with the requirements of specification for approval prior to procurement, fabrication, assembly, installation, and testing.
2. Hold Point: Prior to delivering any equipment, submit to the City of Cambridge for approval six (6) copies of a detailed test procedure intended to ensure all components of the system are compatible and functioning properly, in accordance with these Specifications. The tests performed shall include, but not be limited to, the tests outlined in Paragraph 3.02 of this Section. The detailed test procedure shall include a description of all test equipment to be used, and specific pass/fail criteria for each test.
3. The Contractor shall submit fiber routing diagrams for approval by the City of Cambridge.

Delivery, storage, and handling

1. The vendor is responsible for the storage, delivery, and handling of all materials provided under this specification. The vendor or Contractor shall warehouse all items. Items shall be stored in a safe and secure location. All equipment shall be protected from water, dust, etc.
2. The required length of cable shall be wound on reels. Each reel shall contain only one continuous length of cable. The packaging shall be constructed so as to prevent damage to the cable during shipping and handling.
3. When the length of an order requires a large (4 feet or greater) reel the cable shall be covered with a three layer laminated protective material. The outer end of the cable shall be securely fastened to the reel head so as to prevent the cable from becoming loose in transit. The inner end of the cable shall project into a slot in the side of the reel or into a housing on the inner slot of the drum, in such a manner and with sufficient length to make it available for testing.
4. Test tails shall be at least 6 ft± long. The inner end shall be fastened so as to prevent the cable from becoming loose during shipping and installation.
5. Reel Marking and Labeling: Every cable shall be delivered with the following information:
6. Reel Label:
 - a. Part number
 - b. Reel number
 - c. Length (ft/m)
 - d. Marking (ft/m) top and bottom

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- e. Date of Manufacture
 - f. UL/ETL/CSA listing information
 - g. Package ID
 - h. Reel number
 - i. Quantity
 - j. Customer ID
 - k. Package count
 - l. Factory order number
 - m. Release part number
 - n. Length (ft)
 - o. "Ship to:" Address
 - p. "Attention to:"
7. Stenciling:
- a. Manufacturer's name and address
 - b. Direction of rotation
 - c. Reel Size
 - d. "DO NOT LAY REEL ON SIDE"

QUALITY ASSURANCE

1. The cable manufacturer shall be ISO 9001 registered.
2. All optical fibers in cables lengths of 1,000 ft or greater shall be 100% attenuation tested. The attenuation shall be measured at 850 nm and 1300 nm for multimode fibers. The manufacturer shall store these values for a minimum of 5 years. These values shall be available upon request.

WARRANTY

1. The vendor/manufacturer(s) shall provide a one-year warranty on parts commencing on the day that the items are accepted by the City of Cambridge.

MATERIAL

1. All material shall be new and unused and the workmanship shall be in accordance with the highest standards of the electronic equipment industry. Bids will be accepted only for new and current material. Material discontinued by the manufacturer will not be accepted. All components shall be UL or ETL listed.

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2. Material purchased under this Section shall be covered by standards illustrated in References Section and the manufacturer's warranties against material and workmanship.
3. Provide all material capable of operating within a transit system environment, subject to temperature, humidity, vibration, and light conditions typically encountered.

Connector housing (patch panel)

1. The Connector Housing shall be a wall mountable combination connector and splice housing. The unit provides for pigtail splicing to the connector panel within a single housing. The unit shall be sized to accommodate a 12-strand fiber optic cable, up to a 24-strand capacity. The maximum capacity would be achieved by having 2 panels, each having 12 each.
2. Housings shall be wall mountable so as fit within the traffic signal control cabinet without interfering with other components.
3. The unit shall be modular with a splicing compartment and a termination compartment in a single housing.
4. The unit shall meet the design requirements of ANSI/TIA/EIA-568 and the plastics flammability requirements of UL 94 V-0.
5. The unit housings shall be manufactured using 16-gauge aluminum and shall be finished with a 2-Tone Gunmetal Grey and/or anodized silver for durability. Housings shall be manufactured using 16-gauge steel for structural integrity and shall be finished with a 2-Tone Gunmetal Grey and/or anodized silver for durability. Installation fasteners shall be included and shall be black in color.
6. The unit shall have a hinged top jumper management panel capable of locking in the horizontal or vertical position. When the top panel is locked in the horizontal position, it shall act as a jumper routing area in the top front of the housing and shall enclose the top of the housing.
7. Splice capacity shall be twelve (12) 5.1 mm (.2") tall splice trays with the use of an optional outward pivoting splice tray kit, which includes provisions for mounting splice trays and incorporates fiber routing guides. The housing shall allow splicing via cable entry from the right side only.
8. The unit shall include a clamshell-type cable clamping mechanism to provide cable strain relief. The cable clamp shall accept one cable from 9.5 to 28.6 mm (.37"-1.12") in diameter. The cable clamp mechanism shall also handle multiple smaller fiber count cables when used with the multiple cable insert. The total cable capacity per clamp shall be five cables (≤ 10.2 mm (.4") OD) when used with the multiple cable insert. Housing cable clamp capacity shall be two clamps. Additional cable clamps shall be available as an accessory kit.
9. The front doors shall be made from tinted polycarbonate. Front and rear doors shall utilize a single slide latch to provide ready access and

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closing. An opening shall be provided in the front and rear doors so that an optional key lock kit may be used. The opening shall be filled with a removable plastic insert so that dust may not enter if the optional lock kit is not used. There shall be a removable retaining bracket to prevent the door from being unintentionally sliding off the hinges.

10. The housings shall have a labeling scheme that complies with ANSI/TIA/EIA-606.
11. An additional laminated drawing of the fare array area identifying locations of equipment and fiber designations shall be installed within the controller cabinet. The drawing shall identify locations or equipment in reference as well as have equipment and fiber ID numbers.
12. Provisions for mounting fiber fan-out devices shall be incorporated into the housing. Fiber fan-out devices are used to build 250 μm fiber in buffer tubes out to 900 μm for fiber protection and to allow connectorization.

Fiber optic pigtail panels

1. Fiber optic pigtail shall be comprised of a single multi-mode fiber strand compliant with TIA/EIA-568-B-3.
2. The pigtail panels shall have a 12 factory installed SC type connectors.
3. The pigtail shall contain six 900 μm fibers, which are enclosed by a PVC sheath.
4. The length of the pigtail panels should have a pigtail length of 9.8 feet.
5. The pigtail shall have an insertion loss of 0.5 dB maximum and a minimum reflectance of -55 dB when mated with like jumper.
6. Pigtails should be similar to Corning Cable Systems CCH-CP06-61-P03RH.

CONSTRUCTION METHODS:

INSTALLATION

1. Each equipment manufacturer shall supply recommended installation procedures for all products supplied. Recommended procedures must also be supplied for fiber optic cable installation to include duct, direct buried and aerial installations.
2. Each product shall be tested to ensure compliance with this specification.
3. Fiber optic cable tests shall include, but not be limited to, optical time domain reflectometer and power loss.
4. The fiber optic cable shall meet or exceed performance characteristics when tested in accordance with the EIA/TIA-455A and EIA/TIA-526-7, and EIA/TIA-526-14A standards.

COMPENSATION:

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Interconnect cable system will be paid for at the Contract lump sum price, which price shall include all labor, material, equipment and incidental costs required to complete the work.

Conduit shall be paid for separately under Item 32804.3, 3 in. Electrical Conduit, Type NM Plastic (UL).

NOTES ON EXCLUSIONS:

Handholes shall be paid for separately under Item 32811.22.

32815.98 MAST ARM FOOTING COST ADJUSTMENT FOOT

DESCRIPTION:

The contract lump sum prices for Items 32816.1 and 32816.2 include the cost of the mast arm footing based on an assumed soil type of “Wet Sandy Soil” for a three foot (3’) diameter footing as shown on the plans.

Mast arm foundation depths as shown on the plans may be increased or decreased based on the actual existing soil types determined by the Engineer from soil borings taken under by the Contractor under Item 2010.1. If the Engineer determines that the soil classification requires the use of a deeper foundation, the Contractor shall construct the foundation at the dimensions shown on the Foundation Design Chart as included on the Plans and the Contractor shall be paid for the difference in depth at the contract unit price per foot for Item 32815.98. Conversely, if the Engineer determines that the soil classification requires the use of a shallower foundation, the City shall be credited for the difference in depth at the Contract unit price per foot for Item 32815.98. The difference in depth calculation shall be based in the dimensions shown on the Mast Arm Foundation Detail Sheet for a 3’-0” diameter foundation.

COMPENSATION

Payment (or credit) for work under Item 32815.98 shall be paid at the contract unit price per vertical foot of adjustment, which price shall include for all labor, material, equipment and incidental costs required to complete the work.

32816.1 TRAFFIC SIGNAL RECONSTRUCTION LUMP SUM
(WESTERN AVENUE AT PUTNAM AVENUE)

32816.2 TRAFFIC SIGNAL RECONSTRUCTION LUMP SUM
(WESTERN AVENUE AT HOWARD STREET)

DESCRIPTION:

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Work under the above item shall be performed according to the provisions of Section 800 of the MassDOT Standard Specifications. Traffic signal work includes the following two locations:

LOCATION NO. 1 – Western Avenue at Putnam Avenue

Proposed traffic signal reconstruction

LOCATION NO. 2 – Western Avenue at Howard Street

Proposed traffic signal reconstruction

The work consists of furnishing and installing traffic control signals at the intersections listed above complete and ready for operation, as shown on the plans.

Included in the work is the furnishing and installing of traffic control signal equipment, local traffic controller, cabinet and foundation, signal housings, backplates, red, amber and green LED signal modules, posts and bases, anchor bolts and foundations, loop detectors and amplifiers, service connections, wire and cables, conduit, pull boxes, ground rods, saw cuts, electrical connections, and providing all incidental materials necessary for operating and controlling the traffic control signal, as shown on the plans and specified herein.

A list of the major traffic signal items required is included on the plans.

The top of the concrete base for the control cabinet shall be 18 inches above grade. The top of all other foundations not in sidewalk or paved areas shall be a minimum of 2 inches above grade. The top of all foundations in sidewalk areas shall be located 3 inches \pm below finish grade. The top of each mast arm foundation shall not be exposed in the sidewalk.

Within 30 days following execution of the Contract, the Contractor shall submit shop drawings for signal supports, a list of equipment, and manufacturer's equipment specifications to the Engineer in accordance with the relevant provisions of Section 815.20 of the MassDOT Standard Specifications.

No work shall be commenced by the Contractor until approval of the shop drawings and manufacturer's data has been received in writing from the Engineer. Approval of these drawings will be general in character and shall not relieve the Contractor from the responsibility of, or the necessity of, furnishing materials and workmanship conforming to the plans and specifications.

The Contractor shall deliver to the Engineer a certificate of compliance with the manufacturer for all materials purchased from the manufacturer.

Flashing Operation

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Changes from automatic flashing to stop-and-go operation and from stop-and-go to automatic flashing operation shall occur as set forth in Section 4D.12 of the MUTCD.

Controller and Cabinet

The controller, malfunction management unit, detector amplifiers, bus interface units and all other ancillary traffic signal control components included in the type 6 traffic control cabinet shall comply with the National Electrical Manufacturers Association (NEMA) Standard No. TS 2, Traffic Controller Assemblies.

The top of the concrete base for the control cabinet shall be 18 inches above grade. The controller cabinet foundation shall not obstruct a sidewalk or crosswalk so that they can be easily accessed by physically-handicapped people. Anchor bolts shall be internal to the cabinet. A concrete pad shall be constructed such that it is the width of the controller cabinet foundation by 3 feet.

A slide-in/slide-out shelf or swing-out/swing-in shelf appropriate for the size and load of a laptop computer shall be installed in each controller cabinet to allow maintenance personnel to work in the cabinet in a safe, effective, and comfortable manner.

TS 2 Type 1 Controller and Type 6 Cabinet Assemblies:

Controller shall conform to Section 3, Controller Units of NEMA No. TS 2, Traffic Controller Assemblies. The controller and cabinet assemblies shall be supplied in an 8 phase TS 2 Type 1 configuration. Controller shall utilize an input/output interface conforming to Section 3.3.1 of the NEMA TS 2 Standard for all input/output functions with the backpanel terminals and facilities, the malfunction management unit, detector rack assemblies and auxiliary devices.

The TS 2 Type 1 cabinet shall meet the requirements of configuration 3 as defined in Table 5.3.1-1, "Type 1 Configurations" of the NEMA TS 2 Standard. The cabinet shall be fabricated of sheet aluminum to size six (6) dimensions as specified in Table 7.3-1 of the NEMA TS 2 Standards.

The local traffic controller shall be capable of being operated in the full-actuated mode, in the free mode and as semi-actuated in the coordinated mode. The controller shall be Type 8DW, keyboard entry, menu-driven unit mounted in an eight-phase cabinet. The controller unit shall meet all applicable requirements of the (N.E.M.A.) Standard Publication No. TS-2, Type 1, the MassDOT Standard Specifications and include the following as minimum requirements for the "Keyboard Entry Controller Unit."

1. The Keyboard Entry Controller Unit must be type-tested and approved by the Department.
2. The controller shall have hard-wire interconnect capability and internal time base coordination logic. The coordination control shall have the capabilities to operate as described under Section 815.41 of the MassDOT Standard Specifications.

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3. The controller shall have a data transfer/printer port for data transfer to another controller, printer or laptop PC computer. A port shall be provided for uploading or downloading controller operating parameters from a laptop PC computer.
4. The controller shall have a security code function.
5. The phase or phases selected for "call to non actuated" (C.N.A.) modes shall be determined as needed by keyboard entries.
6. The controller shall have an Ethernet port for coordination.

The Contractor's attention is directed to Table 2, Required Signal Light Switching Assemblies, Section 815.41 of the MassDOT Standard Specifications. The Contractor shall furnish the appropriate type and number of load switches and flash transfer relays and place unutilized load switches and flash transfer relays in the control cabinet for future use. Load relays shall be easily replaced using a screwdriver. Component relays requiring soldering are not acceptable.

In addition to the convenience outlet as described under Subsection 815.41, a lamp with an on/off switch shall be installed in the controller cabinet.

Bus Interface Units

The Bus Interface Unit (BIU) shall comply with Section 8 of the NEMA TS 2 Standard. The BIU shall be fully interchangeable with any other manufacturer's unit and interchangeable in a NEMA TS 2 Type 1 cabinet assembly. In addition to the number of BIU's required for the detector racks, and terminals and facilities, two (2) spare Bus Interface Units shall be supplied with each controller cabinet.

The BIU shall perform the interface function between Port 1 at the controller unit, the malfunction management unit, loop detector rack assembly, and the backpanel terminal and facilities.

As a minimum, two (2) LED indicators shall be provided on the BIU front panel. One indicator shall serve a dual use; as a power on indication and as a diagnostic indicator for proper operation of the device. The second indicator shall serve as a transmit indicator illuminating each time data is transmitted.

Note Well: 2 Spare BIU's shall be provided for each location.

TS 2 Cabinet Power Supply

A separate power supply shall be supplied and installed in the TS 2 cabinet. The unit shall be AC line powered and provide regulated DC power, unregulated AC power, a line frequency reference for the rack mounted loop amplifiers, bus interface units, load switches, and other auxiliary cabinet equipment as required. As a minimum, the power supply shall meet all requirements of Section 5.3.5 of the NEMA TS 2 Standard.

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The power supply shall be either shelf mounted or wall mounted utilizing key hole slots for ease of replacement or installed as part of the rack assembly.

The unit shall contain four LED indicators on the front panel to indicate the four outputs; +12VDC \pm @ 2.0 amps, + 24VDC \pm 2VDC @ 2.0 amps, 12VAC @ 250 milliamps, and 60 Hz line frequency reference. A test point terminal shall also be located on the units front panel for + 24VDC and logic ground testing.

Malfunction Management Unit

The malfunction management unit (MMU) shall comply with Section 4 of the NEMA TS 2 standard. The MMU shall be capable of operating as either a Type 16 with 16 channels (8 vehicle, 4 pedestrian, 4 overlap) or a Type 12 with 12 channels (8 vehicle, 4 overlap). The MMU's supplied shall be configured to operate as Type 16 units.

The MMU's in either the Type 16 or Type 12 configuration shall be capable of operating in a NEMA TS 2 Type 1 cabinet or a NEMA TS 1 cabinet without loss of functionality.

Load Switches

Load switches shall comply with Subsection 6.2 of the NEMA TS 2 Standard. All load switches shall utilize optically isolated encapsulated modular solid state relays. Discrete components on circuit boards are not acceptable.

Load switch indicator lights shall be LED-type and wired on the input side of the device

Flash Transfer Relays

Flash transfer relays shall comply with Subsection 6.4 of the NEMA TS 2 standard.

The field electrical loading for flash operation shall be wired through the transfer relays such that the load on a 2-circuit flasher is as balanced as possible within the limitations of the signal phasing.

Flasher

Flashers shall comply with Subsection 6.3 of the NEMA TS 2 standard and be equipped with tow output indicator lights which will show flashing power out to the cabinet assembly.

Loop Detector Amplifier Rack Assembly

The loop detector amplifiers supplied shall be rack mount, type C two channel units with delay and extension timing internal to each unit's channel. Loop detector amplifiers shall conform to section 6.5 of the NEMA TS 2 standards. The detector amplifiers shall each fit in a standard card rack conforming to Section 6.5 of the NEMA TS 2 Standard. The detector rack assembly shall be a Type 2 configuration conforming to Section 5.3.4 of the NEMA TS 2 Standard. The two channel card rack loop amplifier unit shall occupy one of the rack slots. Each amplifier shall be labeled with the detector number.

Each channel of a dual-channel amplifier shall be connected to a group of wire loop detectors. Each detector amplifier shall operate on presence mode, except as noted on plans, in which case the loop detector shall operate on pulse mode. Detector units shall

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be microprocessor controlled, fully digital, self-tuning and capable of detecting bicycles. Inductive vehicle loop detectors shall utilize a Liquid Crystal Display (LCD) to indicate the operational, set-up, and loop diagnostic parameters of the detector/loop system.

The detector unit shall be capable of operating in a voltage range from 10.8 to 26.5 VDC. The unit shall operate from the cabinet's external power supply at 12 VDC. Each amplifier channel shall be labeled with the detector number. In addition, each amplifier connected to a D2 Bicycle loop detector shall be capable of detecting bicycles. Each bicycle loop detector series shall be connected to an amplifier channel separate from vehicle loop detectors and other bicycle detectors.

Delay times on detectors shall be programmed in the signal controller.

Type 8DW cabinets that utilized loop detectors shall be supplied with a minimum of four, two channel card rack loop amplifiers. Unless otherwise required by the plan's detector chart, phase call assignments for each amplifier channel shall be wired to one of the traffic controller's vehicle phase input channels. Each vehicle phase input channel shall be assigned to the appropriate controller phase as per the detector chart. Additional amplifiers shall be supplied if so required by the major items list on the plans. The Contractor's attention is drawn to the Major Items list.

The Contractor shall install a chart showing the approach name, lane assignment, phase, detector number and terminal numbers on the upper left hand of the back of the cabinet door as approved by the Engineer.

Each amplifier shall be labeled with the detector number. The detector lead-in cables shall be labeled, with the street name, phase, detector number and terminal numbers, in the controller unit. This labeling and attachment shall be of durable materials such as brass or plastic, attached by wire or plastic ties. Adhesive attachment of the label shall not be acceptable.

Note Well: 2 spare dual-channel loop detector amplifiers shall be provided for each location that has loop detectors.

Testing of Grounding System

The Contractor shall perform testing of the equipment grounding system in the presence of the Engineer in accordance with the Standard Specifications. A ground rod shall be installed in each controller cabinet.

Vehicle Loop Detectors

Wire loop detectors shall be installed in the roadway pavement for vehicle detection at locations shown on the plans.

Each amplifier shall be labeled with the detector number. The detector lead-in cables shall be labeled, with the street name, phase, detector number and terminal numbers, both in the controller unit and in the pull box containing the detector lead-in splice. This labeling and attachment shall be of durable materials such as brass or plastic, attached by wire or plastic ties. Adhesive attachment of the label shall not be acceptable.

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Loop wire shall be encased in a protected plastic tubing of PVC or polyethylene plastic, IMSA 51-5, ¼” outside diameter, and the wire may have cross-linked polyethylene insulation or it may have THHN/THWN insulation.

The heat source for soldering shall be electrical, not exceeding 30W capacity.

Splicing insulator shall be a MassDOT approved re-enterable body splice kit with a non-hardening silicone gel sealing compound compatible with the wire insulation.

Splice and Connection

Splicing and connection shall be made in the pull box nearest the roadway loop sensor but not exceeding eight loops per pull box. All loops included in a detector group as shown on the plans shall be spliced in a single pull box. Each lead and lead-in connector shall be stripped back and spliced using a pressure type wire connector applied with a crimping tool. Multiple loop sensors shall be identified as detailed on the plans.

Lead-in splicing shall be staggered to prevent contact with each other. Each crimped splice shall be soldered and insulated. The insulation material shall be heat-shrunked polyolefin. The shielded lead-in cable outer jacket and shield shall be stripped back sufficiently to ensure that the shield cannot come into contact with the spliced conductors. Splice hangers shall be provided in each pull box.

Follow the instructions of the kit manufacturer for this procedure when installing the re-enterable splice kit. The above splice shall be done on the day of the loop wire installation to prevent the entrance of any moisture into the plastic tubing.

The lead-in conductors shall be connected to the appropriate terminals in the controller cabinet, by using crimped and soldered terminal ends. The heat source for soldering shall be electrical, not exceeding 30W capacity.

Testing of Loops

The following test procedure shall be performed in the presence of the Engineer before and after the loop sensor is sealed in the pavement as detailed below. The cost of equipment, labor, and materials to perform such testing and similar re-testing following repairs, replacement, or adjustment of any detector within the project area shall be included in the price bid for the traffic control signal items.

After installation of wire loop sensors in the roadway and installation of shielded lead-in connecting the loop sensors to the controller cabinet, each loop sensor and lead-in combination shall be tested (at the controller cabinet) for proper installation. The resistance from lead to lead of the same loop shall not exceed three (3) ohms per 300 yards as measured by a high quality yard suitable for measurements of low resistance in the range of 1 to 6 ohms.

A megohm yard test at 500 volts DC shall be made between the two leads of a loop/lead-in combination temporarily spliced together, but otherwise disconnected from all

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terminals, and the shield drain wire and the earth ground connection. These resistances shall be at least one hundred (100) megohms or greater.

A megohm yard test at 500 volts DC shall be made between each lead-in shield and the earth ground rod. This resistance shall be at least one hundred (100) megohms or greater.

The yard used for these tests shall be checked for calibration each day of use by using a resistor block of $\pm 5\%$ resistors simulating loads of 1 megohm, 20 megohm and 100 megohms. The observed yard reading shall be $\pm 10\%$ of the nominal resistor load.

If any loop sensor and lead-in combination fails to pass any one of the four (4) tests, it shall be repaired and then re-tested on two occasions at least two (2) weeks apart, and then shall pass on each re-test occasion. If the loop sensor lead-in combination does not pass all these re-tests, a new loop sensor and/or lead-in shall be installed, and shall pass these tests, at no additional cost.

After the above tests have been satisfactorily completed, all loop sensor/shielded lead-in inductances shall be measured and a written report of the results shall be filed with the Engineer and a copy stored with the "box prints" at the intersection.

Data Base Programming

Each programmable local hardware component (controller, malfunction management unit, and detector amplifier) shall be initially programmed by the Contractor based on information contained on the plans. Three (3) sets of hard copy programming per device shall be supplied and stored in the controller cabinet.

Labels

All time settings, switches, harnesses, relays, terminals and fuses shall be clearly and permanently labeled.

Vehicle Signal Heads

All proposed vehicle signal heads shall be aluminum. When, in the judgment of the Engineer, the visibility of existing or proposed signal faces will be obstructed by trees and other vegetation, the Contractor shall clear the obstructions for proper sight distance. Any clearing necessary shall be done within the City layout, as directed by the Engineer.

Pedestrian Signal Heads, Indications, and Appurtenances

All pedestrian signal heads shall be LED types with the ITE international symbolic displays, including the hand symbol for *flashing don't walk* and *don't walk* indications and the walking person for *walk* indications.

Each pedestrian push button shall be equipped with a tactile indicator to provide visually impaired pedestrians with an indication of pedestrian actuations. In addition, the pedestrian pushbutton shall be equipped with an indicator light, provided through the use of an LED, which will provide pedestrians with confirmation of a pending pedestrian

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phase. The confirmation LED shall meet or exceed the specifications of the model PPB-LED or approved equal.

Each visual pedestrian indication shall be complemented by an audible and tactile pedestrian indication. The audible and tactile indication shall meet or exceed the specifications for the BPC type indication.

1. Each separately phased pedestrian movement shall have its own distinctive audible emanation in order for visually impaired pedestrians to discriminate which phase is appropriate given his or her destination and/or direction of travel.
2. The audible emanation shall be a cowbell type sound. No buzzer or ringing type sounds will be acceptable. The output level of the audible pedestrian signal shall vary in intensity with significant fluctuations in ambient noise conditions. At a minimum, the output level shall vary in intensity from daytime to nighttime operations.
3. The housings of both the visible and audible pedestrian indicators shall be painted matte black.

Each visual pedestrian indication shall be complemented by a time display indication. Each time display indication shall be self-programming and microprocessor based, with red LEDs used in the display. The time display will countdown the amount of time remaining in each *walk* and *flashing don't walk* time interval for viewing by the ambulatory public. The time display pedestrian indication shall meet or exceed the specifications of the TASSIMCO Countdown Pedestrian Signal.

Red, Amber and Green LED Vehicle Signal Modules

All Red, Amber and Green signal housings with the exception of optically-programmed and fiber optic housings shall conform to the following:

The LED signal module shall conform to "Interim LED Purchase Specification of the Institute of Transportation Engineers, Vehicle Traffic Control Signal Heads - Part 2: Light Emitting Diode (LED) Vehicle Traffic Signal Modules", July, 1998, or most current version, Institute of Transportation Engineers (ITE), 1099 14th St., N.W., Suite 300 West, Washington, DC 20005-3438, Telephone: (202) 289-0222, FAX: (202) 289-7722, and shall conform to the following: (In the case of a conflict, the following special provision shall overrule.)

An independent laboratory shall certify that the LED signal module complies with Section 6 Quality Assurance of the above stated ITE LED Purchase Specification.

LED signal modules must be type-tested and approved by the Department according to the requirements of Subsection 815.21 of the Standard Specifications for Highways and Bridges.

On the backside of the LED signal module there shall be a permanently marked "up" arrow to aid in the proper orientation of the module during installation.

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The manufacturer's name, trademark, serial number and other necessary identification shall be permanently marked on the backside of the LED signal module.

Physical and Mechanical Requirement

LED signal modules shall fit without modifications into existing traffic signal housings conforming to “Vehicle Traffic Control Signal Heads” (VTCSH) published in the Equipment and Materials Standards of the Institute of Transportation engineers. The LED signal module shall be a single, self-contained device, not requiring on-site assembly for installation. The LED signal assembly construction shall conform to the applicable ASTM specifications for the materials used to fabricate the module.

Each LED signal module shall comprise a smooth surfaced red, amber, or green UV stabilized polycarbonate outer shell, multiple LED light sources, a power supply, and a polycarbonate back cover assembled in a gasketed or silicon sealed unit.

Optical and Light Output Requirements

The minimum luminous intensity values and light output shall be maintained within the rated input voltage of 117 Volts AC. LED signal modules shall not be allowed to fall short of the minimum intensity values at any of the 44 measuring points of the standard when lamp is turned on cold for measurements and after a 30 minute warm-up time period at 100% duty cycle.

Electrical

The maximum wattage for 12” ball shall be 20 Watts and 10 Watts for the 12” arrow.

The LED sources shall not be powered above 70% of the manufacturer’s specified rated load. This shall be clearly shown in layman’s terms through calculations, schematics, catalogue cuts, etc.

Red LED sources shall be made of the AlInGaP (Aluminum Indium Gallium Phosphide) type shown clearly in a catalogue cut or similar literature.

Green LED sources shall be made of the InGaN (Indium Gallium Nitride) type shown clearly in a catalogue cut or similar literature.

Warranty

The LED signal module will be replaced or repaired by the manufacturer if it exhibits a failure due to workmanship or material defects within the first 60 months of field operation.

The LED signal module will be replaced by the manufacturer if it exhibits any partial outage before the final inspection or it exhibits either a greater than 40 percent light output degradation or a fall below the minimum intensity levels within the first 36 months of field operation.

Traffic Signal Master Controller

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The work shall include installing a traffic signal master controller system shall conform to the relevant provisions of Section 800 of the MassDOT Standard Specification, the Manual on Uniform Traffic Control Devices (MUTCD) 2009 Edition, and the following technical provisions. The work shall include furnishing and installation of a master controller, providing graphic maps in the Cambridge Traffic Engineers Office, and all appurtenances required to interface with the local intersection controller.

The work shall include all hardware and software configuration and the on-street master controller to be located at Western Avenue at Putnam Avenue as well as updating the central office workstation as required. 8 hours of training shall be provided to the City of Cambridge personnel at their office.

Specific Requirements:

1. Interconnection and Communications System
 - a. The communications links for the "closed loop" system shall provide the medium for two-way communications between the master and certain specified local intersection controllers using 12C single-mode fiber optic cable.
 - b. Error checking shall be included to assure transmission and reception of valid data.
 - d. A complete description of the proposed interconnection cable, cable attachment hardware, patch panels, terminating devices and lightning protection shall be submitted to the Engineer for approval before beginning installation of any component of the interconnection system.
 - e. Testing: Interconnect cable test readings shall be tested before final acceptance. This test shall be made separately for each conductor against every other conductor.

The Design Engineer shall be present to witness all cable tests described herein, with at least 72 hours notice given, excluding Saturdays, Sundays and holidays.

The Contractor shall furnish and install all amplifiers, relays and other equipment and materials necessary to permit this while maintaining satisfactory operation of all elements of the traffic signal system.

On-street Master Controller

The on-street master shall be listed on the latest MassDOT Approved Traffic Equipment List which shall be located at the Western Avenue at Putnam Avenue intersection and shall coordinate the traffic signals at:

- Western Avenue at Howard Street

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Backplates

Backplates shall have a louvered profile. Backplates shall have a 5 inch border width and a dull flat black color. Only backplates that are listed in the latest MassDOT "Approved Equipment List" will be used on this project.

Mast Arm Poles and Foundations

Mast arm poles and foundations shall be fabricated and constructed in conformance with the MassDOT Standard Drawings included in the plans.

All mast arm poles shall be galvanized steel monolevers with shoe bases.

Acceptance of Type II mast arm poles will be contingent upon review and approval of shop drawings submitted by the Contractor. Long-hand design calculations shall be submitted by the Contractor with the shop drawings for all Type II mast arm poles.

For all mast arms less than 35' included in this Contract, the standard mast arm pole foundation (SD3.040) shall be modified to a concrete cored foundation as shown on the Standard Drawings for 35-foot Type II Mast Arm Cored Pier Foundations included in the plans.

The lump sum prices bid should assume the dimensions shown on the Traffic Signal Plans. Soil exploration borings shall be conducted by the contractor. The lump sum bid prices should assume wet sandy soil.

Where soil conditions are such that, in the opinion of the Engineer, the typical foundation design is not suitable, the Engineer will provide a modified design for the foundation.

Mast arm foundations shall not obstruct a sidewalk or crosswalk so that pedestrian accessibility is impaired.

Posts and Bases

All traffic signal posts and bases shall be aluminum. Bases shall be of the square shape and include a cast iron threaded insert for strength. Signal post foundations in grass areas shall be exposed 2±. In sidewalk or paved areas, the top of all signal post foundations shall not be exposed.

Meter Boxes

The meter boxes shall include a by-pass meter switch.

Intersection Wiring

All cable shall meet the requirements of IMSA Specifications or 20-1 and shall be twisted copper conductors. A minimum of five spare conductors shall be installed to all signal heads.

Wiring Diagrams

Five sets of wiring diagrams with both internal and external wiring for the control cabinet and all accessories as actually used in the field shall be furnished, including one mylar reproducible copy for the control cabinet when installed. All actual and potential terminal strip connections shall be shown. Accessory equipment includes flashers, switches, relays, logic, modules, pre-empt, phase selector, detectors, etc. All

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identification on the diagrams shall be as installed, and all field labeling shall be consistent with the diagrams. Before acceptance of the job, four copies of all operation and maintenance manuals and complete, accurate parts lists shall be supplied.

Service Connection

The service connection shown on the plans is approximate only. The contractor shall determine the exact location from the servicing utility, arrange and coordinate with the utility company to complete the service connection, and be responsible for all charges incidental thereto.

Electric Service

An approved meter socket shall be mounted on the side of the cabinet of the controller. The Contractor shall furnish and install the meter socket and the utility company shall furnish and install the meter. A separately fused, 60 amp, grounded duplex outlet and a light receptacle shall be installed. A separate fused disconnect switch shall be provided on the utility pole with lightning protection and shown on the drawings. Adequate 120 VAC power terminals shall be provided within the controller cabinet.

Cooling Fan

The thermostatically controlled fan shall be sized and set as to limit the upper interior cabinet temperature to a difference of 30 degrees Fahrenheit above the exterior ambient temperature.

Duplex Convenience Receptacle

The duplex receptacle container within the controller cabinet shall be rated for 120 vac, 15 amp and shall be of the Ground Fault Circuit Interrupter (G.F.C.I.) Type.

Work Light

The work light contained within the controller cabinet shall be toggle switch controlled. This toggle switch shall be mounted on the inside of the cabinet door.

Painting

Vehicle signal housings, Visors	-	black
Signal housing supports (posts)	-	black
Mast Arms, posts and bases	-	galvanized
Controller cabinet (exterior) & Meter Socket	-	black
Controller cabinet (interior)	-	aluminum
Front of Signal Housings, and Backplates	-	flat black

Keys

Two controller cabinet door keys and police door keys shall be supplied for each controller cabinet on the project.

Optical Emergency Preemption System

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The work consists of furnishing and installing optical traffic signal preemption systems ready for operation, as described herein and shown on the plans. Included in the work is the furnishing and installing of the traffic signal preemption unit and related equipment, optical detection equipment, and all necessary connections to the traffic signal controller. The emergency preemption system shall be compatible with the existing City of Cambridge system, and installed in the same cabinet as the controller.

The emergency preemption system shall consist of a data-encoded phase selector to be installed within the existing control cabinet. This unit will serve to validate, identify, classify, and record the signal from the optical detectors located on support structures at the intersection. Upon receiving a valid signal from the detector, the phase selector shall generate a preempt call to the controller initiating a preemption operation as shown on the plans.

The phase selector shall be a rack-mounted, plug-in, four channel, dual priority device. Programming the phase selector shall be via a PC-based computer utilizing unit specific software. One copy of software on a disk shall be supplied and licensed to the Town as part of this contract.

A hard copy of final programming data shall be left in the control cabinet. The Contractor shall supply a complete set of interface cables for phase selector to laptop connection.

Emergency vehicles equipped with optical energy emitters transmit optical energy impulses to optical detectors mounted at the intersection. When optical energy impulses are received at the intersection, control of the signals shall transfer from the local controller to show a selected display shown on the plans to assist the vehicle through the intersection without conflict. After the vehicle has passed through the intersection, control of the signals shall then return to the local controller which shall restore the appropriate timings that were in effect prior to preemption.

General Operation and Description of Work

The following description of work specifies the responsibilities involved in the installation of optical preemption equipment.

The Contractor is required to supply material and labor (required or shown) for the complete installation of optical preemption equipment at the specified location in this project. Intersection preemption equipment required includes optical detectors, phase selectors, card rack, preemption indicator lights, cable, interfacing of preemption equipment to the local controller, making electrical connections and all required incidentals.

The following are the operational requirements of the optical preemption system:

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Operating sequence, as specified, shall be initiated when detector receives optical energy of the required repetition rate from an emitter.

1. Detector shall transform the optical energy signals into electrical signals and transmit the electrical signal to the phase selector for processing.
2. Phase selector shall cause the local controller to show a selected display identical to one of the color interval displays normally available in the controller which will assist the emergency vehicles through the intersection without conflict.
3. Phase selector shall allow the controller to release from hold and resume normal operation after optical energy signals are lost provided the desired green display has already been obtained.

Detector cable for optical preemption equipment shall meet specifications of the system manufacturer.

The Contractor shall arrange for a trained representative of the manufacturer of the optical energy preemption equipment to perform the following field supervision and turn-on services:

1. The representative shall select the proper quantity and place and method of installing all components on each controller, to comply with the operational requirements shown in the preemption schedule included in these special provisions.
2. He shall instruct the Contractor and City of Cambridge personnel in the procedures of installation and operations.
3. He shall be available to assist, supervise and check all wiring to insure proper operation.
4. He shall perform a final checkout to include initial adjustment of range and timing to acceptable standards within the capabilities of the intersection.
5. He shall initiate documentation for as-built drawings.
6. He shall demonstrate the system and instruct the drivers of fire fighting vehicles in the operation of the system.
7. Any operation problems occurring within the next 30 days shall be corrected by the Field Service representative. This requirement is not intended to modify the Contractor's six-month guarantee obligation, as set further in an earlier portion of these Special Provisions.

The cost of these field supervision and turn-on services shall be included in the lump sum prices bid for traffic signal controls and no additional payment shall be made therefore.

Installation

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The preemption equipment manufacturer shall be responsible for preemption system design and documentation.

Preemption system design and documentation shall include the following:

1. Provide the installing agency with locations for detector installation. Suggested detector locations are shown on the plans and may be changed to improve the operation. Notice shall be given to the Engineer prior to any change.
2. Provide the controller manufacturer, Engineer, and City with electrical diagrams.

The installer shall install the equipment consistent with the preemption equipment manufacturer's recommended installation procedures and electrical diagrams in a neat and workmanlike manner.

The preemption equipment manufacturer shall be responsible for operational checkout of the specified preemption functions prior to final acceptance and approval by the City.

Operating checkout includes the following:

1. Verifying that the preemption system is properly installed as per the preemption manufacturer's recommendations and the electrical diagrams as provided by the preemption equipment manufacturer.
2. Verifying that the priority system timing and range are properly set. Preemption equipment warranties are put into effect.
3. Instructing the vehicle drivers or their representative(s) in the operation of the preemption system.

Warranty

All components of the preemption system specified herein, shall be warranted by the manufacturer to be free of defects in materials and workmanship for a period of two years from the date of delivery or one year from the date of installation, whichever occurs first.

The Contractor shall repair or replace, free of charge to the City of Cambridge, any part that fails in any manner during the warranty period, and six months after final acceptance of the project by the City.

Preemption Indicator Light

A preemption indicator light shall be provided and mounted as shown on the plans. It shall be located in a position where it may be visible from all preemption approaches to the intersection. The light shall be weather-tight and consist of a double flash clear (white) strobe, which shall be illuminated whenever the controller is in the emergency

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preemption phase. The indicator light shall meet ITE, NEMA, IMSA, and MassDOT standards. The light shall have a minimum diameter of 5.5 in. and height of 6.7 in. It shall be capable of flashing at a rate of 65 to 75 flashes per minute. Candela intensity shall be a minimum of 1,000 for clear lenses. The preemption indicator light shall be connected with a separate cable from the light to the controller cabinet (spare signal conductors shall not be used).

As-built Traffic Layout Plans

It will be the responsibility of the Contractor to provide the Design Engineer with as-built traffic signal layout plans at a scale of 1"=20' indicating all changes made during the construction. The plans shall indicate the final location of all traffic signal equipment installed including detectors, signal posts, mast arms, pedestrian and vehicular signal heads, controller cabinets, conduit, pull boxes, and service connections. The plans shall also indicate the final as-built timing and sequence, major item list, power-pole number and meter number. Upon receipt of the above as-built information from the Contractor, the Design Engineer will field verify the as-built information and plans. Following field verification, the Design Engineer will prepare the as-built Traffic Signal Layouts and/or Permits for submission to the City of Cambridge Traffic Engineer prior to the final acceptance of the project.

Miscellaneous Requirements

Because this is often overlooked, the Contractor's attention is drawn to the requirements of the following sections of the MassDOT Standard Specifications: Section 813.60C Splicing, relative to four optional methods of splicing in signal bases, Section 813.40C Ground Electrodes, relative to Requirement 1 - connection to a water piping system, and

Section 813.61 Equipment Grounding.

The Contractor shall make all necessary arrangements with the electric company for the service connections or for any main power cut off when necessary, and bear all charges incurred thereby.

Basis of Payment

The lump sum price bid for Item 32816.1 and 32816.2 shall constitute full compensation for all labor, materials and equipment necessary or incidental to the installation of a complete intersection traffic control signal system functioning as specified and as shown, including local traffic controller, controller cabinet, vehicle signal heads, loop detectors and amplifiers, mast arms/bases, signal posts/bases, signal wiring and electrical connections, phasing and timing adjustments, removal and stacking of existing equipment, foundations, excavation and backfill, service connections, and all charges therefore.

32823.01	LIGHTING POLE AND LUMINAIRE – TYPE PT-1 (“ACORN” LED)	EACH
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32823.02	LIGHTING POLE AND LUMINAIRE – TYPE PT-2 (“1907” LED)	EACH
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32823.03

**LIGHTING POLE AND LUMINAIRE –
TYPE PT-2A (“1907” LED - DOUBLE)**

EACH

DESCRIPTION

Work to be done under these items shall conform to the relevant provisions of Section 820 of the MassDOT Standard Specifications, the City of Cambridge Electrical Department Specifications, and the following:

Submittals:

The Contractor shall be responsible for verifying the accuracy of current manufacturers catalog model number or style.

Shop drawings for all lamps, luminaires, globes, louvers, cross arms, light poles, bases and all other lighting equipment, and a sample of light pole finish, shall be submitted for approval, by the Engineer, prior to any order being placed.

MATERIALS:

Lighting types shall conform to the Luminaire Schedule included on the Drawings.

Poles for all lighting types shall be finished by the manufacturer with a primer and black finish paint.

All units shall conform to and meet all the current and revised requirements of the Massachusetts Electric Code, the National Electrical Manufacturers Association, Illuminating Engineering Society, American Standards Association, and the American Society for Testing Materials wherever such standards shall apply.

Luminaires shall be completely pre-wired and require only the attachment of power supply leads.

Complete luminaires shall conform to and meet all the current requirements of the National Electrical Manufacturers Association; American Standards Association; The Illuminating Engineering Society; and the Massachusetts Electric Code, wherever such standards shall apply.

All wiring shall be complete and proper operation shall only require attachment of the power supply leads. All power supply leads shall be clearly identified by means of permanently attached metal tags. A color lead for bonding the luminaire shall be furnished with each unit in addition to the power supply leads. Any required splicing in the luminaire shall be accomplished with insulated, compression type connectors. Under NO CONDITIONS shall wire nuts or non-compression type connectors be allowed.

A stamped metallic aluminum tag approximately 1-1/2" x 3" long, bearing the legend as follows shall be affixed inside the luminaire;

PROPERTY OF CITY OF CAMBRIDGE
ELECTRICAL DEPARTMENT
Installed Date

A permanent type adhesive shall be used to securely affix the tag at a location where it can be readily observed inside the luminaire. A surface that will accept writing from a ballpoint pen or pencil, which may consist of a small adhesive label attached to the metal tag can be used for the purpose of indicating the installed date.

The Contractor shall provide an additional 10% (Minimum of 3) of all fixtures as spares for the City of Cambridge Electrical Department.

CONSTRUCTION METHODS:

Poles

The Contractor shall exercise special care in erecting cast aluminum alloy posts to insure that they are firmly secured to the concrete foundation and plumbed in accordance with the details shown on the plans and to the satisfaction of the Engineer. The shims furnished with the post shall be used if necessary. The pole shall not be installed until the related underground wiring has been completed and tested. The Contractor shall exercise special care to insure that paint finish is not damaged and shall repair any damage with factory supplied touch-up paint.

Luminaires

The Contractor shall exercise special care in installing luminaire to insure that they are firmly attached to the pole and level in accordance with the details shown on the plans and to the satisfaction of the Engineer. The luminaires shall not be installed until the related underground wiring has been completed and tested. All lights are to be individually fused in the handhole.

Luminaires shall be wired with #10 AWG cable as per specification with a fused light connector, with appropriate fuse in the power lead as indicated under Item 32811.27. All cables shall be identified with the appropriate colored marking tape. All leads shall be continuous from the pull box to the post top. Neutral and bond leads shall be connected using insulated pressure connectors.

COMPENSATION:

Items 32823.01, 32823.02 and 32823.03, will be measured by the unit Each installed complete, which price and payment shall constitute full compensation for complete compliance with requirements of this item, including all labor, equipment, materials,

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tools, incidental work, excavation, concrete, mounting hardware and construction methods.

The Contractor shall provide an additional 10% (Minimum of 3) of all luminaire types as spares for the City of Cambridge Electrical Department. This includes, globe, louver, socket, ballast, reflectors as specified and shown in the appendix of these specifications. No additional payment will be made as these fixtures shall be incidental to their appropriate item. It shall be noted that the quantities shown on the Section 00300 "Form for General Bid" do not include these spares.

32823.6

HIGHWAY LIGHTING LOAD CENTER

LUMP SUM

DESCRIPTION:

Work to be done under this item shall conform to the relevant provisions of Section 820 of the MassDOT Standard Specifications, the City of Cambridge Electrical Department Specifications, and the following:

MATERIALS:

Enclosure

Enclosure shall be cast aluminum, weatherproof traffic controller type cabinet, including pull box base with heavy duty Neoprene gasket around the door opening. Lettering cast in the door shall read "Street Light Control City of Cambridge". Enclosure shall house the distribution panel, lighting contactor, electric meter, receptacle and other necessary equipment for a complete functioning lighting control system. The housing shall be furnished with a sheet of 3/4" exterior grade plywood, primed and painted, mounted against the back wall and permanently mounted grounding conductor.

The street lighting enclosure shall remain unpainted unless otherwise directed,

Lighting Panelboard

Panelboards shall be 120 /240 – volt single phase, three wire and shall have a minimum 10,000 ampere interrupting capacity bolt on type molded case circuit breakers in the quantities and sizes requires. Panelboards shall be General Electric

A three phase service may be allowed with city approval.

The underground service connection to the streetlight control cabinet shall terminate in a pull box prior to entering the meter socket.

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Signs will be measured for payment as specified in Section 828 of the MassDOT Standard Specifications. Object Markers will also be measured and paid for under this Item.

Payment for work under this item shall be at the contract unit price per square foot, and shall include full compensation for all labor, materials, equipment, and other incidentals necessary for the satisfactory completion of the work as specified.

32847.1	SIGN SUP (N/GUIDE) + RTE MARKER W/1 BREAKAWAY POST ASSEMBLY - STEEL	EACH
32847.2	MEMORIAL SIGN REMOVED AND RESET	EACH

DESCRIPTION:

Work to be done under this item shall conform to the relevant provisions of Section 840 of the MassDOT Standard Specifications and to the following:

Work to be done under this item shall consist of:

1. Furnishing and installing new traffic sign posts as shown on the Drawings, as directed by the Engineer and in conformance with City of Cambridge Department of Traffic, Parking and Transportation specifications.
2. Removing and resetting existing Memorial Signs as shown on the Drawings, as directed by the Engineer.

MATERIALS:

Posts:

New traffic sign posts shall be galvanized steel “U-channel” posts conforming to Section M8.18.6 of the MassDOT Standard Specifications, in particular the Standard Special Provisions dated December 16, 2011, except minimum post weight shall be 3 lbs/foot.

CONSTRUCTION METHODS:

It is critical that traffic sign posts not impede accessible pedestrian access. The Contractor shall install signposts in locations shown on the Drawings, and at additional locations as directed by the Engineer, prior to installation of sidewalk. In general, sign posts located in landscaped or brick feature strip areas shall be located 24” from the front of curb face. Sign posts located in sidewalk areas shall be located at the back of sidewalk, or a minimum of 24” from edge of the cycle track as indicated on the Drawings. All sign post locations shall be verified in the field with the Engineer prior to placement.

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Care shall be taken to install sign post bases in the appropriate direction for sign attachments and proper viewing. All signs shall be installed as high as possible on post with no sign being lower than 7 feet from final sidewalk grade. Sign bases shall be protected with safety barriers prior to installation of signposts. The Contractor shall install signposts and attach signs within 24 hours after sidewalk installation.

Traffic Signs Removed and Reset:

Where signs (other than Memorial signs) are to be removed and reset, as indicated on the Drawings or as directed by the Engineer, the work shall be considered incidental to the related sidewalk item. The Contractor shall be responsible for temporary storage of non-regulatory signs until they are ready to be reset. Regulatory signs shall remain in place at all times, either at their existing or new location as appropriate for the stage of construction. Temporary regulatory signs shall be utilized during any time that permanent regulatory signs need to be removed for construction and cannot be permanently reset at new location.

The Engineer will determine if the existing signs and post are in adequate condition for reinstallation. If signs or post or both are in poor condition, the Engineer will notify the Contractor to stack the signs on-site for future Cambridge Traffic Department disposal, and posts shall be disposed of by the Contractor. The Contractor will furnish and install new signs and posts, which will be paid for under the appropriate items of the Contract.

Memorial Signs Removed and Reset:

The Contractor shall carefully remove, store, and reset existing Memorial signs which are located within the areas of sidewalk reconstruction. Each sign shall be photographed in a way that documents both the location, condition, and the legend on the sign prior to removal. Signs that are in poor condition shall be called to the attention of the Engineer prior to removal.

The existing sign shall be carefully removed from the ground, and portions which were below grade shall be cleaned, including careful chipping and removal of former concrete footing. The sign shall be transported and carefully stacked at the Cambridge Public Works Department storage yard.

The Engineer will determine the new location for Memorial signs in the field, and such locations may vary slightly from original locations. The sign shall be transported back to the site and reset in a new 3,000 psi concrete footing, 8"x 8"x 30" deep. The sign shall be reset plumb and level.

The Contractor shall be solely responsible for the condition of the sign at all times other than when it is stored at Cambridge DPW. Signs which are damaged or lost while in the care of the Contractor will be replaced by the City, and the Contractor will be assessed a replacement and administrative cost of seven-hundred fifty dollars (\$750.00) per sign.

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Signs Removed and Stacked:

Where signs are indicated to be removed and stacked, as indicated on the Drawings or as directed by the Engineer, the Contractor shall carefully remove the existing sign from the post, dispose of the existing sign post, and deliver the sign to the Department of Traffic, Parking and Transportation yard at 59 First Street, Cambridge. This work shall be considered incidental to the related sidewalk item.

COMPENSATION:

Traffic sign posts and Memorial Signs removed and reset shall be measured by the unit each, complete in place.

Payment for work under these items shall be at the contract unit price per each and shall include full compensation for all labor, materials, equipment, and other incidentals necessary for the satisfactory completion of the work as specified. Concrete footings for reset Memorial Signs will not be measured for payment, and will be considered incidental to the cost of Item 32847.2.

32864.02	PAVEMENT ARROWS AND LEGENDS (SURFACE APPLIED TAPE)	SQUARE FOOT
32864.04	PAVEMENT ARROWS AND LEGENDS REFL. WHITE (THERMOPLASTIC)	SQUARE FOOT
32865.1	CROSS WALKS AND STOP LINES REFL. WHITE (THERMOPLASTIC)	SQUARE FOOT
32865.2	HIGH FRICTION SURFACE TREATMENT	SQUARE FOOT
32866.06	6 INCH REFLECTORIZED WHITE LINE (THERMOPLASTIC)	FOOT
32867.06	6 INCH REFLECTORIZED YELLOW LINE (THERMOPLASTIC)	FOOT
32869	GORE LINES – REFLECTORIZED YELLOW (THERMOPLASTIC)	SQUARE FOOT

DESCRIPTION:

Work to be done under this item shall conform to the relevant provisions of Section 860 of the MassDOT Standard Specifications and the following:

The work includes the application of a high friction surface treatment at bicycle facility locations shown on the plans.

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MATERIALS:

Reflective Tape:

Reflective tape for bicycle facility pavement arrows and legends shall be 3M Stamark Series 380I, or approved equivalent product.

High Friction Surface Treatment:

Shall be "TYREGRIP VS" as manufactured by Prismo, USA, Inc.; or approved equivalent product. Color shall conform to the latest edition of the Manual on Uniform Traffic Control Devices (MUTCD) and the following:

- a. Daytime chromaticity coordinates shall be as follows:

1	2	3	4
x	y	x	y
0.2300	0.7540	0.2660	0.5000
0.3670	0.5000	0.4440	0.555

- b. Daytime luminance factor (Y) shall be at least 7, but no more than 35.

- c. Nighttime chromaticity coordinates shall be as follows:

1	2	3	4
x	y	x	y
0.2300	0.7540	0.3360	0.5400
0.4500	0.5000	0.4790	0.520

CONSTRUCTION METHODS:

Pavement markings shall not be installed until a minimum of 15 days after final paving is completed. The Contractor shall notify the City of Cambridge Traffic Engineer at least 72 hours in advance of scheduled pavement marking installation. The exact location of pavement markings will be determined by the City's Traffic Engineer at the time of installation. The City's Traffic Engineer or representative must be present to supervise the pavement marking operations.

Broken lines through intersections (vehicular and bicycle) are indicated only graphically on the Drawings. Actual pattern shall be 4-foot line and 4-foot space.

Pavement arrows and legends in areas subject to general vehicle traffic shall be thermoplastic. Pavement arrows and legends on the cycle track shall be surface applied tape.

The high friction surface treatment shall be installed at bicycle conflict areas and bicycle turn boxes as indicated on the plans and as directed by the Engineer. The Contractor shall install the high friction surface treatment in accordance with all manufacturers'

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installation and materials specifications. Copies of the manufacturer's installation procedures and materials specifications shall be provided to the Engineer for approval before placement of the surface treatment is allowed.

COMPENSATION:

Reflectorized pavement markings will be measured and paid for as specified in Section 860 of the MassDOT Standard Specifications, except the quantity of broken lines shall be 1/3 of the end-to-end length of the line.

High Friction Surface Treatment will be paid for at the Contract bid price per square foot, which shall include all labor, material, equipment and incidental costs to complete the work.

NOTES ON EXCLUSIONS:

Temporary pavement markings at pavement milling locations shall not be paid for and are considered incidental to the project.

32874 STREET NAME SIGN EACH

DESCRIPTION:

Work to be done under this item shall conform to the relevant provisions of Section 828 of the MassDOT Standard Specifications and to the following:

MATERIALS:

Street name signs shall conform to City of Cambridge specifications, and shall be 9" high. Signs shall be 24" to 36" long, depending on the length of legend required.) Lettering shall be 5"-6" height FHWA series B lettering. Signs shall have white high intensity lettering on green EC film.

CONSTRUCTION METHODS:

The location, number and legend of new signs which are required shall be as shown on the Drawings or as directed by the Engineer. Signs will be mounted on posts which are furnished and paid for under Item 32847.1.

The work under this Item includes all hardware, brackets, bolts, labor, etc. necessary to attach new street sign panels to posts furnished under Item 32847.1.

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COMPENSATION:

Street Name Signs will be measured for payment by the unit Each.

Payment for work under this item shall be at the contract unit price per each, and shall include full compensation for all labor, materials, equipment, and other incidentals necessary for the satisfactory completion of the work as specified.

32878 PARKING METER POST FURNISHED AND INSTALLED EACH

32880 PARKING METER POST REMOVED AND DISPOSED EACH

DESCRIPTION:

Work to be done under these items shall consist of removing and disposing of existing parking meter posts, and providing new parking meter posts as directed by the Engineer and in conformance with City of Cambridge Department of Traffic, Parking and Transportation specifications and detail drawings.

MATERIALS:

Parking meter posts shall be Schedule 40 galvanized steel pipe; 2 inches inside diameter / 2 3/8 inches outside diameter. Length shall be 50 to 51 inches. Weep hole and anti-deformation bolt shall be provided as shown on the Cambridge Standard Details.

CONSTRUCTION METHODS:

The Contractor shall completely remove existing parking meter posts and bases in conjunction with proposed sidewalk construction.

The Contractor shall lay out the proposed locations of new parking meter posts for review and approval by the Engineer prior to installation.

Proposed parking meter posts shall be installed in a 4,000 psi concrete base in accordance with the City of Cambridge Department of Traffic, Parking and Transportation specifications and detail drawings.

COMPENSATION

Parking meter posts removed and disposed shall be measured by the unit each.

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Payment for work under these items shall be at the contract unit price each and shall include full compensation for all labor, materials, equipment, and other incidentals necessary for the satisfactory completion of this work as specified, including excavation, Schedule 40 pipe, hardware, cement concrete, and all materials required for surface restoration. No separate payment will be made for restoration of sidewalks areas which shall be considered incidental to the appropriate items.

32900.01 “BREAKING BREAD” PUBLIC ART COORDINATION LUMP SUM

32900.02 “BREAKING BREAD” ART INSTALLATION LUMP SUM

DESCRIPTION:

Work to be done under these items shall consist of coordinating with the City, the project artist, the landscape architect, and the Engineer on the mobilization, transportation, and installation requirements of the public art sculpture (“Breaking Bread”) at James Cronin Park. Coordination shall include the confirmation of final installation and layout locations and configurations of art elements in the park including provision for accurate attachment templates; the furnishing and installing of concrete footings in accurate locations; the furnishing and installing of anchoring systems to attach the art elements; and the coordination, scheduling and mobilization requirements for the installation of the work. The work shall also include the contractor providing electric service to the art piece. This electrical scope is described and paid for under other items of the contract. The work of the Breaking Bread Item shall conform to the relevant requirements of Section 900 of the Standard Specifications, and the following:

Elements to be furnished by Artist:

The “Breaking Bread” sculpture will be fabricated in several pieces and stored by the Artist and will include the following components: 13 wood and metal chairs with provision for 4 attachment points at the base of each of the chairs; 1 table with 8 legs with provision for attachment points at the base of each of the table legs. The Contractor shall assume the 8 legs are to be attached to concrete footings below the brick surface; and shall assume two of the support (legs) will extend through the table and will serve as structural supports for the two light fixture poles; the 3 chandeliers and 2 steel poles form a decorative light assemblage integral to the table. The art elements will be fabricated and ready to be transported at a mutually agreed upon date as decided by the city representative, Contractor and Engineer. The Contractor will be responsible for transporting the piece(s) from an art studio within a 50-mile radius of the project site, to the site. The Contractor shall be responsible for protecting all of the art elements from loss and damage from the time that the Contractor takes possession of the elements at the studio, until final acceptance of the Project.

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MATERIALS:

Concrete Footings, concrete slab, and Stainless Steel anchoring systems:

Shall conform to the section 900 of the Standard Specifications and to the details shown on the Construction documents and per the mockup supplied by the Artist. Attachment methods and templates must be reviewed and approved by Artist, Engineer and Contractor prior to commencement of work.

CONSTRUCTION METHODS:

The sculpture will consist of a series of steel and wood elements attached integrally. The “Breaking Bread” art piece is to be attached to concrete footings and concrete slab. The approximate location, orientation, and dimensions of the required footings are shown on the Drawings. The final site location, orientation and size will be confirmed between the City, the Engineer, the Artist, and the Contractor as part of the work under Item 32900.01, and must be performed prior to any field work under Item 32900.02.

Work Under Item 32900.01:

The Contractor shall anticipate that the work under Item 32900.01 will include up to (4) meetings with the City and Project Artist: coordination with Artist on final dimensions and orientation of the sculpture foundation; coordination with utilities regarding precise locations and depth of facilities at the sculpture location; and coordination with the City on electrical connections to the art piece.

The Contractor shall also provide access to the project site as required by the Project Artist at the time of installation and coordination; and shall make adequate storage and staging areas available within the Project Limits.

Work Under Item 32900.02:

Item 32900.02 consists of the actual construction of the sculpture foundation and installation of the “Breaking Bread” sculpture.

Responsibilities of the Project Artist

The Artist will furnish the steel and wood sculpture and any associated miscellaneous structural items and connection required for permanent assembly. The artist will be responsible for all off-site assembly of the sculpture assemblage.

Responsibilities of the Contractor

Prior to beginning work, the Contractor shall submit its proposed procedure for the transporting and installation of the art piece. No further work on this item shall be performed until the proposed procedure has been approved by the Engineer in consultation with the Artist. The Contractor shall excavate and install the concrete footing and subbase materials below the sculpture prior to the transporting of the art

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piece. The Contractor is responsible for transporting the sculpture from the artist's storage location (within a 50 mile radius of the Project site) to the site and is to be responsible for any rigging related to lowering the sculpture into its final location and attaching the sculpture. The Contractor shall proceed to attach the artist supplied channels to the footing; attach the legs of the table and chair legs to the footings or slab as the case may be; install brick pavement seamlessly around the vertical supports, and restore final surface conditions to the upper plaza at the James Cronin Park as shown on the Construction Documents.

COMPENSATION:

Payment for Item 32900.01 will be at the contract lump sum price bid, which shall constitute the full compensation for all required work, including but not limited to: full compensation for site meetings; direct coordination with the artist and the City; coordination with utility companies; and provision of access and staging/storage areas.

Payment for Item 32900.02 will be at the contract lump sum price bid, which shall constitute full compensation for all required work, including but not limited to: transportation and rigging; protection of art elements at all times subsequent to the Contractor taking possession at the artist's studio; excavation; site protection and temporary fencing; traffic control; furnishing and placing subbase materials, concrete foundation; and attachment of steel channels (furnished by others) to concrete footings.

Construction of brick pavements will be paid for under the appropriate sidewalk items of the Contract.

All repairs or replacement of art elements due to loss or damages of the elements while in the Contractor's possession shall be borne by the Contractor with no additional compensation from the City.

32900.03	BRONZE TILE COORDINATION	LUMP SUM
32900.04	BRONZE TILE INSTALLATION	EACH

Work to be done under these items shall consist of coordinating with the City, Engineer, and project Landscape Architect on the location and installation of bronze tiles to be furnished by the City.

The Contractor installation of the bronze tiles shall consist of setting tiles supplied furnished by the City into depressions in the concrete sidewalk surface as shown on the Drawings and as specified herein. It is anticipated that there will be 10-12 individual installations of roughly 12" x 12" x +/- 3/8" thick tiles as indicated in the detailed documents. The Contractor shall be responsible for setting the bronze tiles into the concrete sidewalk areas while the concrete is still in a fluid state; The Contractor shall furnish and install all required setting materials, as shown on the Drawings and as

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specified herein, except for the bronze tiles which will be furnished by the City at no cost, for installation by the Contractor.

It is the intent of this specification that the timing and final details of installation be agreed upon between the Contractor, the Contractors' qualified installer, the Engineer and the Landscape Architect as part of the construction process. For bidding purposes, however, it shall be assumed that the materials and procedures shown on the Drawings and specified herein will be followed.

The work of these Items shall conform to the relevant requirements of Sections 700 and 900 of the Standard Specifications, and the following:

MATERIALS

Bronze Tiles will be furnished by the City with anchoring bolt/attachment to set into the concrete.

Individual installations will vary in location and be decided in the field with the Engineer, Landscape architect and City. Each installation will be comprised of the bronze units (1' x 1' approximate size) with protective tape-facing on the top surface which can be removed once the piece is installed; and stainless steel anchor bolt welded to the back side of the tile. The Engineer will furnish the Contractor with a sketch specifying the approximate location and orientation subject to final approval in the field.

General:

All mortars, grouts, adhesives and membranes shall be from a single source to ensure compatibility and conformance to manufacturer's written warranties.

Submittals:

The Contractor shall submit:

1. Product data, specification and instructions for using mortars, adhesives, and grouts. (Exact products to be determined.)
2. Representative color samples for each type of grout.
Shop drawing locating and detailing of joints, etc. between imbedded bronze tile and concrete if required.

Grout:

Polymer-modified grout complying with ANSI A118.7 industry standards and ISO 13007 classification CG-2WAF. Grout shall be fast-setting, polymer-modified, color-consistent, non-shrinking, efflorescence free grout, or approved equivalent product. Color shall be specified by the Engineer from the manufacturer's standard color selections.

Latex-Cement Mortar:

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Fast setting, second-generation, two-component mortar consisting of latex additive and mortar: complying with ANSI A118.4 industry standards and ISO 13007 classification C2FS2P2. Mortar shall be MAPEI, “Granirapid System consisting of Granirapid powder and latex additive, or approved equivalent product.

Waterproofing/Crack Isolation Membrane:

rowel-applied, two component, flexible, fiber-reinforced waterproofing and crack-isolation membrane, meeting ANSI A118 requirements for waterproofing. Membrane shall be MAPEI “Mapelastice 315: or approved equivalent product.

CONSTRUCTION METHODS

The final site selection, orientation and size of the bronze tile installations will be confirmed between the City, Engineer Landscape architect and Contractor as part of the work under Item 32900.03 and must be performed prior to any field work under Item 32900.04.

Work Under Item 32900.03

The Contractor shall anticipate that the work under Item 32900.03 will include up to three (3) site meetings with the City, the Engineer and the Landscape architect; coordination with the Landscape Architect on final dimensions and locations of the individual bronze tile installations; one (1) meeting at the city office or studio location in Cambridge, MA to review the tile materials prior to delivery to the site; and one (1) pre-installation conference at the Cambridge Department of Public Works to review installation procedures and coordination required to complete the work.

It shall be the Contractor’s responsibility to ensure attendance at the pre-installation meeting by any specialty subcontractors who will be performing work associated with these Items. The pre-installation meeting agenda will include:

1. Surface preparation
2. Bronze tile and installation material compatibility
3. Mortar application and/or grouting procedures
4. Maintenance and cleaning requirements

The Contractor shall also provide access to the Engineer and other City representatives as required and shall make adequate storage and staging areas available with the Project Limits.

Work Under Item 32900.04

Item 32900.04 consists of the actual installation of the bronze tiles. The work shall conform to the details shown on the Drawings and the following:

Delivery, Storage and Handling: All grout and mortar materials associated with the installation of the bronze tiles shall be delivered in manufacturer’s unopened containers, fully identified with name, brand, type and grade. All materials shall be protected from

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contamination, dampness, soiling, staining, freezing, or overheating in accordance with manufacturer's instructions.

EXAMINATION:

Contractor, Landscape architect and City and Engineer shall examine tiles to verify that tiles comply with acceptable tolerances and other requirements specified. Contractor to verify that tiles are free of cracks, ridges, depressions, scale and foreign deposits that might interfere with adhesion of the bronze tile. Installation may proceed only after unsatisfactory conditions have been corrected and resolved satisfactorily.

INSTALLATION:

The Contractor shall follow all manufacturer's most current written recommended procedures and industry standards to ensure a successful installation.

Note: After bronze tile sections are set into the sidewalk, they shall be given at least one day to set before the polyester tape is removed by the Landscape Architect and the Contractor performs grouting and cleaning.

COMPENSATION

Payment for Item 32900.03 will be at the contract lump sum price bid, which shall constitute the full compensation for all required work, including but not limited to : full compensation for site meetings; direct coordination with the artist and the City; coordination with utility companies; and provision of access and staging/storage areas.

Payment for Item 32900.04 will be at the contract lump sum price bid, which shall constitute full compensation for all required work, including but not limited to: preparing concrete for installation; furnishing and installing all required setting material; setting bronze tiles furnished by the City; and final grouting and clean-up.
Construction of Concrete sidewalk depression to receive the bronze tile installation is not part of the work of this Section and will be considered incidental to Item 32701.10.

32999

CONSTRUCTION LAYOUT

LUMP SUM

DESCRIPTION:

Under this item, the Contractor shall layout and set all lines, grades, and measurements necessary for construction of the surface roadway and streetscape elements of the project.

At a minimum the following items shall be staked:

1. horizontal and vertical alignment of curb
2. back of sidewalk elevations

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3. horizontal and vertical layout of curb ramps and driveways

This work shall include the initial layout work including checking original control information as shown on the Drawings; and furnishing and setting temporary points as necessary to establish intermediate vertical and horizontal control for the construction baseline, radius points, and running bench level circuits. These points shall constitute the field control by and in accordance with which the Contractor shall govern and execute the work.

All staking work shall be directed and performed by qualified surveying personnel who are trained, experienced and skilled in construction layout of the type required under this Contract. The Contractor shall submit the qualifications of the survey personnel to the Engineer for review and approval. The Engineer reserves the right to reject any personnel which, in the Engineer's judgment, are not adequately qualified. The Engineer also reserves the right to evaluate the performance of the survey personnel during the course of the work, and to require the replacement of any personnel whose work, in the opinion of the Engineer, is unsatisfactory.

CONSTRUCTION METHODS:

Bench mark data, grades, and alignment shall be obtained or calculated from data in the plan and shall be verified with the Engineer prior to beginning the work. Methods of survey and staking shall be approved by the Engineer prior to beginning the work. Additional bench marks and control points shall be established as necessary or as directed by the Engineer. The Contractor shall check plan dimensions, alignment, and elevations for accuracy with existing field conditions. Any errors and apparent discrepancies shall be called to the Engineer's attention immediately by the Contractor for correction or interpretation prior to proceeding with the work.

The Contractor shall maintain neat, orderly and complete survey notes and computations used in establishing the lines and grades. The survey notes and computations shall be made available to the Engineer within 24 hours upon request as the work progresses. The Engineer may check the layout as established by the Contractor at any time as the work progresses. The Contractor will be informed of the results of these checks, but the Engineer by doing so in no way relieves the Contractor of its responsibility for the accuracy of the layout work. The Contractor shall correct or replace any deficient layout and construction work which may be the result of inaccuracies in the Contractor's layout at no additional cost to the City.

Layout and staking work shall be completed sufficiently in advance of construction to allow the Engineer to review elevations and make adjustments to proposed grades if required.

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Curb, Curb Ramps, Sidewalks and Driveways:

Construction stakes for curbing and sidewalks shall be placed at a maximum 25 ft interval. Additional stakes shall be set and maintained as necessary to achieve the required accuracy and to satisfy the Contractors' method of operations. Also, additional construction stakes shall be set as necessary to establish the location and grade of curb, curb ramps, sidewalks and driveways including points of change in alignment and grade.

Additional stakes shall also be set along the back of sidewalk at each side of building entries and steps.

All construction stakes shall be located to within 0.02 ft. of the true horizontal position and shall establish the grade elevation to within 0.01 ft of the true vertical position.

COMPENSATION:

Payment for Item 32999 will be at the contract lump sum price bid, which shall constitute full compensation for the work as specified herein, including but not limited to furnishing all labor, tools, stakes, flags, pins, equipment and incidentals necessary to complete the work.

All survey notes and computations used in establishing the required lines and grades shall be given to the Engineer within 21 days of completing work under the above item and must be received before final payment for the work will be made.

NOTES ON EXCLUSIONS:

Layout of subsurface utility work shall not be paid for this item and is considered incidental to the project.

32999.10 TEMPORARY ACCESS RAMPS EACH

DESCRIPTION

Under this item, the Contractor shall furnish and install temporary ramps with railings to provide access to building egress locations during construction operations. The work shall be done in accordance with the Specifications and Massachusetts Building Code and 521 CMR: Architectural Access Board provisions. It is intended that temporary access ramps shall be provided primarily at commercial, non-residential buildings.

MATERIALS:

The Contractor may utilize wood, steel or aluminum. The ramps must have a durable non-skid walking surface of sufficient width to accommodate pedestrian traffic, but in no case shall they be less than 4 feet in width. Ramps shall be accessible in accordance with the Massachusetts Architectural Access Board and shall be designed to support all imposed loads and in no case shall the design live load be less than 150 PSF.

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Railings shall be provided and shall be at least 42” in height and shall be sufficient to direct pedestrians around construction areas.

CONSTRUCTION METHODS:

Temporary access ramp locations will be determined as a result of consultation between the Contractor and the Engineer. Their use is primarily intended at commercial buildings. The Contractor shall receive approval for the locations of temporary access ramps from the Engineer prior to construction.

Pedestrian traffic shall be protected by directional barricades where the ramp extends into streets or driveways. Directional barricade shall be of sufficient size and construction to direct vehicular traffic away from the pedestrian path.

Temporary access ramps shall be maintained in place and kept in good order for the entire length of time that the adjacent construction requires.

The Contractor may re-use temporary access ramps and railing at other locations, provided that the Engineer deems the material in good condition.

Temporary access ramps deemed by the Engineer to be in poor condition shall be immediately replaced by the Contractor with no additional payment.

COMPENSATION:

Payment for Item 32999.10 will be at the contract price bid for each, which shall constitute full compensation for the work as specified herein, including but not limited to furnishing all labor, tools, materials, equipment and incidentals necessary to complete the work.

END OF SECTION 32000

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